HIRINGA

The energy to change. Together.

MBIE & MINISTRY OF TRANSPORT

SUSTAINABLE BIOFUELS MANDATE

HIRINGA ENERGY SUBMISSION

JULY 2021

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1. Introduction

1.1. Hiringa Energy (Hiringa) is a New Zealand company formed in 2016 developing green hydrogen projects. We are working with the Government, partners and leading companies within the road transport and supply chain industry to introduce zero emission hydrogen fuel cell electric heavy trucks, together with associated green hydrogen fuel production and refuelling infrastructure, to the New Zealand market from 2022.

2. Key messages

2.1. The future of transportation will be a combination of multiple technologies working in synergy. Battery electric, hydrogen fuel cell electric and biofuel vehicles will each have an important role to play and need to be deployed where they work best:

- For battery electric, it's the metro and return to base tasks where the vehicle weight, range and charge times aren't going to encumber productivity and the electrical grid has capacity.
- For hydrogen, its linehaul and high productivity motor vehicle (HPMV) operations where uptime and payload are critical and where fleets are large (with high energy requirements).
- For biofuels, which can only ever be produced in limited quantities in New Zealand, it's the existing legacy fleet of heavy vehicles, those which are being road registered today and will still be on the road (albeit in a reduced capacity) in 2040.

2.2. Green hydrogen technology is ready for commercial deployment in New Zealand now and will enable the accelerated decarbonisation of multiple sectors, including the emissions-intensive 'low hanging fruit' of the heavy transport sector.

2.3. Hiringa supports the introduction of a Sustainable Biofuels Mandate. However, we see the role of biofuels as to decarbonise our existing fleet, not to reduce emissions in new vehicles. The mandate should be applied at the fuel importation stage of the supply chain to ensure sustainable competition in the wholesale supply of ground fuels within New Zealand.

2.4. For new fleets, targeting electrification (both battery electric and hydrogen fuel cell electric vehicles) is going to be key if we are to meet our zero emission targets as a country. For our legacy truck fleet, a biodiesel blend (B20) will provide some level of carbon reductions in the early years, however renewable diesel (R100) is the biofuel that will bring the greatest reduction in emissions, being a complete drop-in replacement for diesel. Hydrogen combustion conversion technology also may have a role to play for legacy fleets as hydrogen production scales and becomes more readily available.

2.5. New Zealand has a significant legacy road fleet, some of the oldest average vehicle lives in the OECD, which will cause an enduring emissions problem for the next 20-30 years. The fundamental inefficiency of the diesel ICE and the high production cost and significant volume scaling limitations of renewable diesel (R100) production will fundamentally restrict this

technology's application in new trucks and is one of the reasons the European Union focus has shifted to e-transport.

2.6. Sourcing enough feedstock to produce either biodiesel or renewable diesel remains a challenge in New Zealand. Scion's NZ Biofuels Roadmap found that if all current waste and residual biomass feedstock for biofuels were aggregated, we would have enough to substitute about 8.2% of our liquid fuel demand.[1] According to the 2021 Sapere report, "tallow-based biodiesel (B100) currently sold in New Zealand is imported from Australia and small volumes of biodiesel are produced from domestically sourced used cooking oil".[2] Currently the Z biodiesel facility in Wiri can produce 20 million litres of B100 biodiesel per year, about 0.5% of New Zealand's total diesel usage.[3]

2.7. Making low emission renewable diesel (R100) for our legacy fleet is energy intensive, feedstock limited and costly when done in isolation. If renewable diesel is produced in an integrated way with renewable electricity generation and green hydrogen production, its commercialisation is likely to stack up better and attract investment.

2.8. Renewable diesel (R100) is made from a variety of biological, thermal, and chemical processes. Common methods include hydro-processing where fats and waste oils are reacted with hydrogen at high temperatures, and synthetic Fischer-Tropsch processes where mixtures of hydrogen and carbon monoxide gases are reacted to produce liquid hydrocarbons. Depending on the process used, the hydrogen production capacity required is around 1 MW of electrolysis per 5 million litres of annual renewable diesel production. Hiringa supports the production of renewable diesel for our legacy fleet. A renewable diesel production plant would provide another integrated project opportunity like the Ballance Agri Nutrients and Hiringa green ammonia project in Kapuni.[4] Green hydrogen will therefore play a critical role in decarbonising our legacy fleet (through renewable diesel production) as well as decarbonising New Zealand's new heavy fleet through zero emission fuel cell technology.

