Submission No 26

EMISSION FREE MODES OF PUBLIC TRANSPORT

Organisation: BOC Limited

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Submission to Legislative Assembly Committee on Transport and Infrastructure

11 July 2022

BOC welcomes the opportunity to provide a submission to the NSW Government's inquiry on emission free modes of public transport.

BOC believes hydrogen will play a key role in NSW's future public transport system. Zero emission hydrogen buses, ferries and trains are already being used around the world. Vehicle and refuelling technology is also mature, proven and ready for deployment.

Hydrogen at scale will be more cost effective than electrification in some cases and can mimic the diesel supply chain in terms of central production and distribution.

BOC is the largest industrial gas provider in NSW with over 80 years' experience in hydrogen. We are the largest supplier of bulk and packaged hydrogen in Australia, with expertise and highly efficient technology that covers the entire hydrogen supply chain.

Our significant infrastructure in NSW can support the production, storage, distribution and use of hydrogen with 6 plant sites in NSW, 14 BOC operated gas and gear retail outlets and hundreds of agents offering BOC products to customers every day.

As a Linde company, BOC is part of the world's largest industrial gases company that leads the world in hydrogen innovation. Linde has already delivered hydrogen production and refuelling systems for hydrogen-powered public transport in UK, Germany, South Korea, Norway and China.

Linde has 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 a global team are actively working with Australian governments, research bodies and industry partners on projects focused on green hydrogen production and advancing the use of hydrogen fuel cell electric vehicles (HFCEVs).

As a founding member 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, Victorian Hydrogen Hub and SA-H2H Hydrogen Technology Cluster.

We believe hydrogen has great potential to improve energy availability, affordability and sustainability for businesses and communities in both regional and metropolitan NSW.

NSW's plans to develop large-scale renewable energy zones and hydrogen hubs provide tremendous opportunity to produce green hydrogen and establish initial baseload demand for transport and electricity.

BOC is currently in the second round of the NSW Government's Hydrogen Hubs initiative. Our "Illawarra Hydrogen Technology Hub" submission proposes co-funding the total cost of ownership of hydrogen buses to accelerate decarbonisation of the public transport sector and bring hydrogen bus manufacturing and maintenance jobs to NSW.

If successful, BOC will also bring heavy transport vehicles to Australia, ensuring total cost of ownership from the hydrogen to refuelling infrastructure and vehicle costs are comparable to diesel as the first hydrogen vehicles come to Australia.

Our team has already visited bus locations including the Seven Hills depot operated by ComfortDelGro to see how integration of hydrogen and electric vehicles could work.

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 Committee undertakes its review of submissions, we would be delighted to provide more information or 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:

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1. Capacity and capability for industry to provide emission free modes of public transport

BOC is supporting public transport zero emission projects locally and internationally with experience in hydrogen production as well as refuelling of trucks, buses, ferries and trains.

BOC has the capability to deliver the full ecosystem for hydrogen, with existing infrastructure and industry partnerships focused on demonstrating capability to progress larger trials of hydrogen fuel cell electric vehicles.

Linde is a market leader in liquification of hydrogen, with majority of the world's hydrogen liquefaction plants built by the company. Liquid hydrogen is a more economical solution for transporting and storing hydrogen. We have concepts that can mimic the diesel supply chain with up to 200 hydrogen buses, and case study examples from Korea, California and Europe.

BOC has developed liquid hydrogen refinery concepts for Illawarra and Newcastle, which would enable low-cost distribution of hydrogen into other geographies in NSW and develop a future export market.

BOC is currently in the second round of the NSW Government's Hydrogen Hubs initiative. Our proposed Illawarra Hydrogen Technology Hub project would use existing infrastructure at BOC's Cringila production site to kickstart the use of green hydrogen for transport and electricity, and develop a liquid hydrogen supply chain.

The project would be scalable and if successful, a key focus is establishing up to 3 trials of 4-10 hydrogen buses in NSW, with hydrogen subsidised to reach diesel parity.

BOC is also partnering with industry to deliver hydrogen bus projects across Australia.

Local examples include:

- Memorandum of Understanding with Foton Mobility, a manufacturer of hydrogen buses to develop operational and commercial hydrogen bus models across the entire supply chain
- Providing hydrogen refuelling production and infrastructure for a fleet of up to 10 hydrogen coaches at Fortescue Metal Group's Christmas Creek iron ore operation in the Pilbara
- Preparing commercially sensitive hydrogen refuelling proposals for bus operators across Australia

2. Benefits and costs to taxpayers

BOC believes hydrogen will provide long-term benefits in NSW through reduced carbon emissions, improved energy availability and affordability across both regional and metropolitan NSW.

