AUSTRALIAN BROWN COAL TO GREEN HYDROGEN

AKIN GUMP STRAUSS HAUER & FELD IN SINGAPORE, AS LEGAL COUNSEL TO J-POWER, EXAMINES INNOVATIONS IN AUSTRALIA'S HYDROGEN ENERGY SUPPLY CHAIN DEMONSTRATION PROJECT IN VICTORIA, AUSTRALIA. BY PARTNER **MICHAEL JOYCE**.

As the world increasingly looks for ways to find cleaner and more environmentally sustainable ways to power the global economy, one of the energy sources being given close consideration by both governments and the private sector is hydrogen.

There are several reasons that hydrogen is again receiving serious consideration as an alternative energy source, with the first and foremost being that it is a versatile and environmentally friendly resource that produces only pure water and heat when combusted.

Given the global desire for more environmentally friendly fuel sources, improvements in hydrogen technologies, increasing government support for climate-friendly fuel diversification and changes in global energy policy toward decarbonisation, hydrogen's time to move beyond its traditional use as a feedstock in industrial processes may have come.

Recent developments have shown that hydrogen can be used in a number of applications, including electricity generation – not simply in small-scale fuel cells but in larger, gas-fired generators – land and sea transportation and storing energy from intermittent renewable sources.

However, the uptake of hydrogen for these applications has faced a number of challenges, not the least of which is the ability to demonstrate a commercially viable supply chain that can produce hydrogen at a cost that is competitive with other sources of energy and capable of being stored and transported in bulk, similar to liquefied natural gas.

This is where Australia's Hydrogen Energy Supply Chain demonstration project, or HESC project, in the State of Victoria comes in. The ground-breaking A$500m demonstration project is focused on demonstrating that a viable hydrogen energy supply chain can be achieved between Australia and Japan for the production and transportation of hydrogen.

The operation is currently scheduled to end by March 2021 and the HESC project will involve various elements, including:

- The gasification of brown coal using existing coal gasification technology that has been specifically adapted for the brown coal found in Victoria's Latrobe Valley.

The coal-to hydrogen gasification plant produces synthetic hydrogen gas generated by partially oxidising brown coal feedstock under high pressure. The carbon monoxide generated is then converted into carbon dioxide with steam and then hydrogen is separated out through a refining process. It is expected that for each 150 tons of brown coal used in the gasification process, three tons of hydrogen will be produced;

- Collecting and transporting the hydrogen by road to a purpose-built liquefaction and loading terminal at the Port of Hastings, in Victoria;
- In another world-first, shipping the liquefied hydrogen to Japan by way of the first liquefied hydrogen carrier ship ever to be built; and
- Identifying the necessary requirements to be able to move from beyond the demonstration phase to achieve a commercially viable industrial-scale gasification, liquefaction and transportation project.

The HESC project is being undertaken by a consortium of major Japanese companies and one of Australia's largest energy companies. Each of the project participants possesses a specific area of expertise that will be utilised during the course of the project:

- *Electric Power Development Co Ltd, known as J-Power* – J-Power is one of Japan's largest power utilities and has a long history of research and innovation in the power sector. It is also a global energy producer, with interests in more than 100 power generation facilities around the globe.

In the HESC project, J-Power's primary focus will be to use its cutting-edge technology, expertise and know-how to gasify brown coal for the project and then to refine the gasified coal to safely extract hydrogen.

- *Kawasaki Heavy Industries Ltd* – Kawasaki is one of Japan's leading industrial manufacturers whose key focus for the HESC project is to transport the hydrogen from J-Power's gasification facilities to the hydrogen liquefaction and export facilities that Kawasaki is building at the Port of Hastings. It is also responsible for shipment of the liquefied hydrogen aboard Kawasaki's world first hydrogen carrier, the Suiso Frontier, which was launched in Japan in December 2019.[1]
- *Iwatani Corporation* – As Japan's only producer and supplier of liquid hydrogen, Iwatani will

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use its unique expertise to work with Kawasaki on the transportation, liquefaction and shipment of hydrogen.

- *Marubeni Corporation* – Marubeni, one of Japan's largest trading houses, will focus on determining how to proceed from the HESC demonstration project to a viable commercial industrial scale project.
- *Sumitomo Corporation* – Sumitomo, another of Japan's largest trading houses, will focus on interfacing with the Victorian Government's geo-sequestration project entity known as CarbonNet, discussed further below.
- *AGL Energy* – AGL, one of Australia's largest power and gas companies, plays a critical role in the HESC project by providing the site for the gasification and refining plant at its Loy Yang power complex in Victoria, as well as the brown coal feedstock for gasification and other important project support services.[2]

The State Government of Victoria, Australia's Federal Government and the Japanese Government also play critical roles in the project in terms of funding, project support and coordination. From a funding perspective, the Victorian and federal governments have each committed A$50m to the project, with the balance of the project's funding being provided by the project participants.

