TECHNOLOGY INVESTMENT ROADMAP DISCUSSION PAPER SUBMISSION

H2SEQ is an industry-led Hydrogen Industry Cluster focused on sustainably growing the Hydrogen industry ecosystem in Greater Brisbane/South East Queensland region. Our cluster is joins industry bodies, research institutions (QUT, Griffith University), businesses, large companies and specialist services that contribute to the value chain.

This submission focuses on hydrogen technology and presents the views of the H2SEQ cluster. For further information please contact Diane Hinson diane.hinson@leadengineeringsolutions.com.au

We welcome any opportunities to collaborate for successful activation of the hydrogen industry.

a) The challenges, global trends and competitive advantages that should be considered in setting Australia's technology priorities

There is a growing global appetite to explore hydrogen as a form of renewable energy. Industry is making the technology breakthroughs necessary to reduce the cost of generating hydrogen and countries like Japan, South Korea, Germany, and the US have been investing in hydrogen technology over the past decade or more.

Hydrogen presents a viable alternative to conventional fossil fuels in Australia and conditions are now favourable to capitalise on international technology breakthroughs and grow both hydrogen domestic and export markets. Large scale production is yet to be realised, but it is only a matter of time.

It is vitally important to create a value chain in Australia for the hydrogen industry to gain a foothold and build towards an export market. H2SEQ participants are exploring opportunities to engage end users in the process and develop a viable industry in Australia. Hydrogen presents an opportunity to decarbonise industries including power generation, mining, and transport. There are many proposals to consider including the Grattan Institute green steel proposal.[1]

Australia's competitive advantage is our skills in gas extraction, use, and export; the availability of land to develop on, and complimentary industries i.e. mining, to build a hydrogen industry around.

The export market currently in negotiation with Japan and South Korea will hopefully pave the way for a domestic transition to hydrogen. The Australian Government through the implementation of this policy can assist with the establishment of the domestic demand for hydrogen.

[1] https://grattan.edu.au/wp-content/uploads/2020/05/2020-06-Start-with-steel.pdf

The Government should also support the adoption of hydrogen through emissions targets, fuel excise, support for transition of industrial feedstock and recommendations for fuel mixing with gas for domestic heating cooking and household use.

b) The shortlist of technologies that Australia could prioritise for achieving scale in deployment through its technology investments (see Figure 7).

Australia will need to carefully select existing hydrogen technology to suit the Australian climate. Whilst the TRI/CRL scale is an essential consideration for investment selection, it should not be the only focus. Just as projects within a company are selected according to their cost, business impact, value across its lifecycle, execution effort and alignment to company vision, technology prioritisation should apply similar principles at a macroeconomic and regional level. Prioritisation should consider:

- Technologies addressing the sector with largest emitters
- Technologies that give the largest abatement for an industry
- Where in the energy value chain it fits, its impacts on components upstream and downstream of it. ARENA and CEFC have focused mainly on hydrogen production, with little emphasis on the development of end user markets. How have business cases been assessed if there is no end user or method of delivery?
- The policy effort needed to stimulate investment and uptake of end user market
- The short- and long-term feedstock, socio-economic, community, displacement of resources and environmental impacts. For example, hydrogen electrolysis at export scale will require volumes of water which could have negative impacts on community and other industries.
- The maturity of the energy value chain itself. For example, the Hydrogen for transport value chain has little infrastructure which constrains full commercialisation and is therefore less mature than that for conventional fuels. This maturity is perceived as higher risk for Australian investors in the private sector and will require more leadership and incentives by the Government to encourage investment.
- Cross industry impacts. New technology could cause major disruption or displacement of well-established industries and transition plans will be necessary. Australia's dependence on carbon exports, mining royalties, employment opportunities and public opinion are well understood. The Government may need to consider options for transitioning carbon intensive industries and subsidising new industries when scaling up hydrogen.
- Workforce considerations including capability, upskilling and capacity gaps.
- Overall efficiency of energy lifecycle and sustainability. If it costs more energy to produce hydrogen than its end use; if hydrogen production releases more carbon or generates more waste than it abates in the end use – then those technologies should be de-prioritised.

- Investment required across the industrial ecosystem to ensure all parts are ready for large scale hydrogen production.
- Diversity of technologies to ensure supply chain reliability.

c) Goals for leveraging private investment.

Australia government support is vital to attract international investment in hydrogen research and applications. Private investment in a post COVID-19 recession is likely to prefer more mature investments and hydrogen industry is perceived as high risk as the pathway to commercialisation is not fully defined. Industry players will require continued support through initiatives like ARENA to attract investment and raise equity. For example, Hazer Group is yet to build a facility or return a positive cashflow.

Government could consider expanding the North Australia Infrastructure Fund (NAIF) to stimulate investment in hydrogen projects. Government needs to consolidate the current R&D tax incentives and investment vehicles (ARENA, CEFC, CRC) to ensure effective distribution of capital across the ecosystem and facilitate market entry.

Co-investment and collaboration across industry should be encouraged – for example, Port of Auckland partnered with Kiwi Rail to explore hydrogen use for refrigerated containers running on diesel. Other use cases that present cost savings across a lifecycle and productivity gains should be explored, for example inland rail diesel consumption - why electrify a long track when hydrogen offers clean air, less noise, more energy efficiency and less maintenance for rail applications. Hydrogen or electric trains offer higher productivity, e.g. by elimination of purging fumes per train pass in tunnel ventilation systems.

