Submission No 20

INQUIRY INTO DEVELOPMENT OF A HYDROGEN INDUSTRY IN NEW SOUTH WALES

Organisation: Youth for Conservation

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Youth for Conservation Submission to the NSW Legislative Council's Inquiry into the Development Of A Hydrogen Industry In NSW

23/2/2021

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Standing Committee on State Development
NSW Legislative Council
Parliament of NSW
Parliament House
6 Macquarie Street
Sydney, NSW 2000

Re: Standing Committee on State Development in the NSW Legislative Council's Inquiry into the Development Of A Hydrogen Industry In NSW

Thank you for the opportunity to contribute to an inquiry into the development of a hydrogen industry within NSW. Youth for Conservation is supportive of key governmental actions to help develop a hydrogen industry within NSW for both domestic and international use.

Hydrogen Infrastructure Challenges
With only 1/3rd of Australia's greenhouse gas emissions being attributable to the electrical and heat sector, hydrogen is a key component in delivering deep carbonisation and to reduce the other 2/3rds of Australia's emissions[1]. Hydrogen is storable, transportable, easily convertible, and is more energy dense than batteries. However, in order to provide cheap, accessible hydrogen for both domestic and international consumption, a series of infrastructure challenges need to be met.

Currently, Hydrogen is mainly produced as 'grey' hydrogen, which is derived from fossil fuels with little to no Carbon Capture Utilisation and Storage (CCUS) involved. In time, for hydrogen to be a true carbon neutral energy source, it needs to be sourced from renewable energy. The technical challenges undergirding this is highlighted further down in the submission.

In addition to challenges surrounding production, several challenges remain regarding storage and transport of hydrogen. At room temperature, Hydrogen has a very low volumetric density, so in order to store hydrogen effiently, several technologies need to be developed and optimised. Hydrogen can be compressed, with a storage cost forecasted to be roughly 0.3$/kg at around 2025[2]. Furthemore, it can be liquified, or chemically converted to other forms, which have a higher cost, but superior density. Liquefaction involves cooling hydrogen to -235C and has a storage cost of roughly $1.94/kg, while

[1] PwC Australia, Embracing clean hydrogen for Australia. 2020 https://www.pwc.com.au/infrastructure/embracing-clean-hydrogen-for-australia-270320.pdf [Accessed 23 February 2021]
[2] CSIRO, *National Hydrogen Roadmap*, 2018

chemical conversion to molecules such as ammonia will cost around $1.35/kg[3]. These more expensive storage options are suited to transport over longer distances, (>1000km)[4].

Finally, challenges over utilisation of hydrogen remains. We have examined hydrogen fuelled transport as a case study, further down in our submission. Additional challenges remain in the use of hydrogen in industrial feedstocks, firming the electrical great, and production of heat[5].

Hydrogen as a replacement for petroleum – an economic opportunity

Fuel has always been a source of volatility and an area of insecurity for petroleum-poor countries like Australia. With COVID-19 causing significant uncertainty and economic damage across the globe, increasing instability in oil-rich regions, and a cooling relationship with China (our largest refined oil exporter) securing our fuel reserves is both a crucial domestic need, and an economic opportunity for a hydrogen industry in NSW.

While the natural instinct with a highly exploitable resource like petroleum is to cling to self-sufficiency, this is neither a viable nor profitable option for our country. Australia's crude oil reserves are limited, our refineries are far less cost-effective than those in foreign markets, and major crude oil exporters Saudi Arabia, Russia, and Iraq are not reliable allies. This has left us in a position in which refined petroleum makes up 7.2% of Australia's annual imports (in 2017) at a cost of $14.2 billion with 5 out of 7 Australian refineries having closed or announced they are closing in the last ten years.[6,7]

This shift away from domestic refineries is occurring in conjunction with an increase in electric vehicle ownership and since 2010, electric vehicle battery prices in Australia have fallen by more than 85%.[8] As their popularity continues to grow, conservative estimates suggest that new electric vehicles will reach an average price parity with their internal combustion counterparts by 2024 with a brand audience keen to harness environmentally friendly means of powering their vehicles.[9] This shift is being well noticed by businesses in traditionally carbon-emitting industries seeking to capitalise on this market change by pivoting into the production of Hydrogen fuel sources.