If the HESC project is successful, it is hoped that a commercial-scale hydrogen production and export project based in Victoria can be developed, with production hoped to commence in the 2030s.

Such a project could potentially attract billions of dollars of international investment into Australia, create a significant number of jobs – both in terms of hydrogen infrastructure and supply chain operations – and position Australia as a global leader in the supply of clean hydrogen energy.[3]

The Australian coal-to-hydrogen project will also assist Australia continue its transition to cleaner energy, while at the same time will create a new clean fuel commodity for export to Japan and the rest of world.[4]

While there are a number of alternative methods of producing hydrogen the keys are cost efficiency and carbon neutrality, and here the State of Victoria has some unique advantages in being at the forefront of the new global hydrogen economy.

The first advantage is that Victoria has some of the world's largest recoverable reserves of brown coal and these are located close by major population centres, ports and infrastructure.

Historically, Victoria's brown coal reserves have been used as a major fuel source for electricity generation but as Australia increasingly moves away from fossil fuel usage in its power sector, Victoria's brown

Excavator open cast coal mine © Kasienka - Dreamstime.com

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coal-fired power plants are gradually being decommissioned. This means that the future of the brown coal industry, and the many jobs and regional economies that depend on it, is somewhat uncertain.

However, if producing hydrogen from brown coal is as cost-effective as the HESC project participants – and its state and federal government supporters – expect, then there may yet be a future for the brown coal industry.

Repurposing Victoria's vast coal reserves to hydrogen production and export may not only create a brighter future for the region, but for Australia more broadly and, indeed, may help to further accelerate Australia's transition to a greener energy future.

Given that the brown coal gasification and refining process also produces carbon dioxide (CO_2), in order to ensure that the environmental benefits of using the hydrogen derived from the process are not outweighed by the CO_2 generation caused by its production, the CO_2 needs to be captured and dealt with both safely and to the highest environmental standards.

This is where Victoria's second advantage as a location for a commercial scale hydrogen production and export project comes in.

As a well-established oil and gas producing region, Victoria possesses geological structures located close to its coast, which are highly conducive to geo-sequestration of CO_2 and these structures can be utilised to safely store CO2 generated from the hydrogen production process.

This means that the hydrogen produced from a commercial-scale project will not only limit generation of greenhouse gas emissions when used as a fuel but, just as importantly, it will be environmentally friendly when produced.

To support the safe, long-term geo-sequestration of CO_2, the Victorian and federal governments have each been working to make this a reality.

First, the Victorian government has established, separate from the HESC project, a project known as the CarbonNet project. CarbonNet is investigating the potential for establishing a commercial-scale carbon capture and storage (CCS) network. The network would bring together multiple CO_2 capture projects in Victoria's Latrobe Valley, transporting CO_2 via a shared pipeline and injecting it into deep, underground, offshore storage sites in the Bass Strait.[5]

The CarbonNet project will, therefore, provide the requisite CCS for the development of any commercial-scale hydrogen production and export project that may be developed following the successful conclusion to the HESC project.

Second, the Australian federal government has also taken steps to ensure that the country's regulatory framework is adapted in order to aid the viability of the HESC project. In mid-May, the Australian Parliament passed the Offshore Petroleum and Greenhouse Gas Storage (OPGGS) Amendment Bills amending the OPGGS Act 2006.

Some of the suite of amendments passed include provisions that will facilitate future carbon capture and storage projects. In particular, however, the legislation clarifies the regulatory environment for the CarbonNet project, whose chosen site for development of a commercial-scale offshore CCS project straddles both Victorian state territorial waters and federal territorial waters and hence would be subject to both state and federal legislation.

In passing the new legislation, the federal minister for resources, water and Northern Australia, Keith Pitt, said the new CCS laws would pave the way for Australia's hydrogen export industry.

Hydrogen's versatility and its potential to form a substantial part of the global energy mix as countries and corporations strive to meet their climate change and decarbonisation targets, are key reasons governments and corporations globally are committing significant investment and resources into hydrogen development. The HESC project is a leading example of that commitment.

While the development of a global hydrogen-based value chain faces challenges – such as lowering the cost of hydrogen production, building appropriate infrastructure and ensuring sufficient customer demand – projects such as the HESC project are demonstrating that progress is being made on these issues, and helping to provide the foundation for hydrogen to become a widely used energy resource around the globe. ■

Footnotes

1 – The Japan Times, "Kawasaki Heavy launches world's first liquid hydrogen ship in quest to establish green supply chain", December 13 2019.
2 – Hydrogen Energy Supply Chain, "About HESC".
3 – Forbes, "Japan and Australia Launch an Experimental Coal To Hydrogen Export Industry", July 24 2019.
4 – Ibid.
5 – Victoria State Government, Earth Resources, "The CarbonNet Project".

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