

**Submission
No 35**

INQUIRY INTO DEVELOPMENT OF A HYDROGEN INDUSTRY IN NEW SOUTH WALES

Organisation: BOC Limited
Date Received: 26 February 2021



DEVELOPMENT OF A HYDROGEN INDUSTRY IN NSW

Submission to Standing Committee on State Development
26 February 2021

The NSW Government's announcement of \$50 million funding over the next decade to develop a green hydrogen industry is an important commitment that can play a role in making green hydrogen viable and position NSW for future success in the global hydrogen economy.

BOC is well positioned to support the NSW Government in developing a hydrogen industry in NSW with expertise and highly efficient technology that covers the entire hydrogen supply chain – and significant infrastructure across the state to support the production, storage, distribution and use of hydrogen.

Operating in Australia for over 80 years, BOC has operations in every state and territory spanning 35 production sites, 850 gas agents and 56 Gas & Gear stores. Our national headquarters is in Sydney, with a world-class operations centre in Western Sydney that fills approximately 1.3 million gas cylinders each year and is home to a \$20 million specialty gases facility opened in 2018.

We currently supply hydrogen for industrial applications across Australia and New Zealand, with proven expertise in the safe handling and transport of hydrogen in gas cylinders packs and for bulk use through tube trailers and road trailers.

As a subsidiary of Linde plc, BOC is part of the world's largest industrial gases company that leads the world in hydrogen innovation across the entire value chain, from production (conventional or renewable) and conditioning, to transport and refuelling. The company employs approximately 80,000 people globally and serves customers in more than 100 countries worldwide.

Linde has developed strategic partnerships with world-leading companies including ITM Power, which specialises in the manufacture of integrated hydrogen energy systems including electrolysers, which is critical technology for the production of green hydrogen.

Our local experts backed by our global team are actively working with Australian governments, research bodies and industry on projects focused on green hydrogen production, decarbonising heavy industry and advancing the use of hydrogen fuel cell electric vehicles.

As a founding member and board representative of the Australian Hydrogen Council, BOC is a strong advocate for hydrogen in Australia and has leadership positions on technical committees and working groups including the Standards Australia ME-93 Hydrogen Technologies Committee.

We believe hydrogen has great potential to improve energy availability, affordability and sustainability for businesses and communities in both regional and metropolitan NSW. It has the potential to decarbonise our top three emissions sectors: stationary energy (heat and electricity), agriculture and transport emissions.

Hydrogen technologies are mature, proven and ready for deployment, with countries around the world already using hydrogen to decarbonise transport and industry. These examples should provide confidence to Australian investors and policy makers that hydrogen is not just a concept, but an energy source that can be viably produced, stored, transported and used today.

NSW's plans to develop large-scale renewable energy zones provides tremendous opportunity to produce green hydrogen in various forms (from liquid hydrogen to other carriers such as ammonia) and position the state as a significant exporter.

We look forward to working with the NSW Government to develop a hydrogen industry in NSW, providing long-term benefits for its citizens and supporting the reduction of carbon emissions across the state.

As the Standing Committee on State Development undertakes its review of submissions, we would be delighted to welcome you to our Sydney Operations Centre in Wetherill Park where we can provide a private tour and showcase our hydrogen capabilities in NSW.

For more information, please contact:
Vesna Olles
Director Clean Energy and Hydrogen
BOC Limited

BOC's existing hydrogen capabilities in NSW

The largest local industry gas operator

BOC has a large distribution network spanning the South Pacific. We fill more than 40,000 gas cylinders every day from 12 industrial and medical filling sites. Delivering cylinder gases to more than 350,000 delivery points.

We have significant infrastructure in place to facilitate the energy transition to green hydrogen, and are continuously investing to increase our hydrogen production, storage and delivery capabilities.

Hydrogen production

In Australia, BOC operates 2 hydrogen production plants in Western Australia and Victoria which provide our industrial customers in the refining, steelmaking, manufacturing and energy sectors with a reliable supply of hydrogen which is used as an essential feedstock in production processes.

In several months, we will commence production of green hydrogen at our Bulwer Island facility in Brisbane through an electrolysis process powered by renewable energy, as part of a \$3.1 million end-to-end demonstration project. This facility will initially have capacity to produce 876 tonnes of hydrogen annually, with potential to increase production to 20,000 tonnes annually for supply to industrial customers and the mobility market.

We have 24 production plants in total including 2 hydrogen plants, 4 carbon dioxide plants and 10 air separation plants.

Hydrogen storage

Hydrogen can be stored in many ways: from a few grams in handheld cartridges to thousands of tons in an underground cavern. This gives hydrogen a unique potential to store renewable energy – both on small and very large scale.