2.9. It is possible to convert or retrofit existing diesel engines to run on hydrogen, supplementing the options for long-life or legacy vehicles. There are two commonly accepted practices for achieving this. The first is to retrofit the existing diesel fuel manifold to allow it to blend hydrogen directly into the combustion chamber. The other option is to remove the diesel engine completely and replace it with an electric motor and a fuel cell. Each pathway has its own strengths and weaknesses. Whilst there are not many companies out there who specialise in diesel engine to fuel cell electric conversions, it is likely that New Zealand will build its own capability in this space. This would likely be seen is in marine, rail, and bus applications.

2.10. "Sustainable Aviation Fuel (SAF) is the only current option for decarbonising long-haul flights and proven technology in other parts of the world".[5] "SAF is made by blending conventional kerosene (fossil-based) with renewable hydrocarbon".[6] Much like renewable diesel (R100), if SAF can be

[1] https://www.scionresearch.com/science/bioenergy/nz-biofuels-roadmap
[2] https://www.eeca.govt.nz/assets/EECA-Resources/Research-papers-guides/Liquid-Biofuel-Research-Report-March-2021.pdf
[3] https://www.eeca.govt.nz/assets/EECA-Resources/Research-papers-guides/Liquid-Biofuel-Research-Report-March-2021.pdf and MBIE Data Tables for Oil
[4] https://www.greenhydrogennz.com/
[5] https://p-airnz.com/cms/assets/PDFs/Airnz-sustainable-aviation-fuel-in-new-zealand-may-2021.pdf
[6] https://aviationbenefits.org/media/166152/beginners-guide-to-saf_web.pdf

produced as part of an integrated project with renewable electricity generation and green hydrogen production, its commercial viability and therefore scalability could increase significantly.

2.11. With the International Maritime Organisation's tightening of permitted fuel sulphur levels, biofuels have the potential to assist with reducing levels of sulphur and other greenhouse gases in the near term. However, competition for biofuels internationally and domestically is growing and New Zealand's ability to produce biofuels at scale is limited. New Zealand is however well positioned to utilise green methanol and green ammonia technologies (based on our burgeoning green hydrogen economy) in order to decarbonise our own fleets as well as offer these fuels to international shipping lines which are likely to increasingly use these fuels. The International Energy Agency predicts that "as ships using fossil fuels blended with some biofuel reach the end of their life from 2050 onwards, they are replaced by new vessels equipped with propulsion technologies compatible with ammonia and hydrogen, two technologies that become steadily more competitive after their first use on short and medium-distance trips from 2025, gradually replacing vessels using oil and, later, LNG, as they retire".

3. Climate Change Commission's recommendations for decarbonising transportation

3.1. Hiringa agrees with the Climate Change Commission (CCC) which recognises that the Emissions Trading Scheme (ETS) alone is not sufficient for driving major behavior change, with complementary policies being required to drive changes to the way New Zealanders travel. To this end we agree with the CCC's recommended policies below that would support low-carbon fuel adoption for the heavy freight sector:

- A low-carbon fuel standard or mandate to increase demand for low-carbon fuel.
- Supporting demonstration and pilot projects for low-carbon heavy vehicles.
- Offering targeted support for the uptake of low-carbon heavy vehicles e.g. extending Road User Charge (RUC) exemptions to renewable diesel (R100) and hydrogen electric vehicles, as well as their trailers.

3.2. It is worth nothing that currently biofuels are exempt from the ETS, however manufacturers of biofuels face the same ETS costs as other businesses. Therefore, if they are using coal or diesel in the facility to produce biofuel, the cost of that carbon will be loaded into the manufacturing costs. This system breaks down if New Zealand imports biofuels manufactured overseas.

4. North American Low-Carbon Fuel Standards

4.1. There are a number of successful Low-Carbon Fuel Standard (LCFS) systems internationally, such as in California and many other states in the Pacific Northwest and in British Columbia, Canada. These put a price on carbon emissions and a decreasing baseline fuel-mix carbon intensity. Fuel suppliers that sell fuels above the baseline (i.e. fossil fuels) must buy credits to make up for their average fuel mix difference, and fuel suppliers that sell fuel below the baseline (i.e. biofuels, or hydrogen) generate credits. Over time, the baseline continues to decrease, so higher emitting fuels need to purchase more credits. This ensures real reductions are made in the transport sector, rather than cross-industry reductions (i.e. tree planting to offset transport emissions) as encouraged by the ETS.

