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New Energy Quarterly

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Hydrogen's Green Horizon

Contents

Editorial

The GH2 Bus

The hype around green hydrogen (**GH2**) is real. GH2 is widely regarded as the future fuel that will drive Australia and the rest of the world to net-zero. This hype is largely based on numerous uses that GH2 can be put towards – from heating homes and frying pans to assisting hard to abate industries reduce and ultimately eliminate their CO2 emissions. The latter is the reason GH2 is garnering so much support as industries that have traditionally been anxious about the global push to decarbonise now have a viable alternative to fossil fuels that can satisfy their needs. Industries such as the shipping, aviation, and steel industry can now see a future in which they exist. GH2 provides an opportunity where households' and heavy industry interests are aligned and one does not have to suffer at the expense of the other. This is a rare feet. Hence why so many are jumping on the GH2 bus. Speaking of buses, GH2 also provides operators of heavy vehicles a viable and clean alternative to fossil fuels without the need to part ways with the internal combustion engine. The guttural roar of engines may survive the eerily silent onslaught of the electric vehicle.

Australia's competitive advantage

Australia is blessed with a number of competitive advantages as a GH2 exporter. We have the expertise and infrastructure to develop GH2 export energy supply chains (think abundance of renewable energy and sophisticated port infrastructure to name a couple). Our position in the world (proximity to Asia) and our strong trading relationships can give us the leverage to take advantage of GH2 production and export. This competitive advantage is well regarded, with international reports from both the World Energy Council and the International Energy Agency highlighting Australia as a "giant with potential to become a world key player"[1] and predicting that we could produce in a chanter 100 million tonnes of the oil equivalent of GH2.[2] All this means our GH2 export industry could be worth $1.7 billion by 2030 and help create up to 2,800 jobs most of which would be in regional areas.[3]

The GH2 industry as it stands

As with the growth of any new industry, Government will have a major say in whether there is a real demand for GH2 in Australia. Through the National Hydrogen Strategy, Australia aims to grow its domestic hydrogen industry and position itself as a major player in the global economy by 2030. However, to do this, targeted policy is required both in terms of regulation and incentivisation.

As seen previously with the Renewable Energy Target, its successful deployment has resulted in the addition of 33,000GWh of new renewable generation. Similar schemes focusing on production of, and demand for GH2 will impact greatly on a fledgling hydrogen sector in Australia.

We are beginning to see greater government support for GH2 across Australian States and Territories. Most States and Territories have set up GH2 funding programs and have already successfully deployed captial to a number of GH2 projects across Australia. The continuation of these funding programs will be crucial in driving down the costs of production of GH2 and incentivising investment in GH2 projects that would not otherwise be commercially viable. However, a targeted and consistent approach is required in the long term to sustain this new industry and drive down the costs of hydrogen.

Part of this targeted approach must involve support to develop the demand side of the GH2 market. NSW is the only State government to adequately address the importance of driving the demand side of the GH2 market in their NSW Hydrogen Strategy. The NSW Government included a number of incentives on the demand side in their NSW Hydrogen Strategy including: 10% gas blending targets; targets to have 20% of the Government's heavy vehicle fleet and a further 10,000 heavy vehicles be powered by GH2; and developing a GH2 refuelling network to encourage heavy vehicle fleet operators to convert to GH2.

1 World Energy Councils *International Aspects of a power-to-x roadmap*
2 IEA's *World Energy Outlook*
3 Australian Department of Industry, Services, Energy and Resources, *Australia's hydrogen potential: A message from the Chief Scientist*

An opportunity for offshore wind?

While still in its infancy, the potential for offshore wind to play a crucial role in decarbonising our environment and supporting the national electricity market's transition from fossil fuel is immense. Offshore wind may also have a critical role in the production of GH2. Northern European countries such as Norway, and countries closer to home, such as Japan, are already exploring the commercial viability of using offshore wind capacity to produce GH2. With the passing of the Offshore Electricity Infrastructure Bill through the Australian Parliament, governments should incentivise GH2 projects that look to capitalise on the abundance and consistency of offshore wind to produce GH2.

The future

A developed GH2 industry will not only contribute to a cleaner environment and accelerate the achievement of net-zero by 2050, but will strengthen Australia's industrial competitiveness globally and create jobs and economic growth at home. It should also stabilise Australia's electricity grid which in turn should reduce electricity costs for Australian consumers. The benefits of jumping on the GH2 bus and seizing the GH2 opportunity are therefore clear. Rather than just pie in the sky ideals, the time for the promotion and implementation of GH2 as a leading renewable energy source is now.

