

**Submission
No 17**

INQUIRY INTO DEVELOPMENT OF A HYDROGEN INDUSTRY IN NEW SOUTH WALES

Organisation: Clean Energy Council

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Standing Committee on State Development
NSW Legislative Council
Lodged via Inquiry web site

Dear Committee,

Inquiry into the development of a hydrogen industry in New South Wales

The Clean Energy Council (CEC) welcomes the opportunity to provide a submission on the opportunities and barriers to the development of a hydrogen industry in New South Wales.

The CEC is the peak body for the clean energy industry in Australia. We represent and work with over 800 of the leading businesses operating in and servicing the wind, solar, hydro, renewable hydrogen and energy storage sectors, and are committed to accelerating Australia's transition to a clean energy future.

Renewable hydrogen provides the opportunity for NSW to reach its decarbonisation goals more quickly

New South Wales has committed to a target of net zero emissions across its economy by 2050. The development of a hydrogen industry in New South Wales and Australia, provides the opportunity to power more of Australia's economy, more quickly, with clean renewable energy sources.

The production of renewable hydrogen¹ can provide a clean alternative to polluting natural gas for local households and businesses, and diesel for transport. It can also support the competitiveness, expansion and emissions reduction of harder-to-abate activities such as minerals processing and industrial manufacturing.

In addition, renewable hydrogen and its derivatives, such as ammonia, have the potential to become a massive export market to service Australia's power-hungry, resource-poor neighbours in Asia and beyond, which are looking for suppliers of clean energy to replace natural gas, oil and coal to support their emissions reduction ambitions.

Japan, South Korea and China are the three largest importers of liquified natural gas (LNG) in the world. With each of these countries committed to decarbonising their economies, Australia should

¹ The International Renewable Energy Agency (IRENA) notes that 'the most established technology options for producing green hydrogen is water electrolysis fuelled by renewable electricity. Other renewables-based solutions to produce hydrogen exist. However, except for steam methane reforming with biogases, these are not mature technologies at commercial scale yet.' See IRENA's report '*Green hydrogen: A guide to policy making*', 2020.

expect that demand for fossil fuels will decline over time and our trading partners will be seeking cleaner alternatives, presenting valuable new market opportunities.

It is likely that in the early stages, the transportation and export of hydrogen could be in the form of the derivative product, ammonia (NH₃), which is easier and cheaper to store and transport, and which has many current uses from fertiliser, pharmaceuticals and explosives, through to future possible uses as a shipping fuel. For example, one study² of the maritime sector's future energy outlook suggests that renewable ammonia (produced using renewable hydrogen) could represent between 30-55 per cent of the total energy used by global shipping industry by 2050.

A report by Deloitte in 2019 found that if Australia were to secure the same global market share percentage of the hydrogen market as it has today for LNG, it would result in an increase to Australian GDP of up to \$26 billion on a net present value basis and 16,900 new jobs by 2050.

New South Wales' Electricity Infrastructure Roadmap sets the state up for success

Renewable hydrogen represents a strategically important economic development opportunity for New South Wales which has just unveiled its Energy Infrastructure Roadmap and passed legislation to bring online 12 GW of new renewable energy generation within the decade.

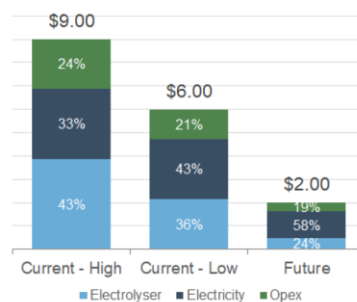
This landmark policy will enable the state to generate plentiful, low-cost clean electricity, which can and should be leveraged to cultivate a renewable hydrogen industry. Home-grown production of hydrogen could assist the state to decarbonise its industrial and transport sectors, secure the long-term competitiveness and expansion of steelmaking in the state, and enable New South Wales to compete in international clean hydrogen markets.

The Australian Government's Low-Emissions Technology Statement sets the stretch target of reducing the cost of renewable hydrogen from between around \$6-8/kg today to around \$2/kg, which would enable it to compete with fossil fuel equivalents.