4.2. The current average California LCFS credit price is ~US$200/t-$CO_2$ (NZ$285/t-$CO_2$), and the baseline fuel-mix carbon intensity is at around 8% below conventional fossil fuel. The system is targeting 20% by 2030. The ceiling price for 2021 in the LCFS credits is US$221/t-CO2 and has been increasing steadily since 2016.

4.3. The impact targeted by a low-carbon fuel standard should be to push up the price of fossil fuels and provide attractive cash incentives for alternatives to enter the market. For example, the California LCFS systems awards credits to hydrogen station developers based on the total throughput of the station (not just fuel sold) to incentivise rapid roll out of stations at scale.

5. Other policy levers that can help decarbonise transportation

5.1. The Road User Charge (RUC) exemption currently in place for battery electric trucks is a key enabler for early adoption of these vehicles to undertake light-medium duty tasks. This exemption needs to be extended to cover other low/zero emission fuels such as renewable diesel (R100) and green hydrogen which are well suited to heavy duty tasks, in order for them to be incentivised in the same way and effectively compete with diesel in the short term.

5.2. The current RUC Act only provides an incentive to battery electric powered vehicles that can plug-in and recharge, not renewable diesel or green hydrogen vehicles, which will actually be lower net carbon emitters than battery electric trucks (when the battery electric truck is recharged via our ~80%[7] renewable electricity grid).

5.3. The current RUC exemption assumes that trucks are only available in rigid body format, providing no recognition that most of the heaviest trucks (biggest emitters) tow trailers. By also exempting trailers pulled by any zero emission vehicle, fleet operators would be incentivised to transition their highest emitting vehicles. It would also ensure that safer B-train configurations are encouraged over rigid truck plus trailer combinations.

5.4. It is important to recognise that using a powerful mechanism such as the RUC exception to stimulate uptake of zero emission heavy duty vehicles should only be a temporary measure, a way to incentivize the early adopters of the new technologies such that the rest of industry can benefit from their willingness to innovate. As the uptake of zero emission trucks rises and the costs reduce, any government incentives should also diminish.

5.5. A significant challenge for displacing the incumbent diesel ICE is the low cost of commercial diesel. In addition to Low-Carbon Fuel Standards discussed above, another policy setting to be considered is for new heavy vehicles to become progressively more fuel efficient each year under a type of Clean Heavy Vehicle Standard.

5.6. Hiringa supports the development of a National Supply Chain Strategy given its intention (as outlined in Hīkina te Kohupara) is to engage with industry on ways to reduce emissions. Hiringa has been keen participants in the Ministry's Green Freight Project to date and look forward to adding value to this proposed strategy.

[7] https://www.eeca.govt.nz/insights/energys-role-in-climate-change/

5.7. We welcome the announcement of the Low Emission Transport Fund as a part of Budget 2021. The increase in the amount of funding available and EECA's openness to explore more appropriate and efficient ways of funding projects (other than contestable funding) is a positive step towards achieving large scale impact in partnership with large fleet owners.

Withheld under section 9(2)(b)(ii)

5.8. [redacted]

6. Background: The hydrogen opportunity and industry commitment

6.1. Heavy vehicles are responsible for around a quarter of transport emissions, with the heaviest trucks (linehaul) driving the most kilometres and emitting 150 times more CO_2 than the average light passenger vehicle. Zero emission hydrogen electric linehaul trucks begin operation in New Zealand in 2022 and will provide a 'quick-win' in terms of emissions reduction, without the feedstock constraints that biofuels suffer from.

Figure 1. Decarbonising linehaul trucks has high impact

Green hydrogen refuelling infrastructure available from 2022

6.2. Hiringa is partnering with companies such as Waitomo to establish a nationwide green hydrogen refuelling network. Operational from 2022, the refuelling network will initially serve heavy transport such as buses and the freight and logistics sectors, providing coverage for ~95% of heavy freight routes in the North Island and ~82% of the South Island. The network will be implemented without requiring any significant grid upgrades and will fuel a heavy vehicle in 15 minutes regardless of time of use. Importantly for industry, with hydrogen electric vehicles there is no need to time-shift fleet charging (as may be required if using battery electric technology), meaning the impact on operations when transitioning from diesel to zero emissions is minimal.

6.3. Decarbonising heavy freight routes has a high impact on overall transport emissions reductions. Hiringa has been working with Government and across multiple industry sectors to tie together the zero emission transport value chain to enable road freight decarbonisation and we look forward to working further with the Ministry of Transport to decarbonise our heavy fleet as we head towards our 2050 target.