Certification

Central to driving an increased demand for GH2 will be establishing a robust certification regime that clearly sets out the green credentials of any GH2 that is produced and enters the supply chain. In a welcome step, the Clean Energy Regulator (CER), on 3 November 2021, announced its Guarantee of Origin scheme which aims to measure and set out the key attributes of how and where each molecule of hydrogen is produced including its carbon intensity. The CER proposes to display this information in a digital certificate which will follow a supply chain from electricity generation to hydrogen production through to manufactured products purchased by consumers with key inputs and emissions at each stage of the supply chain being recorded on the certificate. When the producer sells the hydrogen, the digital certificate would transfer with the physical supply. The digital certificate would then be cancelled once the hydrogen is consumed. The CER provides that the Guarantee of Origin framework is designed to provide assurance and integrity at each step of the supply chain. The Australian Government and the CER have been developing with trading partners methods to determine the emissions associated with hydrogen production. This collaborative approach is promising as it will help ensure that the framework is robust, globally recognised and supported by Australia's trading partners and markets.

Matt Baumgurtel
Partner – Head of New Energy

Andrew Smith
Lawyer – Energy, Infrastructure and Resources

Watt's happened?

Leading digital intelligence publication, Which-50, featured our New Energy Lead partner, Matt Baumgurtel and lawyer Andrew Smith on their insights on the Offshore Electricity Bill. (Read more)

Leading digital intelligence publication, Which-50 covered part I of our New Energy Expert Insights series on the commencement of 5-minutes settlements in the National Electricity Market (NEM), authored by New Energy lead partner Matt Baumgurtel, associate David O'Carroll and paralegal Chanum Torres. (Read more)

Australia's leading clean energy publication, RenewEconomy covered part I and part II of our New Energy Expert Insights series on the commencement of 5-minute settlements in the NEM, authored by New Energy lead partner Matt Baumgurtel, associate David O'Carroll and paralegal Chanum Torres. (Read more)

Lawyers Weekly featured our New Energy Lead partner, Matt Baumgurtel, associate David O'Carroll and paralegal Rahul Tijoriwal their insights on the ESB's advice to the Energy National Cabinet Reform Committee on the post-2025 redesign of the NEM. (Read more)

"Barclay Pearce Capital" (BPC) co-hosted their online panel with our New Energy Lead partner Matt Baumgurtel discussing the Australian renewable energy sector on 29 September 2021. The online panel sought to answer the question, "Will Australia become a global superpower in the export of renewable energy?". (Read more)

Our New Energy Lead partner, Matt Baumgurtel, spoke at the Ammonia Energy Conference on 26 August 2021. Matt discussed future export markets and project development pathways in Australia. (Read more)

Connecting Green Hydrogen APAC Conference rescheduled to 7 to 9 December 2021: Matt Baumgurtel moderated the panel 'Green Hydrogen: Accelerate Production and Use of Renewable Hydrogen' and spoke on the panel 'Exploring Opportunities for Hydrogen Export & Industry Supply'.

Solar Energy Future Australia Conference rescheduled to 7 to 9 December 2021: Matt Baumgurtel spoke on the panel 'Key considerations when going into a corporate PPA in Australia.

Watt's new?

Hamilton Locke

New starters

Benny Sham
Partner, Corporate, Brisbane

Jo Ruitenberg
Partner, Corporate, Sydney

John Poulsen
Special Counsel, Litigation and Dispute Resolution, Brisbane

Jeremy Murnain
Special Counsel, Finance, Sydney

Andrew Smith
Lawyer, Energy, Infrastructure and Resources, Sydney

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Hamilton Locke Partners named in 2021 Edition of Best Lawyers in Australia

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Australasian Lawyer Recognises Hamilton Locke in Top 15 Fast Firms

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Halo Group

Halo Group Acquires Remaining 50% of Source

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Watt's new?

World

Federal Government commits to net-zero by 2050 and attends COP26.

