NEW ZEALAND
FOREIGN AFFAIRS & TRADE
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Republic of Korea: The Hydrogen Economy

Market Report

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Prepared by the New Zealand Embassy in Seoul.

Summary

- The Republic of Korea is moving at scale and speed to develop a hydrogen economy, with incentives and initiatives to encourage the production, import and consumption of hydrogen.
- Korea's search for international partners provides opportunities in hydrogen production, transportation and the development of hydrogen fuel cells, vehicles and charging stations.
- This report highlights the potential opportunities for business in Korea's hydrogen economy.

Report

Korea announced in 2019 that it would build a "hydrogen economy" and is now moving at scale and speed to fulfil this ambition. The government doubled down on hydrogen in July last year by making it a central pillar of Korea's "Green New Deal" strategy – intended to help de-carbonise the economy and accelerate recovery from COVID – with investments of NZ$92 billion.

Why hydrogen? Opportunity #1: Hydrogen production

- The focus on hydrogen has spawned out of Korea's reliance on fossil fuels (currently only 5% of Korean energy is renewable) and growing public concern with worsening air pollution and climate change. The government's pledge in October of last year to achieve carbon neutrality by 2050 only reinforced the significance of hydrogen, particularly "green" hydrogen (produced from renewable energy), expected to play a key role in helping Korea to meet this target.

Opportunity #1: Hydrogen production

- Korea's interest in producing hydrogen, developing the technology and infrastructure for the storage, transportation and consumption of hydrogen, and securing liquid hydrogen imports from abroad (including New Zealand) is serious, and presents a number of opportunities for New Zealand businesses as we develop our own hydrogen economy and associated technologies.

- As Korea moves ahead with plans to produce "brown" and "grey" hydrogen (i.e produced from fossil fuels) through methods such as gas reformation, there is not only a lucrative opportunity for New Zealand "green" hydrogen exports, but also potential partnership opportunities for New Zealand companies.

- Spearheaded by the private sector, a number of hydrogen production projects are underway:

- Korea's first liquid hydrogen plant: Scheduled for completion in 2021 by Doosan. This plant will have the capacity to produce 182.5 tonnes of hydrogen per year.

- World's largest liquid hydrogen plant in Korea: scheduled for completion in 2022 by Hyosung Group in partnership with multinational chemical company Linde. This plant will have the capacity to produce 13,000 megatonnes of hydrogen per year

- SK Group plans to build an even bigger liquid hydrogen plant with an annual capacity of 30,000 tonnes in Incheon in 2023, to be scaled up to 280,000 tonnes in 2025.

- KOGAS has partnered with the Gwangju municipal government to establish a hydrogen production base by December 2022, with plans for a further plant in Changwon province.

- Additionally, the government has made it easier for state-run natural gas wholesalder KOGAS to supply natural gas directly to hydrogen manufacturers (bypassing local retailers) and subsidised liquefied natural gas (LNG) imports (by removing government charges and taxes for other producers).

Opportunity #2: Hydrogen storage and transportation

- Significant government and industry investment into the development of liquid hydrogen storage and shipping technology is another opportunity as Korea's track record in shipbuilding and LNG transport and storage suggest that this is an area in which Korea could be a world leader.

- A recent (October 2020) example saw Korea Shipbuilding & Offshore Engineering Company obtain approval to build the world's first commercial carrier capable of transporting 20,000m3 of liquefied hydrogen, in partnership with Hyundai.

- Korea therefore provides companies with a scalable test-bed for these technologies. The New Zealand hydrogen green paper (September 2019) identified hydrogen exports as potentially beneficial to New Zealand's domestic hydrogen development by enabling larger scale operations, in addition to the the potential to reserve a local source of hydrogen as part of any export establishment agreement.

Opportunity #3: Exports

- Korea believes that hydrogen imports could support the move to sustainable fuels domestically so is actively seeking international partners. The government intends to use imported hydrogen as a 'proof of concept' to attract private investment in local production. However, the government estimates that, even with local production, 10 - 50% of Korea's hydrogen needs from 2030 onwards will have to be met through imports. While initially focused on cheaper grey hydrogen, the government aims to have 70% green hydrogen by 2040 – either locally produced or imported.

- But we are not alone. Korea has also concluded government-to-government hydrogen agreements with Norway and Saudi Arabia (June 2019), Israel (July 2019), and Australia (Sept 2019). A separate MOU was also concluded with Norway in 2019 developing hydrogen shipbuilding. Furthermore, Korea and Russia have agreed to build stronger ties on hydrogen with Korea seeking to import Russian hydrogen in exchange for Hyundai's assistance with hydrogen vehicle supply.