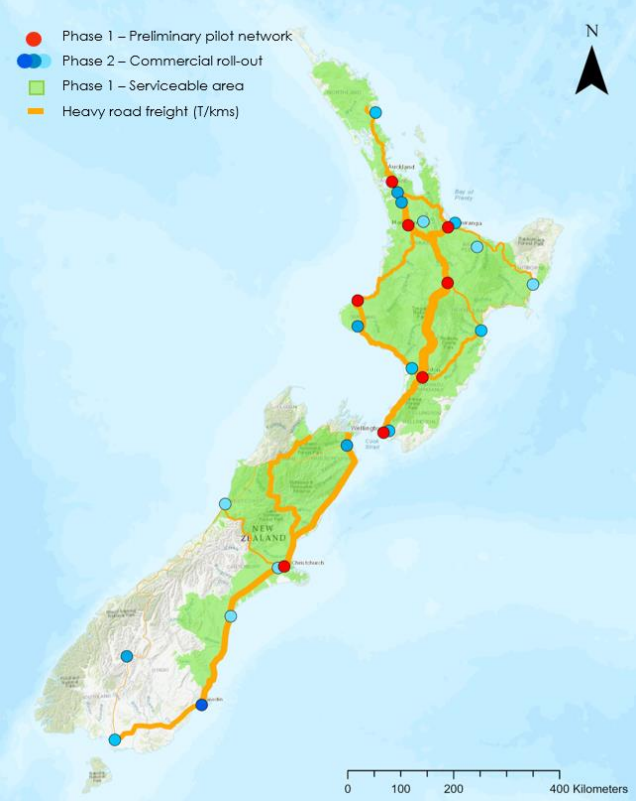
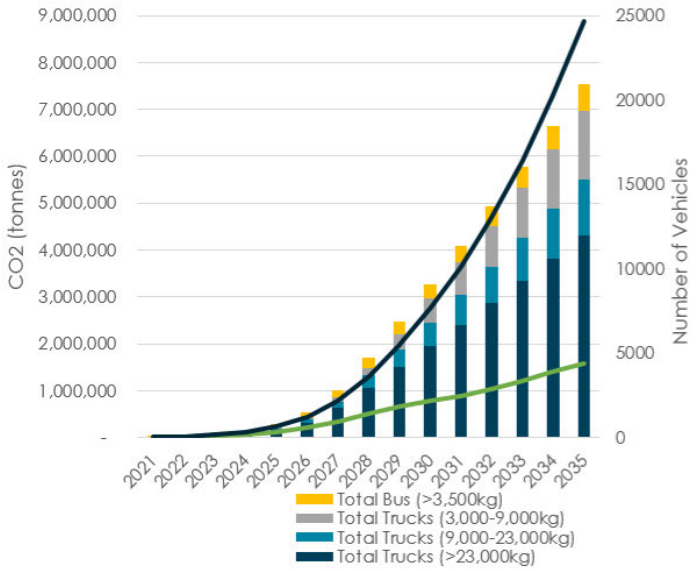


Figure 2. Hiringa's future national hydrogen refuelling network

Commercial deployment of hydrogen electric heavy trucks begins in 2022

6.4. The capital cost reduction of hydrogen electric trucks is following a typical technology commercialisation pathway. To help manage the introduction of the technology, Hiringa has partnered with TR Group to introduce fuel inclusive hydrogen electric truck leases in rated combinations between 38t and 58t, providing ranges from 400km up to 650km, with comparable payloads and refuelling times to diesel equivalents. There are multiple other local industry stakeholders also making progress in this space, collectively helping to lay the foundation for the ramp up of zero emission freight in the medium term.

6.5. Heavy fleet turnover will take several decades with New Zealand only purchasing around 6,500 heavy vehicles each year. Even if we purchased zero emission trucks from now on, it would take more than 20 years to transition the heavy fleet. Encouraging a rapid increase in zero emission heavy vehicle uptake is critical and needs to start now if we are to meet our net zero target.



IMPACTS OF MODEST FLEET UPTAKE

By 2035:

- 20,000+ heavy vehicles replaced by fuel cell vehicles (>13% of fleet)
- 9,000,000 tonnes CO_2 abated

By 2050:

- >64,000 fuel cell vehicles on road (>40% of fleet)
- ~60 million tonnes CO_2 emissions abated

Figure 3. Emissions impact of hydrogen fuel cell electric vehicle uptake

New Zealand's freight industry committing to hydrogen, providing high impact

6.6. As a result of New Zealand's early investment and planning in hydrogen refuelling infrastructure, industry leaders have secured early access to leading hydrogen fuel cell electric truck technologies. New Zealand is seen to provide a perfect test bed to establish the commercial roll out of hydrogen electric heavy vehicle fleets.