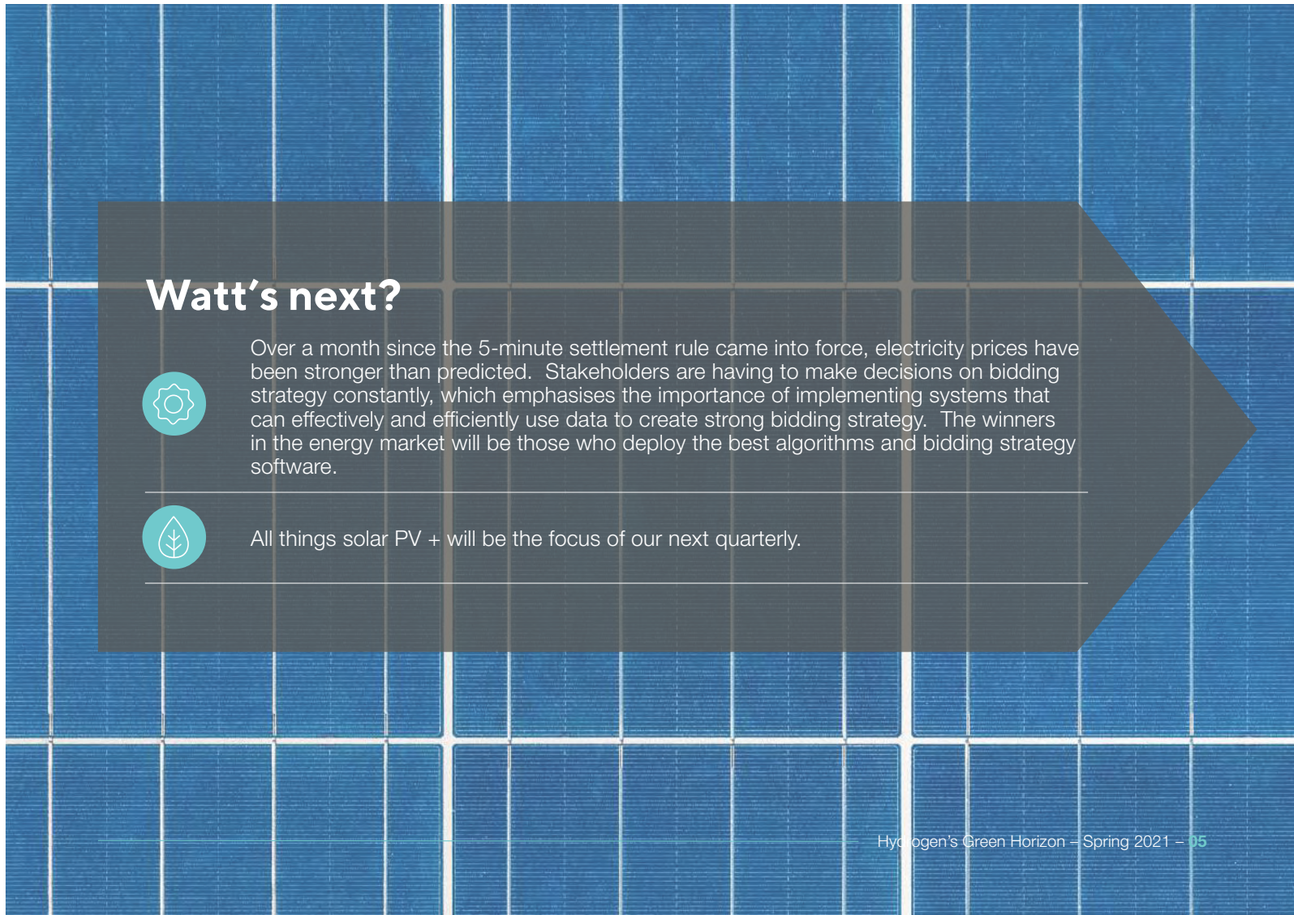
Federal Government unveils its Clean Hydrogen Industrial Hubs Grant Program worth $464m. On 20 September 2021, the Federal Government released a statement unveiling its AUD$464m Clean Hydrogen Industrial Hubs grant program (the **Program**). An additional AUD$150m and a further two locations now extends the Program to seven prospective locations across Australia which include: Bell Bay (TAS), Darwin (NT), Eyre Peninsula (SA), Gladstone (QLD), Latrobe Valley (VIC), Hunter Valley (NSW) and Pilbara (WA).

AEMC given go ahead to review National Gas Rules and National Energy Retail Rules. In what is the first step towards an Australian hydrogen gas network, Energy Ministers have requested the Australian Energy Market Commission (**AEMC**) review the National Gas Rules (**NGR**) and National Energy Retail Rules (**NERR**) to determine what changes are necessary to include low-level hydrogen blends and renewable gases in the NGR and NERR frameworks.

On 25 November 2021, the Offshore Electricity Infrastructure Bill was passed by the Australian Parliament. The Bill establishes a regulatory framework for the offshore wind industry.

NSW revealed its Hydrogen Strategy which is backed by up to $3 billion worth of incentives to grow the hydrogen industry in NSW, particularly in the Illawarra and Hunter hydrogen hubs. These incentives – which are hoped to attract between $50 and $80 billion worth of investment – include a 90% exemption from electricity network charges for green hydrogen producers who connect to parts of the network with spare capacity.