In NSW, BOC has capacity to provide a range of hydrogen storage options including liquid hydrogen cryogenic vessels, compressed gaseous hydrogen cylinders and specialised tubes.

We currently have capacity to store approximately 1 million litres of hydrogen contained in trailers.

Hydrogen delivery

BOC has a fleet of 65 compressed hydrogen tube trailers across the South Pacific that are readily available to deliver hydrogen where it is needed. We can also deliver hydrogen

through pipelines to industrial customers, in cases where they are located in close proximity to a production site.

Specialty gases facility in Western Sydney

BOC's \$20 million specialty gases facility at its Sydney Operations Centre in Wetherill Park is a state-of-the-art facility that allows BOC to locally produce and supply more than 8,000 specialty gases to many high value sectors in Australia such as medical and scientific research, environmental emissions monitoring and energy.

Similar to the LNG export market, hydrogen exports will require calibration testing to determine the calorific value of the product prior to exporting. BOC's specialty gases facility is NATA accredited and has a proven track record of locally producing high quality specialised gases.

Supporting research and development

BOC provides its expertise across the entire hydrogen supply chain to support research and development work of government institutions such as CSIRO and academic institutions including Macquarie University in NSW.

We are also committed to supporting the research and development priorities of the Australian Renewable Energy Association (ARENA) and customers across the private sector.

We contribute our global expertise across Linde plc to innovate across the industry and develop tailored solutions for unique applications.

Immediate opportunity in NSW

The biggest challenge in developing a hydrogen industry in NSW is securing baseload demand to drive investment in infrastructure.

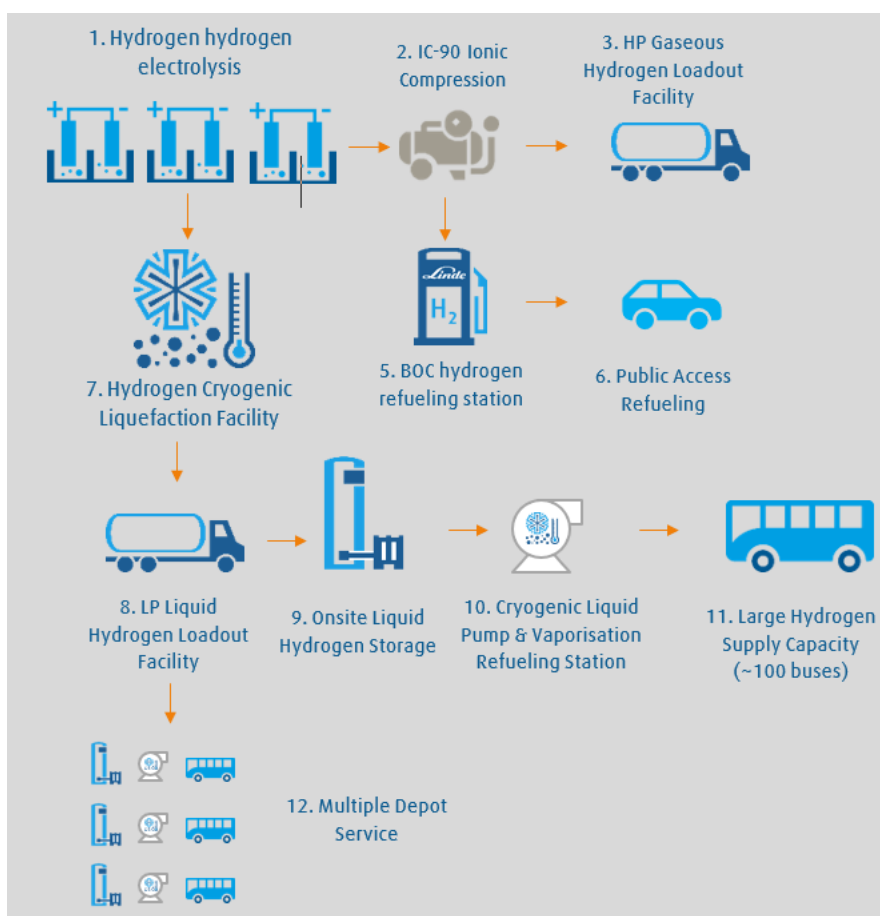
Hydrogen technologies to produce, supply and dispense hydrogen are already being used at scale around the world. Linde has installed more than 180 hydrogen refuelling stations worldwide and recorded over 1.5 million successful car refuellings.

NSW can move quickly to make hydrogen competitive and accelerate the uptake of hydrogen fuel cell electric vehicles (HFCEVs) by committing to a fleet of metropolitan hydrogen fuel cell electric buses.