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[3] Ibid
[4] Ibid
[5] Ibid
[6] Harris, R., 2021. Craig Kelly resigns from the Liberal Party to move to the crossbench.The Sydney Morning Herald. Available at: https://www.smh.com.au/politics/federal/craig-kelly-resigns-from-the-liberal-party-to-move-to-the-crossbench-20210223-p574zg.html [Accessed 23 February 2021].
[7] Hutchens, G., 2021. Australia loses another oil refinery, leaving our fuel supply vulnerable to regional crises. [online] ABC News. Available at: https://www.abc.net.au/news/2021-02-11/australia-loses-another-oil-refinery-risking-fuel-supply/13139648 [Accessed 23 February 2021].
[8] NSW Department of Planning, Industry and Environment, 2020. Net Zero Plan Stage 1: 2020–2030. Sydney: NSW Government.
[9] Australian Parliament House Select Committee on Electric Vehicles. 2021. Report of Select Committee on Electric Vehicles. [online] Available at: https://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Electric_Vehicles/ElectricVehicles/Report [Accessed 23 February 2021].

While Hydrogen has not yet reached price parity with methane, it is quickly coming down the cost curve and attracting private investment. Signally its ambition to be at the forefront of Australia's hydrogen industry, last year Fortescue, the fourth largest iron ore producer in the world, signed an agreement with ATCO to build and operate a hydrogen production facility in Perth, set to provide the infrastructure necessary to power Western Australian electric vehicles.[10] Likewise, both Origin Energy and Fortescue metals are vying for positions in Tasmania with both companies signalling intentions to build export-scale hydrogen plants that will convert hydropower into green ammonia.[11] NSW should seek to attract this private investment to ensure it is in a prime position to reap the economic benefits of the growing hydrogen industry.

Based on the current use of fuel and the present make-up of vehicles in Australia, the domestic transport sector accounts for 18.9% of the nation's greenhouse gas emissions[12]. The opportunity to secure fuel security and jobs in NSW through hydrogen production will also make it easier and more affordable to own an electric vehicle thereby assisting the move to net-zero emission by 2050.

The Commonwealth Government's Australia Renewable Energy Agency (ARENA) have made great strides in initiating a hydrogen industry, with over $1.6 billion committed for more than 500 projects since the Agency's establishment in 2012.[13] The NSW Government's aspirational target of 10% hydrogen in the state's gas network by 2030 is a positive step in the right direction and we hope the Committee will support further moves to invest in the future of hydrogen.[14]

Feasibility of Green Electrolysis in NSW's Hydrogen Industry Development

Currently, the main processes of electrolysis include steam methane reforming (SMR), gasification, partial oxidation (POX) and autothermal reforming (ATR).[15] These processes do not involve carbon capture and storage (CCS), therefore they contribute significantly to our carbon footprint and are not appropriate composites of Australia's future electrolysis processes if we are to achieve net carbon neutrality by 2050. It is the view of Youth for Conservation that NSW's electrolysis componentry should predominantly consist of renewable electrolysis as it is the best near-term carbon-free hydrogen production solution.[16]

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[10] FMG. 2021. Fortescue and ATCO power on with hydrogen agreement. [online] Available at: https://www.fmgl.com.au/in-the-news/media-releases/2020/04/06/fortescue-and-atco-power-on-with-hydrogen-agreement [Accessed 23 February 2021].
[11] Macdonald-Smith, A., 2021. Origin, Fortescue in rival hydrogen projects in Tasmania. [online] Australian Financial Review. Available at: https://www.afr.com/companies/energy/origin-fortescue-in-rival-hydrogen-projects-in-tasmania-20201117-p56f76 [Accessed 23 February 2021].
[12] Quarterly Update of Australia's National Greenhouse Gas Inventory: March 2019, Commonwealth of Australia 2019
[13] Investing in Regional Australia, Commonwealth of Australia (Australian Renewable Energy Agency) Available at: https://arena.gov.au/assets/2020/02/investing-in-regional-australia-brochure.pdf [Accessed 23 February 2021].
[14] NSW Department of Planning, Industry and Environment, 2020. Net Zero Plan Stage 1: 2020–2030. Sydney: NSW Government.
[15] Briefing Paper: Hydrogen for Australia's future (Hydrogen Strategy Group) 2020
[16] Renewable Electrolysis Integrated System Development and Testing, Ben Kroposki, National Renewable Energy Laboratory, 2006