Achieving such a significant price reduction relies in significant part on the ability of the renewable energy sector to approximately halve the cost of renewable electricity today, as indicated in the chart below by the Australian Renewable Energy Agency.

Figure 1: Getting to H2 under \$2/kg: hydrogen cost components, current and *aspirational*³

- Electrolyser (and balance of plant)
... \$2-3m / MW → **\$0.5m / MW**
- Electricity (solar plus wind)
... \$1.5m / MW → **\$0.75m / MW**
or \$45-55 / MWh → **\$23 / MWh**
- Opex (incl. water and stack replacement)
... 2-2.5% of capex p.a. → **2%**
- Electrolyser efficiency
... 55 kWh / kg of H₂ → **50 kWh / kg**
- Electrolyser capacity factor
... 50% → **no change**
- Life
... 20 years → **no change**
- Cost of capital
... 6-8% → **6%**



ARENA

² DNV-GL Maritime Forecast to 2050: Energy Transition Outlook 2020

³ Presentation by Darren Miller, CEO of the Australian Renewable Energy Agency, All-Energy Conference, October 2020

For this reason, the NSW Government's commitment to five new renewable energy zones, which will strengthen and expand the state's high-capacity transmission network, is a very important foundation initiative to lower the cost of renewable energy projects and support the development of the hydrogen sector.

Not only will the renewable energy zones support the hydrogen industry, but an emerging hydrogen industry could in turn support the successful development of these zones in the coming decade. Renewable hydrogen is an electricity-intensive industry and can help create much needed new 'load' (ie. energy demand) to bring forward the 12 GW of new generation projects more efficiently, while the market awaits the retirement of large amounts of ageing coal fired power stations.

New South Wales is yet to declare its hydrogen ambitions

New South Wales is however, yet to decisively enter the field in the development of a hydrogen sector. The state has endorsed the National Hydrogen Strategy (released in November 2019) but is still to develop a hydrogen strategy/action plan of its own, and allocate significant funds to drive public/private investment.

Such a plan is vital to signal the State Government's intentions and to attract private investment. Without it, the state risks ceding economic growth opportunities to other states such as South Australia, Western Australia, Queensland, Tasmania and Victoria who have each released plans and established hydrogen deployment funds.

Were the New South Wales Government be interested in developing a hydrogen export market, it would also be facing competition from a range of other countries including Abu Dhabi, Chile, and Norway who are positioning themselves as major hydrogen producers.

Significant public investment will be required to support a home-grown hydrogen sector

While public spending to support a New South Wales' hydrogen industry should be guided by the state's forthcoming strategy/plan, it is clear that the State Government will need to begin gearing up to invest in enabling, common-use infrastructure such as transmission, pipelines and transport routes; demand creation initiatives to get the industry started; project support for early movers in the production or use of renewable hydrogen, and skills and training programs for a growing hydrogen workforce.

The necessary investment will be in the order of hundreds of millions of dollars – perhaps more – over the coming decade, depending on the scale of the state's ambitions. As at the end of 2020, New South Wales had committed just \$3.5 million to supporting hydrogen projects⁴, which is towards the bottom end of the current spending commitments by the states.

Small and incremental amounts of funding by the states and territories will be insufficient to build an industry that reflects Australia's ambition to become a top-three exporter of hydrogen in Asia. We strongly encourage New South Wales to commit generous funding to this prospective new industry in these critical early years in order to maximise the state's future options.

Domestic market activation is the number one priority for industry

To contemplate international export opportunities, it is widely considered that the industry must first build scale and efficiency locally. Building an Australian clean hydrogen industry from the ground

⁴ HyResource: A Short Report on Hydrogen Industry Policy Initiatives and the Status of Hydrogen Projects in Australia, December 2020

up is a big undertaking, particularly considering that there is currently very low demand for clean/renewable hydrogen.