On 3 November 2021, the Clean Energy Regulator announced its Guarantee of Origin scheme which aims to measure and set out the key attributes of how and where each molecule of hydrogen is produced including its carbon intensity.



Watt's next?

Over a month since the 5-minute settlement rule came into force, electricity prices have been stronger than predicted. Stakeholders are having to make decisions on bidding strategy constantly, which emphasises the importance of implementing systems that can effectively and efficiently use data to create strong bidding strategy. The winners in the energy market will be those who deploy the best algorithms and bidding strategy software.

All things solar PV + will be the focus of our next quarterly.

The Federal Government's Electric Vehicle Future Fuels Strategy Lacks Spark!

Authors:
Veno Panicker and
Nasreen Jahan

First published:
07 December 2021

Background

The Federal Government has announced its Future Fuels and Vehicles Strategy (**Future Fuels Strategy**) in furtherance of its target to achieve net zero emissions by 2050.

The Future Fuels Strategy aims to reduce emissions in the transport sector - currently Australia's third largest greenhouse gas emissions-producer – by injecting $250 million dollars into electric vehicle charging and hydrogen refuelling infrastructure. Such investment is welcome. The same infrastructure is in place in many jurisdictions, enabling governments to become early adopters of hydrogen fuel cell fleets. For example, Sarawak in Malaysia has entered into an MOU with Australian company, H2X Global, to produce fuel cell electric buses for the Sarawak Transport System – this is only possible because of Sarawak's established refuelling infrastructure network.

The announcement of the Future Fuels Strategy coincided with the COP26 Summit in Glasgow at which Australia, along with 30 other nations, committed to a road transport 'Breakthrough Agenda' to make zero emission vehicles "*the new normal and accessible, affordable, and sustainable in all regions*" by 2030.

Support from the states and industry driven initiatives complement the Future Fuels Strategy. However, more direct Federal funding and initiatives to support investment into zero emission fuel technologies are needed if Australia is to become a leader in this emerging space. Commitment to firm targets for the use of vehicles using electricity or hydrogen fuel cells would also give investors further confidence.

The Federal Government could showcase Australia's depth of expertise in this sector, with fleet purchases for Federal vehicles and by mandating targets within key government procurement bodies for the use of such vehicles in the short term. This would give further comfort to other regions looking to invest in or procure hydrogen fuel cells and electric vehicles from Australia.

The Future Fuels Strategy: Key initiatives to be implemented

The Federal Government predicts that its Future Fuels Strategy will reduce emissions by over 8 metric megatons of carbon dioxide equivalent (CO2-e) by 2035, by allowing access to convenient public fast charging for up to 84% of the population and enabling 30% of all new light vehicle sales to be electric or hybrid electric vehicles by 2030 (meaning 1.7 million electric vehicles on the road). These outcomes are expected to be achieved through the following key initiatives outlined in the Strategy:

- Establishing widespread public electric vehicle charging and hydrogen refuelling infrastructure that addresses 'blackspots';
- Helping businesses to incorporate low or zero-emission vehicles into their commercial fleets, including heavy and long-distance vehicle fleets;
- Effectively integrating battery electric vehicles into the electricity grid to prevent overloading of the grid, including by supporting the installation of smart charging technologies in households;
- Increasing consumer access to information regarding the effectiveness of low emission vehicles, to enable consumers to make informed choices.

Where the Future Fuels Strategy needs a jump-start

While the Morrison Government has heralded the Future Fuels Strategy as a means to "*give Australian consumers and business confidence to purchase low emission vehicles*", its success will be dependent on individual consumers choosing to adopt low emissions vehicles. For that, the Government is relying entirely on increasing access to information regarding the benefits of electric, hybrid and hydrogen-fuelled vehicles as well as creating "*the right enabling environment through infrastructure*" to encourage consumer confidence in those technologies. The Government has expressly entrusted private industry with developing technological improvements and innovations which will achieve price parity between low emission and existing petrol and diesel vehicles. However, it has not proposed any targets, mandates or financial incentives that would stimulate the motor vehicle industry to invest in producing such innovations or lowering the cost of zero-emission vehicles.

The Electric Vehicle Council has stated that Australia is unlikely to see a significant increase in the uptake of electric vehicles without introducing discounts or tax benefits to drive consumers to move away from petrol or diesel cars.