NSW's current public transport system is powered by a range of energy sources including diesel, electricity and compressed natural gas. A future public transport system will also include different zero emission energy sources, predominantly focused around hydrogen and electricity.

In some cases, hydrogen at scale will be more cost effective for taxpayers than electrification, especially where electrical infrastructure requires significant upgrades. In these cases, hydrogen can mimic a diesel supply chain in terms of central production and distribution.

In the long-term, BOC would recommend building 1-2 liquid hydrogen refineries in NSW to progress hydrogen uptake for heavy transport including trucks and public transport.

Getting hydrogen tried and tested in the public transport system today will ensure the right investment decisions are made as bus and other transport depots are upgraded and transitioned to zero emission vehicles.

Developing a hydrogen economy based on transport will also create local skills and experience for NSW which will support a future hydrogen export sector.

3. The opportunities for, and impact to, local manufacturing operations

BOC is working with hydrogen bus manufacturer Foton Mobility to secure a commitment of hydrogen buses at scale. This commitment would result in Foton Mobility locally manufacturing hydrogen buses.

BOC leveraging existing production sites to produce green hydrogen would support local jobs and infrastructure, and be maintained by BOC engineers across NSW.

The build-up of demand will also support hydrogen exports over time.

4. Other jurisdictions that have emission free modes of public transport

Hydrogen trains in Germany

Linde installed the world's first stationary hydrogen refuelling station for fuel cell trains in Bremervoerde, Germany. A fleet of 14 hydrogen-powered regional trains manufactured by Alstom will be operational on the local rail passenger network in 2022, after the hydrogen refuelling station was commissioned in 2021.

The trains have a range of 1,000 kilometres and will be able to run emission-free all day on the network with just one tank filling. One kilogram of hydrogen replaces 4.5 litres of diesel fuel.

The refuelling station can produce up to 1,600 kilograms of hydrogen per day, with onsite storage of up to 1,800 kilograms of green hydrogen. Hydrogen is supplied through Linde hydrogen trailers.

Hydrogen buses in United States, Europe and China

United States

Linde has installed hydrogen refuelling stations in numerous locations across California including the world's first hydrogen refuelling system for cars with 4 refuelling points.

AC Transit's hydrogen refuelling station in Emeryville supports hydrogen cars and buses. The ionic fuelling system installed in 2011 is a high-throughput, low maintenance and efficient compression technology that can fuel up to 12 AC Transit fuel-cell buses each day with 30 kilograms of hydrogen per bus. It was the first public hydrogen refuelling system in the San Francisco Bay area.

Linde installed its first hydrogen fuelling station in Southern California in January 2016. The public hydrogen refuelling station in San Juan Capistrano is located on a 7-Eleven and 76 petrol station property. Liquid hydrogen is supplied by an aboveground 11,360-litre liquid hydrogen tank. It stores approximately 60 kilograms of hydrogen at high pressure.

Linde installed a public hydrogen refuellnig station in West Sacramento, California in January 2015. The station is equipped with Linde's 90 MPa ionic compression technology and a Linde Quantum dispenser. Liquid hydrogen is supplied by an above-ground 11,360-litre liquid hydrogen tank. The West Sacramento hydrogen fuelling station stores approximately 60 kilograms of hydrogen at high pressure.

UK

Linde installed the UK's largest hydrogen refuelling station for the Aberdeen Local Council in Scotland, with capacity to refill 15 hydrogen buses per day.

High pressure storage technology allows for multiple back-to-back fillings. Completed in 2021, the project delivered Europe's largest trial of hydrogen buses manufactured by Hydra Liners.

Germany

In August 2020, Linde commissioned one of Europe's largest hydrogen bus refuelling stations in Cologne, Germany. It has capacity to refill 20 buses per day, with high pressure storage technology allowing for back-to-back fillings. The project was sponsored by the German Federal Ministry of Transport and Digital Infrastructure.

China

In 2021, Linde commissioned hydrogen refuelling stations in SPIC Yancheng, China's fifth largest power generator with installed cap of 126 gigawatts. This was to support the Beijing Winter Olympics including four hydrogen refuelling stations and supply of hydrogen for transport routes between downtown Beijing and event locations in Yanqing.

Hydrogen ferries in Norway

Norwegian ferry operator Norled is operating the world's first liquid hydrogen driven ferry, with capacity for 80 cars and 299 passengers. It was designed by Norwegian company LMG Marin and is the first hydrogen ship to be approved by the Norwegian Maritime Directorate.

Linde was selected by the Norwegian ferry operator Norled to supply liquid hydrogen and related infrastructure to the hydrogen-powered ferry.