A survey by the Clean Energy Council of its renewable hydrogen members in January 2021 found that the top priorities for industry were (in order of importance):

1. Creating local demand for hydrogen
2. Building international demand for hydrogen export
3. More government funding to close the commercial gap for early projects, and
4. Strategic planning and investment in hydrogen hubs.

Without market demand for renewable hydrogen or government incentives to promote market development, the deployment of hydrogen production technologies/infrastructure will develop very slowly or not at all. The funding gap that many projects currently face in order to be economically viable is substantial, and no project is as yet considered to be financially viable without government funding support.

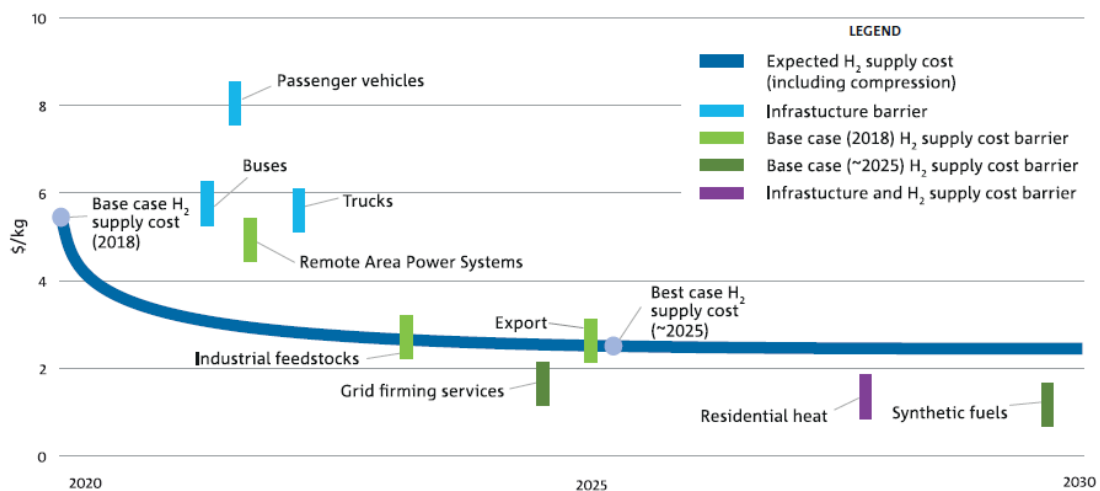
In the remainder of this submission, we discuss our insights and recommendations for addressing these above priority areas, so that New South Wales may seize its opportunity to develop a competitive local hydrogen industry. We note that this submission is not exhaustive – there are many more issues and measures that the State Government can and should evaluate as it prepares its own hydrogen strategy.

1. Local demand creation initiatives

i) Conversion of NSW' publicly-owned heavy transport fleet is likely to be the most economically efficient place to start

Analysis conducted by CSIRO in its landmark 2018 Hydrogen Roadmap identified transport as the most prospective early application opportunity for the emerging fuel.

Figure 2: Hydrogen competitiveness in targeted applications (CSIRO Hydrogen Roadmap, 2018)



Heavy vehicles, particularly back-to-base bus and truck fleets appear to be the most competitive early application opportunities for hydrogen within the transport sector because hydrogen fuel cells are lighter, less bulky and faster to recharge than batteries.

We welcome the State Government's announcement that it will transition Sydney's 8000-strong bus fleet to electric buses by 2030 to support the NSW Government's goal to reach net zero emissions by 2050. The CEC notes that both fuel-cell electric vehicles (EVs) and battery-EVs could fulfil the requirement for a renewable energy powered bus fleet, and encourage the Government to remain open-minded about the technology mix it selects to achieve its aims.

Hydrogen fuel cell buses could create significant local demand for this emerging clean fuel, with a typical bus requiring in the order of 30kg of hydrogen per day on average. Multiplied by even a share of Sydney's 8000-strong bus network, the demand would be sufficient to underpin significant investment overtime in local renewable hydrogen production facilities.

If the conversion of some or all of the Sydney bus fleet to renewable hydrogen fuel cell vehicles represents a significant opportunity for market activation, then the conversion of the regional train fleet and ultimately, the greater Sydney ferry fleet, represent even larger opportunities.