We commend the fact that the State's first hydrogen facility at Horsley Park is making use of renewable electrolysis and we urge the government to continue this practice throughout the process of developing a hydrogen industry here in this state. Electrolysers that produce hydrogen are yet to be manufactured at scale and the cost of doing so is considerable. However, the capital and operating costs are expected to decrease dramatically as the hydrogen industry and investment in renewable energy advances. According to the International Energy Agency's forecasts, growth in renewable sources of energy from market forces alone (irrespective of any government policy) shall triple from less than 5% today to more than 15% through 2025. Moreover, the investments of major oil and gas companies' in renewable electricity capabilities is expected to rise tenfold from 2020 to 2025.[17] This means that we can expect the cost of producing hydrogen energy through renewable electrolysis to become considerably more economically viable than it is currently in a relatively short period of time.

In a Briefing Paper written by the Hydrogen Energy Group in 2018, chaired by the former Chief Scientist Alan Finkel, the cost and the net carbon emissions of four different types of electrolysis processes were compared. These processes were steam methane reforming with CCS, coal gasification with CCS, alkaline electrolysis and proton exchange membrane (PEM) electrolysis. Both alkaline electrolysis and PEM electrolysis represent processes that utilise renewable energy sources, the former representing a more widely used and mature technology and the latter exemplifying a more efficient but also currently more costly method. The net process CO_2 emissions in terms of kilograms of CO_2 per gigajoule of hydrogen was found to be 6.3 for steam methane reforming with CCS, 5.9 for coal gasification with CCS and zero for both alkaline electrolysis and PEM electrolysis.[18,19] The cost of each method in AUD per kilogram in the year 2018 was $2.30-$2.80 for SMR, $2.60-$3.10 for coal gasification, $4.80-$5.80 for alkaline electrolysis and $6.10-$7.40 for PEM electrolysis.[20] It is clear that the renewable electrolysis methods were an extremely costly method in comparison with the alternative electrolysis processes during 2018, however the 2025 cost projections are far more promising. Prices are expected to drop to $2.50-$3.10 for alkaline electrolysis, to $2.30-$2.80 for PEM electrolysis, to $1.90-$2.30 for SMR and to $2.00-$2.50 for coal gasification.[21] Furthermore, the Australian Renewable Energy Agency's 'Renewable Hydrogen Market Report' dubbed on-site solar as the most cost effective form of renewable hydrogen production with a cost of only $3.19 per kilogram of hydrogen, which is also expected to drop.[22] Evidently, the renewable processes shall decrease in price at a substantially faster rate than the CCS methods due to the rapid decarbonisation of the global market, suggesting that the 'green hydrogen' electrolysis processes are a safer investment both economically and environmentally when compared to 'blue hydrogen' generation in the long term.

[17] Renewables 2020, Analysis and Forecast to 2025, International Energy Agency
[18] CSIRO, *National Hydrogen Roadmap*, 2018
[19] CO2CRC, *Australian Power Generation Technology Report*, 2015, accessed July 20, 2018, http://www.co2crc.com.au/wp-content/uploads/2016/04/LCOE_Report_final_web.pdf
[20] CSIRO, *National Hydrogen Roadmap*, 2018
[21] Ibid
[22] Renewable Hydrogen Market Report, Australian Renewable Energy Agency, 2020

We must take advantage of the current opportunities to become a leader in the renewable hydrogen export market. Currently, Australia's production of renewable hydrogen is falling short of the predicted potential demand forecast conducted by ACIL Allen, which estimated that Australia could fill 10-20% of the demand for renewable hydrogen in the Japanese and South Korean export markets. This demand was forecasted to be approximately 500,000 tonnes annually,[23] but our current export capacity stands at a mere annual 3,000 tonnes by the year 2025.[24] State and Commonwealth governments must stimulate growth for our renewable hydrogen capabilities to accommodate this gap, as filling it would represent a $1.6 billion of potential economic opportunity and the creation of approximately 2,800 jobs by 2030.[25]

Riley Taylor
Youth for Conservation Chair
Coalition for Conservation Inc.

[23] Opportunities for Australia from hydrogen exports, Acil Allen consulting for ARENA, 2018
[24] Renewable Hydrogen Market Report, Australian Renewable Energy Agency, 2020
[25] Opportunities for Australia from hydrogen exports, Acil Allen consulting for ARENA, 2018