Government should also consider incentives to encourage capitalists to invest specifically in hydrogen projects or trials, or other means to de-risk investment in the industry. Perhaps more creative financial vehicles are required to facilitate investment and deployment of capital across an entire value chain.

International examples to learn from include Germany's €9 billion green hydrogen investment, with a focus on the necessary market signals. Japan's Hydrogen strategy sets clear goals to reduce the cost to 30¥/Nm^3 by 2030 and to 20¥/Nm^3 in the long term, having collaboration with major industry players.

d) What broader issues, including infrastructure, skills, regulation or, planning, need to be worked through to enable priority technologies to be adopted at scale in Australia.

The Technology Investment Roadmap identifies Australia's goal of reducing the cost to under $2 per kg and industry engagement is essential to ensure the goal can be sustainably reached.

The Australian government should actively build Australia's profile as a producer, trading partner and research partner in hydrogen. Outreach activities should include attracting international research funding and expertise to Australia for undertaking trials. Japan's program of investment internationally is one example of the global opportunity.

Skills:

- CSIRO identified the opportunity to repurpose the advanced skills developed in the gas industry to support the hydrogen industry. The local hydrogen industry will capture and retain some of these skills in Australia as the boom in gas production declines.
- Australia is home to internationally recognised universities and world leading research. Further support for investment in hydrogen projects, generation and uses through industry research partnerships.
- Collaboration and knowledge-sharing with overseas proponents as well as adoption of well-established standards from other industries – e.g. refineries, gas and space agencies - to accelerate learning.
- Training for the next generation of professionals including tradespeople, contractors and academics should align with benchmarking through to commercialisation of technologies.

Regulation:

- Develop nationally harmonised regulations and standards for hydrogen applications through COAG to level the regulatory playing field in each state and territory. Uniform standards would also contribute to shortening design and production times and allow flexibility when combining components from different manufacturers.
- Revision of other legislation that could impact industry development including workplace health and safety, dangerous goods etc. A framework outlining the legislative requirements in each state and territory for new developments should be developed.
- Government to provide a supportive policy and regulatory environment geared towards hydrogen industry, for example priority land use such as State Development Areas in Queensland and accelerated approvals in Special Activation Precincts in NSW.
- Develop consistent training standards and certification system for hydrogen industry workforce.
- Use of hydrogen for credits or certificates in Scope 1 & 2 emission reduction, similar to renewable energy generation instruments.
- Hydrogen as a fuel for transport will have tax implications and incentives are needed for heavy vehicles to take up hydrogen. How does this fit with governments Heavy Vehicle Charging policy?
- Hydrogen would play a vital role in long-distance heavy freight, road, rail and sea. Targeted incentives for Australian truck and trailer manufacturers to produce

hydrogen-enabled vehicles as well as manufacturers of associated components will encourage growth of manufacturing sector.
- Enable regulatory import of available technology and equipment for early adopter companies to utilise readily in Australia.

Planning and Benchmarking:

- Develop a roadmap for hydrogen supply chain and integrate incentives and tax relief for strategic investment in hydrogen fuelling through a carefully selected network of service stations.
- Government support for a framework to benchmark and determine the efficiency, environmental and cost benefit of technologies for the freight sector. Provide a trusted platform for industry to utilise in making sustainable fleet purchasing decision for their business.
- Policy and regulatory environments coupled with funding opportunities that address interactions, networking, and optimisation of energy systems under real-life conditions and enable de-risking of technologies for commercialisation.
- Clear policy objectives and targets for industry to deliver and report against, which must be clearly articulated in the technology strategy and goals proposed. H2SEQ supports the proposal for annual technology benchmarks and measures.

Research and Development:

- R&D must be considered when setting policy and practice to facilitate commercialisation of technologies. A coordinated, integrated deployment of clean energy technologies across urban and remote communities will be necessary. Innovative clean energy technologies require reliable foundations to develop scale and capability to enter the Australian and global markets.
- The role of pre-commercial demonstration/ pilot plant infrastructure, capability to benchmark rapidly evolving technological advances, test to Australian standards and eliminate scale-up risk is essential when translating research outcomes into commercialisation.

e) Where Australia is well-placed to take advantage of future demand for low emissions technologies, and support global emissions reductions by helping to deepen trade, markets and global supply chains.

Australia has an existing viable and flourishing renewable energy market and hydrogen will fit into the energy mix both as an energy store and as a stand-alone fuel. Australia is also an economic power in the Pacific region and can expand industry development and innovation to neighbours in the Asia-Pacific region. Major trading partners in Japan, China, India, and

South Korea are ready to explore new opportunities for renewable energy. Our university sector, its research capability and global research standing all place Australia in a strong position to collaborate and expand the development of a sustainable hydrogen industry.

Hydrogen industry development will require both a vibrant, interconnected, and viable domestic industry and a growing global trading environment to succeed.

There are opportunities to significantly reduce emissions in the freight industry through hydrogen, however end user development and supply planning will be critical to the deployment of hydrogen as a fuel. Government support in establishing the regulatory environment and assistance to transition fleets to lower carbon options will be instrumental in the development of a viable domestic market. Fleets take many years to turn over and support for the transition will be necessary. Austroads paper on decarbonising the transport industry indicates larger freight vehicles might take up to 50 years to completely retire diesel vehicles. H2SEQ believes that when the cost of hydrogen generation falls to an acceptable level the freight industry will be ready to seize the opportunity.