- Hyundai Motors New Zealand with the support of EECA has announced a programme to bring five zero emission Xcient fuel cell electric trucks to New Zealand before the end of 2021.[8] The trucks are based off the production run for Hyundai's global program that is deploying 1600 units into Switzerland by 2025, leveraging their global manufacturing capabilities.[9] Hiringa has been working closely with Hyundai New Zealand to ensure its refuelling infrastructure is configured to fuel the vehicles and positioned to serve the target applications within heavy freight for the Xcient platform.

- Hiringa has signed a framework agreement with Hyzon Motors to supply up to 1500 fuel cell electric trucks into the New Zealand market between 2021 and 2026 as Hiringa builds upon its nationwide refuelling network. An initial tranche of 20 trucks is planned to be introduced in 2022.[10]

[8] https://www.hyundai.co.nz/hyundai-new-zealand-welcomes-funding-for-hydrogen-fcev-truck-demonstration
[9] http://www.koreaherald.com/view.php?ud=20201008000980
[10] https://hyzonmotors.com/hyzon-motors-and-hiringa-energy-advance-partnership-to-decarbonize-heavy-road-transport-in-new-zealand/

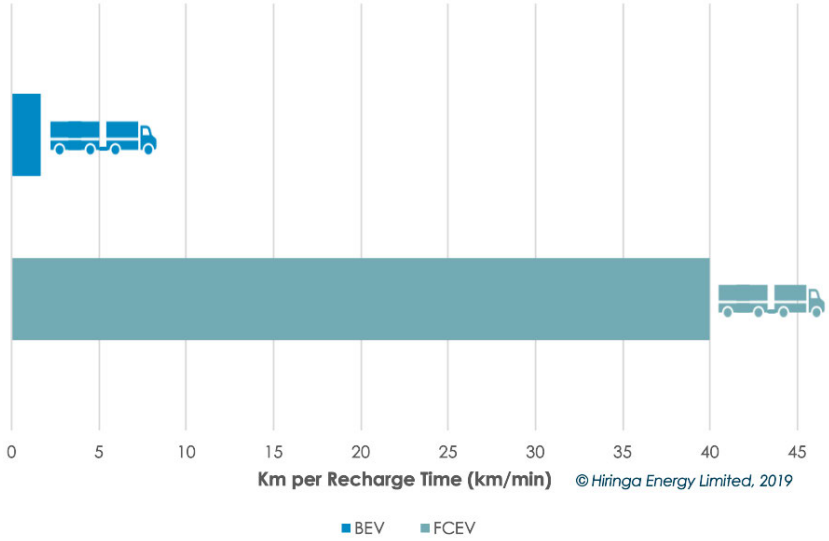


Figure 4. Less charging (refueling) time is more time on the road

6.7. In 2018, Hyundai Motor Group announced that it will invest 7.6 trillion won ($6.58 billion USD) in hydrogen car production facilities and related R&D activities by 2030. Under the plan, the group plans to produce 500,000 hydrogen vehicles by 2030. Hyundai Motor Group is committed to fostering a "hydrogen society", in the belief that hydrogen fuel cells will be equally competitive in achieving a zero carbon future and possibly more efficient in fuel use and overall emissions.[11]

6.8. In 2020 "Daimler and Volvo signed a binding agreement to produce and commercialise fuel cell systems for HDV applications and other uses, and a new entity, Daimler Truck Fuel Cell, consolidates the company's current fuel cell activities under the joint venture".[12] "Customer trials are planned for 2023 and series production in the second half of the decade. Mitsubishi Fuso Truck and Bus Corporation, part of the Daimler truck group, intends to make all new vehicles for Japan carbon neutral by 2039, with series production of fuel cell trucks by the late 2020s."[13]

[11] http://www.koreaherald.com/view.php?ud=20210128001102&ACE_SEARCH=1
[12] https://fuelcellindustryreview.com/
[13] https://fuelcellindustryreview.com/

Figure 5. Hydrogen fuel cell electric trucks entering the market from a variety of OEMs