According to current projections, the impact of the Future Fuels Strategy as it stands is likely to be less significant than the Government hopes. Whilst Government modelling issued in 2019 predicted that electric vehicles would make up 27% of new sales by 2030, the Future Fuels Strategy is expected to enable 30% of all new vehicle sales to be electric and hybrid vehicles by 2030. This is a mere 3% increase from what was already projected to occur.

Fortunately, industry support for hydrogen fuel cell vehicle development has so far been encouraging. For example, the Gippsland Circular Economic Precinct (including Ferguson Civil, Solis RE and Nexsys Industries Consulting) is securing funding from major investors, including Octopus Investments with support from the CEFC, to produce a plant for hydrogen fuel cell vehicle manufacturing plant with H2X Global in that precinct. However, more economic incentives at a Federal level would encourage more investment at a greater pace.

State governments leading the charge

In June 2021, the New South Wales government announced subsidies and a waiver on stamp duty for those who purchase electric vehicles, as well as delaying any tax on electric vehicles until 2027. These measures are forecast to result in 50% of new car sales in NSW being electric vehicles by 2030. The Victorian government announced subsidies for purchasers of electric vehicles, coupled with a target of 50% of new car sales being low or zero-emission vehicles by 2030. The ACT has instituted a full waiver on stamp duty for first-time purchasers of zero-emission vehicles as well as 2 years of free registration for any new or used zero-emission vehicles.

Western Australia and South Australia have been more conservative in their policies – the former has only offered electric vehicle owners an exemption from the transport levy, whilst the latter will limit the number of electric vehicle subsidies it hands out.

Conclusion: No Sticks, No Carrots – the Federal Circuit Disconnected

While it is reassuring to see the Morrison Government introduce policies that encourage electric and hydrogen fuel cell vehicles, more can be done to ignite a widespread switch to zero-emission vehicles across the nation. Australia has an opportunity to present a unified and credible approach to meeting its commitments under the COP26 Breakthrough Agenda and to keep up with global efforts to reduce carbon emissions. However, this will require stronger policies, tangible targets and incentives to be put in place to ensure that demand for this industry is stimulated.

read more

GH2 – Generating Demand in Green Hydrogen

Authors:
Matt Baumgurtel, David O'Carroll, and Andrew Smith

First published:
03 December 2021

Renewable energy is cheap. It is the cheapest form of new generation. With the ever-increasing global buzz surrounding hydrogen as a new renewable energy fuel source and numerous funding pathways developing across Australian States and Territories, the key question for Australia is how to develop a sustainable green hydrogen (**GH2**) industry at home. This is fundamentally a question of demand - what are the ways of generating enough demand in GH2 such that supply, and hence the price competitiveness, in theory, takes care of itself. With an eye on the importance of developing the demand side of the GH2 industry, the NSW Government through the Department of Planning, Industry and Environment (**DPIE**) released its NSW Hydrogen Strategy in October this year (**Strategy**). The Strategy aims to incentivise the production of GH2 while also providing conditions that will enable the private sector and market forces to drive large scale investment. Initiatives set out in the Strategy include funding GH2/gas blending projects; supporting the heavy vehicle industry to develop GH2 refuelling networks and GH2 fuelled vehicles; and committing to converting 20% of the NSW Government heavy vehicle fleet to GH2 by 2030.

Price and scale

For GH2 to become a legitimate alternative clean energy fuel, it requires a price point that is as competitive if not more competitive compared to its dirtier counterparts. The target often quoted is to reach a price point of $2 per kilo. The NSW Government has targeted a price point of below $2.80 per kilo in their Strategy. However, this modelling does not consider forecast reductions in the price of renewable energy. While this conservative assumption may be considered prudent, it ignores a highly probable outcome, but also leads to the conclusion that GH2 production at less than the magical $2 per kilo is not achievable in the medium term. It also does not allow the analysis of the sensitivity of GH2 production cost to reductions in electricity cost. For these reasons and more, the price modelling should be made public.

To achieve production cost reductions, significant production economies of scale are required. Traditionally, the problem with producing large amounts of hydrogen was the resulting generation of large volumes of CO2. Fortunately, advances in electrolysis technology and the falling cost of renewable energy are enabling the mass production of GH2 globally. Australia has a wealth of experience in renewable energy production. With an abundance of solar and wind power, these existing forms can be coupled with electrolysers to produce GH2 efficiently. While this industry is still in its nascent years (arguably where solar PV was a decade ago), as more and more projects get off the ground and scale ramps up, costs should in turn come down.

A major input, and therefore, cost of GH2 production is electricity. Therefore, crucial to driving down production costs are cheap electrons and utilising electrolysers as much as possible (at high-capacity factors) at a large scale. This will likely favour project sites that have both wind and solar generation potentially firmed by energy storage. This is likely to be the fundamental project anatomy of GH2 projects and is the design being used by some of the largest GH2 projects including Infinite Blue Energy's Arrowsmith project.