This would support the development of a liquid hydrogen (LH2) supply chain to service the fleet, drive investment across the hydrogen supply chain and support NSW in reaching zero emissions targets by 2050.

LH2 production plants powered by renewable energy could be built in regional areas such as Port Kembla or Newcastle, with the opportunity to scale up production to allow LH2 exports both locally and internationally.

The below image shows how the LH2 supply chain could work under this scenario:



Why LH2?

LH2 is a more economical solution for transporting hydrogen over longer distances, which is suitable in Australia given the geographic size of the country. One single liquid hydrogen trailer can deliver 7 times more hydrogen than in compressed gas form. The same principles also apply for storing hydrogen at a refuelling station.

Linde is a market leader in liquification of hydrogen, with majority of the world's hydrogen liquefaction plants built by the company. We have concepts that provide record efficiencies for plants up to 100 tonnes per day, which is enough LH2 to fuel 1,000 buses every day.

LH2 fueling is also more efficient. A Cryopump that compresses LH2 when refuelling, needs seven times less energy than a compressor for gaseous hydrogen. Linde is currently the only supplier of LH2 refuelling stations, with 25 built worldwide based on Cryopump technology.

Why buses?

Hydrogen buses have already been rolled-out in California and Germany.

NSW Government commitment on hydrogen buses will provide a baseload of hydrogen demand, reducing the capital cost of hydrogen refuelling stations and providing economies of scale in the hydrogen supply chain with a single tanker, multi-drop model.

This will then open the market for passenger FCEV, making it more cost competitive with existing back-to-base infrastructure already established.

The LH2 supply chain would mimic existing diesel supply chains and avert the need for larger investment into electricity distribution networks.

Building the Port Kembla Hub

Port Kembla has well established infrastructure to support shipping exports of LH2 and is strategically well positioned to supply metropolitan areas. This would diversify exports from the region, which are predominantly focused on agriculture.

Similar models have been rolled-out in Germany, Korea and California by our global colleagues. These real-world examples and BOC's deep understanding of the unique requirements to develop an LH2 supply chain in NSW with Port Kembla as a hub – have all been key considerations in proposing this viable concept.

H2OZBus Project

BOC is a member of the H2OzBus Project, a consortium of strategic partners that have signed a memorandum of understanding (MOU) to evaluate and demonstrate the concept of hydrogen fuel cell electric buses for use in public bus transport in Australia. Partners include NSW public transport operator Transit Systems, ITM Power, Palisade Investment Partners and Ballard Power Systems.

Other barriers and considerations

Cost of achieving large scale production

Cost remains a key issue in getting the hydrogen production to large industrial volumes. As hydrogen research and development activities continue across Australia, the key will be to ensure the right balance of investment and policy support to allow technologies to be commercialised and deployed at a larger scale – therefore driving down costs across the hydrogen value chain. Government incentives during the initial set-up phase may help relieve costs.

Close collaboration and partnerships with relevant industry associations and Technology Clusters will build strong relationships with industry and identify initiatives that can be leveraged for overall sector growth. It is also important to consult with large industrial players who have a track record of delivering largescale projects with complicated supply chains.

Investment in shipping infrastructure is also required as ports will provide an opportunity for NSW to take on bulk volumes and set up long term sustainable supply contracts.

Investment and incentives

Strong government incentives are needed to help drive down the cost of electrolyzers, which is one of the biggest hurdles for the hydrogen market in Australia.

Ensuring the right balance of investment and policy support to allow technologies to be commercialised and deployed at a larger scale will drive down costs across the hydrogen value chain. Government incentives during the initial set-up phase may help relieve costs.

Australia needs to begin installing a critical mass of hydrogen refuelling station (HRS) units to facilitate the uptake of buses, cars and trucks.

Other government grants could be considered for liquefier and storage projects to develop hydrogen production and export infrastructure – as well as for stationary energy projects to gain experience on hydrogen for power generation, energy buffer and traditional heating appliances e.g. boilers and burners.

Skills

Nationally recognised standards will provide government with a regulatory framework in which they can operate; and learnings can be shared among all states and territories. Commonwealth and State regulators rely on prescribed standards to regulate safety in gas industry.

Likewise, standards being developed or adopted by Standards Australia would ensure consistency and certainty across all states. Industry utilises standards to determine minimum

safety requirements and the absence of standards will likely lead to less investment or delays in investment.

Engineering and technician capabilities will need to be developed against a well-defined competency-based framework. Adequate levels of technical expertise are essential, particularly when large-scale projects commence at the same time.

Organisations with established infrastructure and expertise in hydrogen can assist TAFE Colleges in training and upskilling tradesmen to ensure correct certifications for maintaining hydrogen refueller systems, and installation and commissioning of hydrogen gas system.