6.9. "Other players planning to supply trucks include Toyota and its subsidiary Hino for both the Japanese and North American markets, Cummins and Navistar, MAN under its brand TRATON, Freudenberg Sealing Technologies and Quantron, and Foton and Feichi in China. Swiss company GreenGT, better known for its Le Mans fuel cell developments, continues to integrate its technology onto the Kamaz truck chassis. Illustrating the importance and the ambition, a coalition of vehicle manufacturers, technology and infrastructure providers and more signed a statement in March with targets of 5,000-10,000 hydrogen trucks on Europe's roads by 2025, and at least 100 fuelling stations. The ambition is for 100,000 trucks by 2030 and 1,500 hydrogen refuelling stations. While non-binding, this clearly shows a cross-industry acceptance that fuel cells will play an essential role in cleaning up heavy-duty vehicles."[14]

Hydrogen electric buses are already in use within New Zealand

6.10. Hiringa is working with major regional councils around the country on the integration of hydrogen electric buses into their fleets, with one council committing to 12 and another to 5 in principle. Auckland Transport (AT) is trialling New Zealand's first hydrogen fuel cell bus in 2021 after being assembled in Christchurch. AT and Hiringa have signed an MOU to assess feasibility of commercial hydrogen fuel cell electric buses entering their fleets from 2023 and hydrogen powered ferries in the future.

[14] https://fuelcellindustryreview.com/

Figure 6. Auckland Transport's Hydrogen Electric Bus

6.11. Many regional councils see hydrogen fuel cell electric buses being used in their busiest and longest routes given their longer range, higher payload and quicker refuelling times, without the need for sometimes significant grid upgrades and sizeable battery-electric recharging infrastructure in their compact urban areas or grid constrained areas.

6.12. Hydrogen electric bus fleets are well suited for large zero-emission fleets where depot space and electrical grid constraints can limit the number of battery electric buses able to be deployed from a single depot. RedBus's integration of battery electric buses into their Christchurch fleet highlighted that small battery electric fleets can be simple to roll out, however if 40 battery electric buses were needing to recharge it would require 320 megawatts, which was comparable to the power draw of a small suburb and was likely to push past the capacity of the nearest substation.[15] Please refer to our PTOM submission recently submitted for more discussion on the opportunity that hydrogen electric technology provides for decarbonising our public transport bus fleet.

Hydrogen is a cost-effective way to turn non-electrified railway lines into zero emission lines

6.13. Hiringa endorses the Government's desire to decarbonise and grow New Zealand's rail network. There is the ability for trains to switch between electrification in urban areas and hydrogen fuel cell power when travelling through rural areas. Hydrogen fuel cell electric trains provide a solution to the system compatibility issues that arise for trains travelling between Wellington and Auckland electrified networks. New long-distance hydrogen electric trains could be compatible with either Wellington or Auckland electrified systems and use hydrogen fuel cells to power the remainder of their journey once departed.

6.14. Hydrogen trains require only 20 minutes to refuel with 18+ hours of operation between refuelling and provide a cost-effective way to turn existing non-electrified railway lines into zero emission lines. Hydrogen trains are proven technology, having been in use for over four years in places like Germany[16] and more recently in France and the UK.

[15] https://www.stuff.co.nz/business/113790113/economics-vs-environment-the-battle-for-the-electric-bus
[16] https://www.cummins.com/news/2020/02/28/power-passenger-trains-how-hydrogen-can-revolutionize-railway-operations-europe

Hydrogen electric domestic aviation commercially available circa 2024

6.15. The leading development pathway for domestic fleet (e.g. turbo prop Q300 aircraft) low emission fuels is the conversion/retrofit of existing aircraft with hydrogen electric powertrains. The current estimation for commercial availability of this technology is circa 2025. Light electric aircraft (6 to 18-seater) powered by hydrogen fuel cells have been conducting successful test flights since 2016, with commercially available models converted to fuel cell power and electric engines flying since 2019. Light fuel cell powered electric aircraft could be entering service in New Zealand before 2025.

6.16. There is also potential for fuel cell technology to decarbonise New Zealand's 'narrow body' fleet, enabling Trans-Tasman carbon free travel/freight. Beginning with the decarbonisation of the ATRs, Q300 and Dash8 fleet in the short term enables the infrastructure and regulations to adjust and paves the way for 'narrow body' decarbonisation in the medium term.

Green hydrogen forms part of Government energy strategy

6.17. The Government's 'A Vision for Hydrogen in New Zealand - Green Paper' says that "Hydrogen could become a major differentiator for New Zealand's energy, transport and industrial sectors with substantial export potential". "Maritime, long distance road-based freight, buses, coaches and aviation have limited available low-carbon fuel options and represent a significant opportunity for hydrogen-based fuels. Ports, warehousing facilities and freight handling operations using forklifts and straddle carriers that run continuously, could also benefit greatly from the ability to refuel with hydrogen as quickly as with diesel but without the associated transport emissions." [17]

6.18. Hydrogen is rightly placed as one of the Government's pillars of its draft Energy Strategy and complements other pillars such as Renewable Electricity Generation, Just Transition Work, Process Heat, and Backing Emerging Technologies.

