

HYDROGEN

An emerging economy

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Michael Joyce and Euan Strachan, at law firm Akin Gump in Singapore, consider the impact of recent events on the hydrogen economy and provide an update on some of the key developments.

Hydrogen is gaining prominence as a key element in the future global energy mix. In a recent report published by a coalition of 19 major oil and gas, automotive, fuel cell and hydrogen companies (including Chevron, Shell, Engie, Hyundai, Microsoft, Toyota and Daimler), hydrogen is considered to have the potential to generate \$140bn/y of revenue in the US alone by 2030, along with 700,000 jobs, rising to \$750bn/y and 3.4mn jobs by 2050.

According to the report (see www.ushydrogenstudy.org), the US is positioned to establish itself as a leading player in the hydrogen economy. It has the low-cost primary energy sources required for the production of low carbon hydrogen, as well as an abundance of low-cost natural gas and carbon storage capacity for hydrogen produced via natural gas reforming with carbon capture and storage (CCS). The country has well-established industry leaders capable of building the necessary scale to drive a hydrogen economy. Hydrogen is also a strong low carbon alternative in the US transport sector.

In Asia, Japan and South Korea remain at the forefront of the hydrogen revolution, with ambitious plans to help them transition to hydrogen-powered societies. South Korea is proposing to build three hydrogen-powered

cities by 2022, using the fuel for cooling, heating, electricity and transportation. Consultation regarding location of the new cities is reportedly underway, but the impacts of the recent oil price war and COVID-19 are likely to see the projects delayed. Japan, where the Ministry of Economy, Trade and Industry is actively promoting the adoption of hydrogen in its Basic Hydrogen Strategy, recently announced completion of the Fukushima Hydrogen Energy Research Field, comprising a solar energy powered 10 MW class hydrogen production unit, claimed to be the largest in the world.

However, Singapore is also starting to gain prominence as a centre for hydrogen technology development. Earlier this year, PSA, Jurong Port, City Gas, Sembcorp Industries, Singapore LNG, Chiyoda and Mitsubishi entered into a memorandum of understanding to study how hydrogen can be utilised as a low carbon alternative to contribute towards a clean and sustainable energy future for Singapore.

What is claimed to be the world's first coal-to-hydrogen demonstration project is being undertaken in Victoria, Australia, by Japanese power utility Electric Power Development (known as 'J-Power'), in conjunction with Kawasaki Heavy Industries, Marubeni, Iwatani and Sumitomo, and Australian energy company AGL, with support from the Australian national and Victoria state governments.

Australia is now pressing ahead with further projects that should cement its place as a world leader in the hydrogen sector. The Australian Renewable Energy Agency (ARENA) recently announced \$70mn of funding for

hydrogen projects. The Renewable Hydrogen Deployment Funding Round will target the deployment of new large-scale electrolysers with a capacity of at least 5 MW (but with a preference for at least 10 MW or larger). Any project receiving support from the fund will be required to source electricity from renewable sources, either directly or through a power purchase agreement or the purchase of large-scale renewable energy certificates. ARENA is also to fund a feasibility study for a renewable hydrogen demonstration plant in Queensland, being undertaken by Stanwell (a power company owned by the Queensland government).

Queensland is also the setting for two new major hydrogen projects. Situated in Gladstone, the project dubbed the 'H2-Hub' is estimated to cost about \$1.61bn and is potentially scheduled to include electrolyser capacity up to 3,000 MW, producing renewable hydrogen and 5,000 t/y of ammonia.

New development snapshots

A raft of other new hydrogen-related developments are being developed around the globe. These include (along with further projects):

Australia – Global mining companies BHP, Fortescue Metals and Anglo American and engineering consultancy firm Hatch are collaborating on a new 'Green Hydrogen Consortium'. The consortium wants to encourage innovation in the sector, including research, new supply chain initiatives and technology pilots.

China – Chinese utility company Beijing Jingneng announced plans to invest \$3bn in a combined solar

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and wind power plant to produce hydrogen as an energy store. The project, located in Inner Mongolia, aims to produce 400,000–500,000 t/y of hydrogen.

Netherlands – Shell, Gasunie and Groningen Seaports have launched the NorthH2 Project, which aims to produce green hydrogen using renewable sources. If the project proceeds, it aims to produce green hydrogen through renewable electricity generated by a 3–4 GW offshore windfarm by 2030, rising to 10 GW by 2040. It is hoped that NorthH2 will be a significant contributor to the objectives of the Dutch Climate Accord.