The NSW Government has acknowledged the need for cheaper electricity to drive down the production costs of GH2. A key policy in their Strategy is to provide electricity network costs concessions of approximately 90% to hydrogen producers for network use of system charges where electrolysers are placed in parts of the network with excess generation capacity. The concession is available only for the first 750MW, therefore it will be the first in, best dressed projects benefiting from this concession. Exemptions from other chargers will also be available under the Electricity Infrastructure Roadmap, Climate Change Fund, Energy Security Safeguard and GreenPower programs. To provide investor certainty, these concessions will be available for at least 12 years. Legislation is currently passing through NSW Parliament to facilitate these concessions by amending how the National Electricity Retail Law and National Energy Rules are applied to the NSW network.

Domestic and export demand

The basic principles of economics dictate that without demand, supply essentially becomes redundant – supply can only front run demand for so long. Therefore, for GH2 production to upscale, hydrogen projects first and foremost need long term domestic or export markets.

Taking green ammonia – produced using GH2 - as an example, the main markets are currently in fertilisers and explosives. However, we are starting to see the use of ammonia as a fuel. If produced from renewable energy, this is a clean fuel. While this market does not exist at the moment in Australia, Japanese co-firing of ammonia as a demonstration project is a leading example of how large amounts of potentially green ammonia can be burned using existing infrastructure. If this is successful in Japan, this sets the road map for Australia, both as domestic use and export opportunity.

Green ammonia is also gaining traction as the preferred future fuel of the shipping industry. Currently, the shipping industry contributes 2.9% of the global CO2 emissions through its use of fossil fuels. In recognition of this, the Australian and Singapore Governments in June 2021 announced ahead of the agreement for the deployment of low emissions fuels and technologies (including green ammonia) in maritime and port operations. Both countries have committed up to $10 million over five years to fund industry-led pilot and demonstration projects. The potential demand for green ammonia (and GH2 as a production input) is immense. It is estimated that by 2050 global fuel demand for green ammonia will be 900 million tonnes per year.

Hydrogen also has a wide range of applications across several industries. For example, the train, trucking, and aviation industries look set to be radically altered by hydrogen technologies in the coming years. Hydrogen-fuelled trains have been implemented in Germany with hugely positive results and in the last year, China, Japan and South Korea have pledged to put almost 8 million hydrogen fuel cell cars on the road.

Hydrogen can also be used, like natural gas, to heat homes. The delivery of hydrogen for this use would most likely be via new or existing gas networks. Hydrogen can also be blended with natural gas for heating and cooking. In fact, NSW has included a stretch target of 10% gas network blending with GH2 by 2030 in their Strategy and provided that gas blending projects will be able to apply for funding support under the relevant hydrogen hub initiatives. NSW has also indicated that it will review relevant legislation to determine the maximum gas blending limit while also providing support to research and industry organisations investigating safety, standards, injection requirements and the economics of GH2 blending in the gas network.

The more end uses for GH2 - covering multiple applications and capable of downstream conversion to other energy carriers and products - the more the demand side of the GH2 market will grow, providing flexibility as to the ways to achieve decarbonisation. This will also help generate larger economies of scale and faster deployment, leading to a virtuous cycle of increasing demand encouraging increased supply, improving efficiencies and economies of scale which reduce production costs, lower prices, and further encourage demand. Lower prices also open additional markets where green hydrogen can replace existing inputs, e.g. replacing coal in steel production.

So the key to kick starting demand, and this is where governments can and should lead the way – are governments making policy choices that look beyond the immediate economic outcome. Such policies can either:

- Incentivising GH2 production: by bridging the price gap between green and non-green hydrogen; and
- Disincentivising substitutes for GH2: either by taxing or regulating their use or price.

Both incentivising GH2 production and disincentivising substitutes supports demand for GH2. The enormous success of policies designed to encourage renewable energy and therefore reduce its cost of production (such that those subsidies are no longer required) provides a clear example of how substantial short term government intervention can enable an industry to evolve from collage, to mainstream, to dominate a market in a very short period.

Given the enormous global push for GH2 arising from macro themes such as ESG, economic recovery post pandemic, and a renewed global will to address climate change post COP26, the market is convinced of the case for GH2. Therefore, behaviour and attitudes do not need to shift – and hence disincentives are not required. Incentives will be much more effective on a dollar-for-dollar basis. This is primarily because of the 'green halo effect' - people will pay more because it is green. Price parity is not required, merely price comparability/ compatibility.