Figure 7. Government's Renewable Energy Strategy[18]

[17] https://www.mbie.govt.nz/dmsdocument/6798-a-vision-for-hydrogen-in-new-zealand-green-paper
[18] Energy strategies for New Zealand

Green hydrogen is a cornerstone for a Just Transition within the energy sector

6.19. Hiringa is working with international technology vendors to identify suitable New Zealand partners for service, maintenance, and assembly of hydrogen production, refuelling equipment and vehicles in order to include local businesses in the supply chain.

6.20. Hiringa and E tū are working together to develop a plan for worker retention and job creation as a part of the Ballance Agri Nutrients/Hiringa joint venture[19] and other projects. There is a significant opportunity to create 'green jobs' on the back of regional hydrogen hubs, as demonstrated in Figure 8 below. The assembly of Auckland Transport's hydrogen fuel cell bus in Christchurch is an example of 'green job' creation associated with a hydrogen economy.

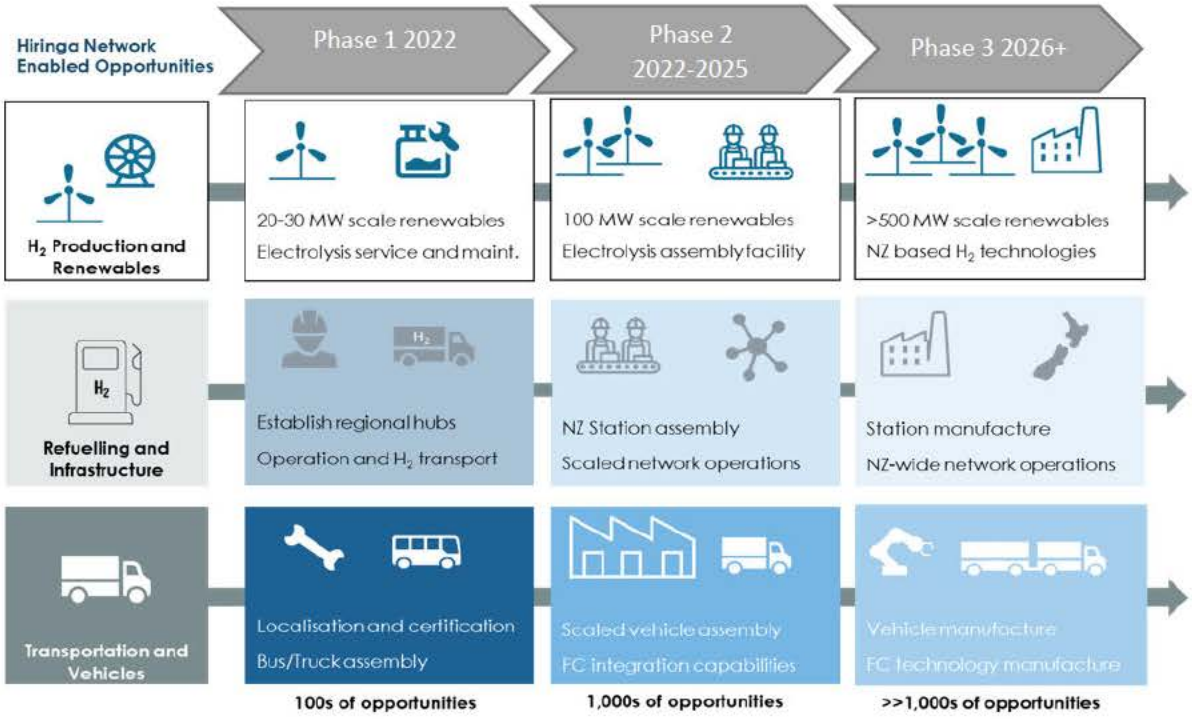


Figure 8. A Hydrogen Economy Creates Green Jobs

6.21. The H_2 Taranaki Roadmap[20], authored by Hiringa in conjunction with Venture Taranaki and New Plymouth District Council was launched in March 2019 by the Rt. Hon Jacinda Ardern and outlines the potential for Taranaki to leverage its existing skills and infrastructure to become a leader in hydrogen production. This document became a cornerstone in outlining Taranaki's plan for a Just Transition. Taranaki is vulnerable as we transition to a low emission economy but has the skills and resources to create a regional hydrogen hub that supports New Zealand Inc's wider hydrogen economy.