Oman – In February 2020, Belgian engineering company DEME Concessions was selected, along with local partners, to conduct a feasibility study into a solar and wind-powered hydrogen production plant in the Special Economic Zone in Duqm, Al Wusta Governorate, Oman. The final investment decision on the project, which is proposed to feature electrolyser capacity estimated between 250 and 500 MW, is expected to be taken next year. The announcement came shortly after the launch of the Oman Hydrogen Centre by the German University of Technology in Oman, in coordination with Hydrogen Rise.

UK – The UK government has announced £28mn (\$36.47mn) in funding for five demonstration projects focused on hydrogen production. The proposed projects include two that are described as ‘low carbon hydrogen production plants’, as well as one using offshore wind power to produce hydrogen through electrolysis. (See *Petroleum Review’s* September 2019 issue for more on current UK hydrogen initiatives.)

US – Mitsubishi Hitachi Power Systems recently announced that it has been awarded a contract to supply two natural-gas fired turbines that, by 2025, will run on a mixture of 30% hydrogen and 70% gas before increasing to 100% renewable hydrogen by 2045. The gas turbines will be installed at the coal-fired Intermountain Power Plant in Delta, Utah, that is intended to transition to gas, followed by renewable hydrogen with a capacity of 840 MW. Meanwhile, South Korean car manufacturer Hyundai has signed an agreement to collaborate with the US Department of Energy to support research and development of hydrogen technology.

Impact of COVID-19

It is impossible to provide an update on the global hydrogen economy without considering COVID-19, the impacts of which have been far reaching, infecting the population of practically every country across the globe, while at the same time disrupting almost all aspects of trade and commerce.

There is concern in some quarters that efforts to revitalise the global economy are likely to shift focus from climate issues (including the development of green technologies such as hydrogen) in the short term, as national governments scramble to provide support for industries which have suffered hugely as a result of the pandemic (not least the airline sector). These concerns appear to be genuine, particularly in light of the recent call made by Czech Republic Prime Minister, Andrej Babis, for the European Union to abandon its Green Deal and instead focus on fighting the virus that is currently paralysing the world. The Green Deal, announced in December 2019, seeks to invest €1tn (\$1.1tn) with the aim of making the EU economy net zero carbon by 2050. Investments are intended to focus on huge offshore wind development, to accelerate electrification of heat and transport, as well as the development of large-scale carbon capture projects and hydrogen storage and related infrastructure.

However, some see economic stimulus packages as a significant opportunity to accelerate the global energy transition. Fatih Birol, Executive Director of the International Energy Agency (IEA), recently commented that investment in renewables should be ‘a central part’ of strategies being devised by national governments, as this would ‘bring the twin benefits of stimulating economies and accelerating clean energy transitions’. He went further to state that the significant investments required to raise hydrogen and carbon capture up to industrial capability ‘could be helped by current interest rate levels, which were already low and are declining further, making the financing of big projects more affordable’.

Impact of the oil price war

Meanwhile, the recent collapse in oil prices caused, in part, by the ongoing global oversupply and exacerbated by the impact of COVID-19, has potentially far reaching consequences for the development of the

hydrogen economy. With prices cratering and US oil and gas development slowing, natural gas and, consequently, hydrogen are expected to be hit. Currently, 99% of hydrogen is derived from natural gas and one-third of global hydrogen is used to refine crude oil into other petrochemical products.

However, some see the current oil price war as a prime opportunity for ‘green’ hydrogen derived from water and renewable electricity (as opposed to natural gas) to become the fuel of choice for the future. Manuel Kuehn, Senior Vice President of Business Development for Siemens Middle East, has said that green hydrogen could be the ‘new oil’ in the next 20 years. Siemens, the Dubai Electricity and Water Authority (DEWA) and Expo 2020 Dubai are currently collaborating to build the Middle East’s first solar-driven hydrogen electrolysis facility at the Mohammed bin Rashid Al Maktoum Solar Park in Dubai, claimed to be the largest single-site solar park in the world based on the independent power producer model. The facility will test and demonstrate an integrated megawatt-scale plant to produce hydrogen using a solar photovoltaic system, storing the gas and then deploying it for re-electrification, mobility or other industrial uses.

The way forward

The emerging hydrogen economy appears to be developing at pace as the number of new projects continues to grow worldwide. The Asia-Pacific region, primarily Japan, South Korea and Australia, is expected to continue to lead the way in terms of new developments, but Europe is fast becoming a key market for hydrogen technology.

In addition, the natural, technology and scale benefits of the US energy and transport sectors have the potential to make the US a future world leader in the global hydrogen economy.

However, headwinds from the fallout of the COVID-19 pandemic and the oil price war are expected to have a detrimental impact for the foreseeable future, and it is difficult to predict to what extent these will affect hydrogen going forward. Nevertheless, the collapse in oil prices potentially presents an opportunity for green hydrogen, derived from renewable sources, to take centre stage in the emerging hydrogen economy. ●