New South Wales' fleet of diesel-powered trains could be gradually converted to hydrogen fuel cell technology overtime, creating significant local demand for renewable hydrogen, (each train would require potentially hundreds of kilograms of hydrogen per day, depending on hours spent in service), reducing emissions and improving air quality.

The first hydrogen trains in the world have been operating successfully in Germany since 2018⁵, with the German fleet expected to grow to more than 40 trains by 2022. Other countries (including United Kingdom, the Netherlands, France and Italy) are also exploring adoption of the technology.

Meanwhile, Sydney's iconic ferries should also be considered for conversion to clean energy technologies. The CEC notes that relatively lightweight and compact hydrogen fuel cells may represent the most prospective alternative to the existing diesel engines. And whereas trains may require in the order of hundreds of kilograms of hydrogen per day, ferries could each require in the order of thousands of kilograms per day, thereby creating very significant further demand in the metropolitan area for renewable hydrogen.

ii) Green steel production represents a major industrial manufacturing expansion opportunity

Green steel – in which iron ore is reduced to iron metal using renewable hydrogen rather than metallurgical coal – has been identified by the Grattan Institute in its report *Start with Steel*⁶, as the leading market expansion prospect to propel Australia to a clean energy superpower.

The relatively high cost of shipping hydrogen '*strongly favours making green steel in the same place as where the hydrogen is made*' and the Hunter Valley (together with Central Queensland) is identified as strong candidates for steel production hubs due to the availability of a skilled workforce, and the existing infrastructure.

If Australia were to capture a 7 per cent share of global steel production, this could create 25,000 ongoing jobs in green steel production, in addition to the thousands of jobs involved in the construction, operations and maintenance of renewable energy plant.⁷

⁵ <https://www.alstom.com/press-releases-news/2020/9/alstoms-hydrogen-train-enters-regular-passenger-service-austria#:~:text=The%20operational%20success%20of%20Alstom's,series%20trains%20beginning%20in%202022.>

⁶ [Start with Steel. The Grattan Institute \(2020\)](#)

⁷ *ibid*

The huge opportunity for New South Wales to leverage its emerging clean energy advantage and existing skills base to not just retain but also expand its local steel industry is one that the State Government should grab with both hands. As a first step, the CEC recommends that the Government commission a green steel processing pre-feasibility study to develop a detailed understanding of the opportunities for, and barriers to, a local green steel industry, with particular regard to how it could best support existing facilities at Port Kembla to leverage their advantage.

Finally, we note that the clean energy transition itself will be a key source of demand for steel production, with large volumes of steel required for wind turbine and electricity transmission towers.

iii) Gas blending can help to get the industry started

The blending of relatively small amounts (up to 10 per cent or potentially more) of renewable hydrogen in our gas distribution networks is a lever at the disposal of State Governments to create local demand for hydrogen production.

In late 2019, Energy Minister Matt Kean announced an aspiration for New South Wales to blend 10 per cent renewable hydrogen within the state's gas distribution networks. Such an initiative could help the industry to build scale and accelerate the reduction in production costs over the short-to-medium term, with Australia's gas distribution networks generally regarded as hydrogen ready at these low-blending rates, subject to appropriate safety trials and controls.

The Australian Renewable Energy Agency (ARENA) has provided funding to support such a trial – the Western Sydney Green Gas Project – which will inject renewable hydrogen into a small area of the Jemena Gas Network. If the project is successful, the State Government should consider establishing a fund to expand the trial to build knowledge, experience and confidence in the feasibility of broad-scale blending across the gas distribution networks in metropolitan and regional centres.

The State Government's purchasing power could also be used to drive early demand through a commitment to satisfy 10 per cent of its gas needs with renewable hydrogen from a local producer.

2. Grant programs are good, but broader based support mechanisms are required

To date, support for hydrogen industry development in Australia has been characterised by relatively small-scale state and federal government grant programs, which while useful for assisting smaller individual projects, are not sufficient to generate the broad-based market response that would enable the industry to grow efficiently at scale.