Government intervention - supply vs demand

As with the growth of any new industry, the government will have a major say in whether demand for GH2 keeps pace with supply in Australia. Through the National Hydrogen Strategy, Australia aims to grow its domestic hydrogen industry and position itself as a major player in the global economy by 2030.

However, to do this, a targeted policy is required to incentivize both demand and supply for GH2. While all States and Territories have some form of funding schemes in place to incentivize the supply side of the GH2 market (click here for more information), NSW is the only state or territory that has provided a clear plan to generate both supply and demand for GH2. Government support of the demand side of the GH2 market is integral to driving large scale investment which will drive the costs of production down below $2.80 per kilo and beyond.

The NSW Government has already committed $380 million of funding in the Net Zero Industry and Innovation Program to support existing, high-emitting facilities to significantly reduce their emissions. For many of these hard to abate facilities, GH2 is the likely decarbonisation pathway, and the $380 million will be used to support these facilities overcome the technical and commercial barriers to adopting GH2.

Another welcome initiative to drive the demand side for GH2 is the commitment by the NSW Government to have 20% of their heavy vehicle fleet fuelled by GH2 by 2030. The Strategy provides that by 2030 this initiative alone will create demand for 10,000 tonnes of GH2 per annum or around 70MW of electrolyser capacity. This is coupled with a commitment to support refuelling operators invest in GH2 refuelling stations which will support not only the NSW Government's heavy vehicle fleet but also encourage fleet operators to convert to GH2 fuel. The Strategy estimates that by 2050, the heavy-duty truck sector in NSW will grow to around 500,000 tonnes of GH2 per annum or 2.6 GW of electrolyser capacity. Primed to capitalise on the growth of the GH2 vehicle sector are companies like H2X, Australia's first hydrogen vehicle manufacturer who can supply to, and expand with, the growing sector.

Don't forget demand

One issue that has become clear in the frenzy to fund GH2 throughout Australia's States and Territories is the general lack of a coherent plan to ensure there is demand for GH2 as well as supply. The NSW hydrogen Strategy is a step in the right direction and provides the foundations of a plan to stimulate GH2 demand. However, the credentials of this Strategy can only be adequately assessed once the modelling the DPIE relied upon to prepare the Strategy is released. This will not only increase consumer and business confidence in the Strategy, but it will provide other States and Territories with useful information as they develop further GH2 government programs. In the meantime, other States and Territories should follow NSW's lead and adopt GH2 strategies that prioritise developing the demand side of GH2 as well as the supply side.
As we have seen previously with the RET, its successful deployment has resulted in the addition of 33,000GWh of new renewable generation. Similar schemes focusing on the generation of GH2 can have a real impact on a fledgling hydrogen sector in Australia.

A new industry in hydrogen will not only contribute to a cleaner environment but will strengthen industrial competitiveness globally and create jobs and economic growth at home. It should also stabilize Australia's electricity grid which in turn could lower electricity costs for consumers. The benefits of seizing the GH2 opportunity are therefore clear. Rather than just pie in the sky ideals, the time for the promotion and implementation of GH2 as a leading renewable energy source is now.

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26 https://www.ammoniaenergy.org/articles/maritime-decarbonization-is-a-trillion-dollar-opportunity/

Who's got gold? – Global leaders in the Hydrogen Olympics

Authors:
Matt Baumgurtel, David O'Carroll and Rahul Tijoriwala

First published:
02 December 2021

On the global stage, the momentum for hydrogen use continues to grow. This has been underpinned by a shift in national regulations and increased investment towards decarbonization with hydrogen receiving unprecedented interest and acknowledgement within the energy sector. As of the beginning of 2021, 75 countries (which together represent over half the world's GDP) have ambitions to achieve net-zero carbon emissions, with 30 of those countries implementing specific hydrogen roadmaps to guide future investments and targets.[27]

In the second part of our Hydrogen Olympics series, we look to showcase the countries who are emerging as world leaders within the hydrogen industry. These nations bear the standards for other countries to follow in the Hydrogen Olympics, upholding the gold medal standards in either its production or uses.

Norway

Norway unveiled its Hydrogen strategy in June 2020, with the hope to expand the use of hydrogen as an energy carrier. Norway's hydrogen future was established through the successes of its past, following the successful implementation of HyNor and the hydrogen highway in 2009. Initiated by heavy industrial actors such as Norsk Hydro, the project opened Norway's first hydrogen fueling station in Stavanger in 2006 alongside an additional 3 stations opened between 2007-2009 in Porsgrunn, Oslo and Lier respectively. The 600km hydrogen highway successfully launched in March 2009 in Oslo, with all stations except the one in Stavanger still in operation.