Opportunity #4: Hydrogen fuel cells

- Collaboration between Korea and New Zealand could also explore the development of fuel cell technology. Korea's goal is to power 10% of the country's cities with hydrogen by 2030, rising to 30% by 2040. To achieve this, the government has allocated NZ$1 billion towards the development of hydrogen mobility, supply infrastructure, and core hydrogen technologies.

- The plan includes efforts (first announced in 2019) to establish five hydrogen-specialised cities by 2022

(Ulsan – home of Hyundai Heavy Industries, Ansan near Seoul, Jeonju, Wanju, and Samcheok) to test the use of hydrogen for cooling, heating, electricity, and transportation.

- The private sector has been very supportive, with SK Group – one of Korea's largest oil refiners – moving to purchase a 9.9% stake in US-based hydrogen fuel cell developer Plug Power for around NZ$2 billion. The purchase is expected to help SK Group lay the groundwork for the construction and expansion of hydrogen infrastructure in Korea.

- Recent developments also include the launch (in June 2020) of what Hanwha Energy has called the world's largest industrial hydrogen fuel cell power plant and the first to use hydrogen recycled from petrochemical manufacturing – reportedly enough to power 160,000 households.

Opportunity #5: Hydrogen vehicles

- Hydrogen vehicles are at the forefront and Korea already has a strong advantage, claiming 52% of the global hydrogen fuel cell electric vehicle market in 2019, ahead of the US (29%) and Japan (10%). The government has recently doubled down on its ambitions, with plans to have 1.3 million electric vehicles and 200,000 hydrogen cars on the road by 2050.

- Since the launch of Hyundai's Nexo hydrogen fuel cell electric vehicles (FCEV) in 2018, more than 10,000 units have reportedly been sold. Hyundai is also developing hydrogen-powered commercial vehicles (trucks, buses) with plans to produce 50,000 vehicles per year by 2030.

- Hyundai has also been expanding its hydrogen vehicle footprint offshore. In September of last year, Hyundai began exporting hydrogen vehicles to Saudi Arabia's ARAMCO oil giant for test-driving and pilot projects. Hyundai also expects to begin construction of its first overseas hydrogen fuel cell factory ($NZ1.3 billion) in China shortly, with construction expected to finish in 2022. 6,500 fuel cell systems will be produced each year at the facility, which will be used for Nexo electic SUVs.

- To accelerate the transition, the government has begun offering up to NZ$47,175 in subsidies to people who buy a hydrogen vehicle. This year, the government plans to build 54 hydrogen stations across Korea and will establish a new company – Korea Hydrogen Energy Network (Kohygen) – to operate Korae's charging stations.

- The construction of hydrogen vehicle charging stations also continues to accelerate, with the city of Chuncheon recently completing a NZ$3.7 million hydrogen charging station, capable of refilling a vehicle in six minutes – allowing it to cover a distance of roughly 600 kilometers.

- For more 'accessible'-scale projects, the Jeju local government also intends to encourage the use of hydrogen vehicles by banning the registration of internal combustion engine cars from 2030, and has committed to achieving carbon neutrality by 2030, twenty years ahead of the rest of Korea.

Opportunity #6: The economics of hydrogen (e.g. pricing)

- Finally, cooperation with Korea would provide New Zealand with a stronger understanding of the viability of a hydrogen economy and export market, including the economics of export hydrogen infrastructure and the benefits of scale that could be leveraged for domestic supply in New Zealand.

- Although it is unclear to what extent Korea will prioritise and support green hydrogen over dirtier (blue or grey) variants at this stage, a key determinant of the mix is likely to be pricing policy. Hyundai anticipates that hydrogen will be competitive with diesel at US$4 per kg (international) while the Australian federal government has predicted production costs of US$2 per kilogram.

- The current pricing framework in Korea requires 21 large companies with generation capability of 500MW or more to generate 7% of gross power from renewable energy sources under the renewable portfolio standards (RPS). The quota is expected to go up to 10% in 2023.

- At the same time, the pricing framework incentivises renewable energy production by regulating higher prices for renewables than traditional fossil fuels (it does so largely through its majority ownership of KEPCO, one of the world's largest energy companies which controls 93% of Korea's generation (through subsidiaries), transmission and distribution).

- These incentives seem likely to be expanded further to meet the government's targets. A promising sign is that from 2021 large energy consumers are able to purchase renewable energy and have it delivered separately from traditional fossil fuel energy – which may be attractive to firms wanting to brand their products as 'green'. Building on this, eight SK Group affiliates, including SK Hynix (semi-conductors) and SK Telecom, have joined the Renewable Energy (RE) 100 initiative, requiring them to meet 100% of electricity demand with power from renewable sources by 2050.

Contact details

Companies interested in hearing more about the hydrogen opportunities in the Republic of Korea can contact Jim Guo or Stephen Blair – details below.

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