Earlier in this submission we discussed the State Government utilising its own purchasing power to activate local demand for hydrogen within the transport sector. Other mechanisms that the Government could pursue which have the potential to support a broader private sector response would be a price signal, such as a carbon price to help reduce the cost differential between fossil fuels and renewable hydrogen, and incentivise investment in clean solutions.

Alternatively, another mechanism which could provide more direct support for a fledgling hydrogen industry could be a certificate scheme with an obligation placed on retailers to procure a certain percentage of renewable hydrogen each year (potentially from a low base, increasing over time). This approach, based on clear targets, would enable the industry to plan, invest and scale-up over time, and prepare for a potential step-change from natural gas to green hydrogen in the future.

Regardless of the mechanism selected, the CEC notes that while grant-making programs are helpful in the short term, they are unlikely (due to their piecemeal nature) to deliver the least-cost development of the industry, or build the necessary scale to realise the state's full potential.

3. The NSW Government should identify, plan and fund strategic hydrogen hubs

The development of 'hydrogen hubs' will be the best way for the state to lower the cost of production and use by aggregating demand. Hubs are regions/zones that are positioned to leverage plentiful renewable energy resources, electricity networks and gas pipelines, transport routes and a skilled workforce, to create efficiencies and deliver economies of scale.

Coastal areas and ports are often favoured for hub locations in order to facilitate bulk transportation of hydrogen or products manufacturing from hydrogen. In 2019, Arup was commissioned by the National Hydrogen Taskforce to assess potential hub locations across Australia, and a desktop analysis concluded that Newcastle, Port Kembla and Port Botany/Kurnell represented prospective hub sites in New South Wales.

The existing ammonia production facilities at Newcastle (Orica) and the steelworks at Port Kembla (BlueScope Steel) could make the Hunter Valley and Illawarra regions particularly prospective locations for future hydrogen hubs, and merit more detailed evaluation. Sydney's Port Botany could also represent a prospective site were hydrogen to be in demand for metropolitan transport and gas distribution networks.

Our members report that a significant impediment to early-stage project planning in Australia at the present time is the uncertainty about availability of common use infrastructure to support hydrogen projects. The State Government's early involvement in the strategic identification and planning of sites, matched with targeted funding to support common infrastructure, would help to support the broad-based development of hydrogen supply chains and avoid "winner-take-all" scenarios. Given the importance of this work for guiding major public and private investment decisions over the decade ahead, this strategic planning should be treated as a high-order priority.

4. Planning must begin to prepare the skilled hydrogen workforce

A thriving hydrogen industry will require a skilled hydrogen workforce capable of servicing large industrial manufacturing sites as well as residential and commercial premises across cities, towns and regional communities. Training and upskilling tradespeople will take years and planning should begin without delay to ensure that a lack of localised skills does not prove a barrier to the growth of the sector.

South Australia has been designated under the National Hydrogen Strategy as the lead state in developing nationally consistent training materials and guidelines for procedures to do with the production, handling, transport and use of hydrogen.

To complement this activity, New South Wales should also undertake a study to understand the existing local skills base, the ability of this base to meet the needs of an emerging hydrogen sector and any gaps that will need to be addressed through skills development and training programs over the coming decade.

In conclusion

New South Wales has the opportunity to leverage its emerging clean energy advantage to support the development of a nascent renewable hydrogen industry and in turn grow its industrial manufacturing base, as it delivers on its 2050 decarbonisation goal.

The renewable hydrogen sector is eagerly anticipating the state's forthcoming hydrogen strategy, which will provide a much-needed market signal to the private sector of the State Government's vision and intent.

We urge the Government to prioritise demand creation initiatives that will create reliable, bankable demand, which can assist industry to attract the investment to build projects and scale-up over time.

Thank you for the opportunity provide feedback on New South Wales' opportunity, and I look forward to an opportunity to address the Committee in the coming weeks. Please don't hesitate to contact me at _____ or on _____ should you wish to discuss our submission further.

Yours sincerely,

Anna Freeman
Policy Director – Energy Generation