[19] https://www.greenhydrogennz.com/
[20] http://venture.taranaki.info/projects/h2-taranaki-roadmap.aspx

Figure 9. Potential integration of hydrogen infrastructure and subsequent regional economic stimulus

Global hydrogen momentum

6.22. Global uptake of hydrogen is summarised by the Hydrogen Council[21] below:

- More than 30 countries now have a national hydrogen strategy and budget in place, and there are 228 projects in the pipeline on both the production and usage sides.
- Two-thirds of the global hydrogen production expected to be operational in 2030 has been announced in the last year.
- Government decarbonization initiatives are a huge driving force behind the hydrogen wave, with some $70 billion committed globally.
- Japan and Korea are leading the charge on fuel cell vehicles, from which much of our second hand vehicles are imported. Globally there will be 4.5 million hydrogen vehicles on the road by 2030, with 10,500 hydrogen fuel stations targeted to meet that demand.

[21] https://newatlas.com/energy/hydrogen-council-insights/

- A recent study undertaken by the World Energy Council analysing 19 National Hydrogen Strategies demonstrates the deep consideration given to hydrogen technology across economies and the initial focus on transport and industry.[22]

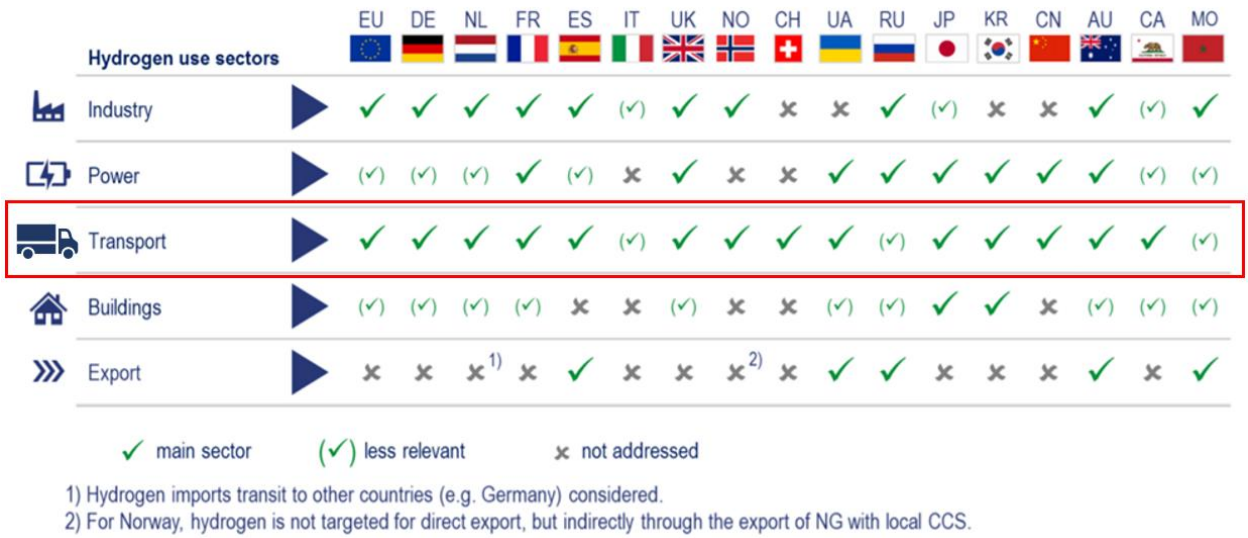


Figure 10. International Analysis into Hydrogen's Potential Sector Penetration[23]

6.23. Major grant-based investments are being made by governments abroad to establish domestic hydrogen markets and create future export opportunities. Recent regional examples include:

a) Australian Government Advancing Hydrogen Fund AU$300m.

b) ARENA conditionally approved $103.3m grant funding for 3 domestic H2 projects

c) New South Wales Net Zero Industry and Innovation Programme:
   - AU$195m to research and develop new clean technologies including hydrogen.
   - AU$175m to set up low carbon industries such as green hydrogen.

d) Queensland Hydrogen Industry Development Fund (HIDF) AU$30m.

e) Queensland Renewable Energy and Hydrogen Jobs $2billion fund.

END

[22] https://www.weltenergierat.de/wp-content/uploads/2020/10/WEC_H2_Strategies_Executive-Summary_final.pdf
[23] https://www.weltenergierat.de/wp-content/uploads/2020/10/WEC_H2_Strategies_Executive-Summary_final.pdf