Norway has also identified two zones in the North Sea for the development of up to 4.5 GW of offshore wind capacity, in the hopes of assisting their oil and gas industry's transition Europe.

Pro-hydrogen policies implemented and adopted by the EU and individual European nations have created the environment for many European countries to position themselves as global leaders within the emerging hydrogen energy industry.

Germany

Germany recently published a directive to support green hydrogen projects in other countries, with up to 350 million euros to be invested in hydrogen related projects worldwide by 2024. Germany has already established partnerships with countries such as Australia to support the importation of hydrogen and fund projects in hydrogen hubs in between both countries. This was solidified in the Germany-Australia Hydrogen Accord with the German government signing off on similar deals with Canada, Japan, and South Korea.

Germany's national hydrogen strategy was released in mid-2020 and emphasizes the importation and future production of green hydrogen with ambitious goals to become a global leader in renewable technologies. The German industry is aiming to capitalize on the momentum with their selection of 62 large scale projects to be funded as a joint EU investment in hydrogen technologies.o a low-carbon business model. HEGRA (short for Herøya Green Ammonia), launched in Norway on 16 August 2021, is one such company looking to decarbonize and electrify to enable large-scale green ammonia production.

North America

Canada

Canada has aimed for loftier targets with its hydrogen strategy, anticipating that, by 2050, hydrogen will be able to deliver up to 30% of Canada's end-use energy. This includes envisioning a sufficient hydrogen supply network that is inclusive of both large-scale centralized plants in natural gas-rich provinces or regions as well as smaller-scale electrolytic distributed production closer to demand centers.[28] Canada remains the world's fourth largest producer of hydropower with most of its operations based out of Ontario which is host to one of the largest operating nuclear plants in the world. The opportunity for Canada here is abundantly clear, with both sources of zero-carbon electricity having the ability to enable green hydrogen production.

27 https://www.forbes.com/sites/jimmagill/2021/02/24/europe-asian-nations-leading-the-world-in-hydrogen-development/?sh=215e9f834112

28 https://www.powermag.com/countries-roll-out-green-hydrogen-strategies-electrolyzer-targets/

Asia

Whilst large parts of Asia continue to place a heavy reliance on fossil fuels, the current state of hydrogen policy making, and production is continuing to rise from year to year.

Japan

Japan continues to further future initiatives to implement offshore wind to produce green hydrogen. Planning continues towards the construction of a 110 MW offshore wind farm and hydrogen facility in the coastal city of Ishikari continues with the aim that it will exceed production of up to approximately 550 tonnes of hydrogen a year.

Japan continues to establish itself as a world leader in investments in hydrogen technology research, investing government budgetary support of up to approximately $650 million USD in their last financial year (ending March 2021). Alongside the highly successful nature of the first Hydrogen Olympics and their ambitions to increase hydrogen consumption intake, Japan is well placed to establish itself as a hydrogen powerhouse in the years to come.

South Korea

South Korea has taken a major step forward in building its hydrogen economy by forming an extensive green ammonia alliance involving 13 private firms and five public institutions. The alliance will not only produce and transport green ammonia but also extract hydrogen back from the ammonia for various uses in the hydrogen sector. Specifically, Samsung Engineering and Doosan Heavy Industries will convert green hydrogen into green ammonia using their plants located overseas.

One of the major hydrogen hubs for the country will be based in Ulsan with talks that the hub will be the largest in Northeast Asia. Expected to be completed in 2022, it plans to utilize hydrogen from fuel-cell electric vehicles (FCEVs), local petrochemical complexes and other items to provide key infrastructure to the hub.

Much of this follows from South Korea's hydrogen roadmap which was unveiled in 2019 and the "Green New Deal" in July of 2020 which included construction of three hydrogen cities by 2022 with the intention to add more in the future. Coupled with the enforcement of the world's first hydrogen law earlier this year, South Korea will look to continue its progression within the industry over the next 5-10 years.

Other

The use and future for hydrogen is heavily contingent on how many other countries are willing to meet the investment requirements to ensure a successful transition to cleaner energy uses. The global Hydrogen Council predicts that hydrogen could provide 18% of global energy demand by 2050 with an industry worth 2.5 trillion dollars annually.[29]

Countries such as Germany, Norway, Canada, Japan, and South Korea, who have directly invested time, resources, and money into hydrogen related programs, are firmly placed as favourites for the gold medal in the Hydrogen Olympics. Whilst they all hold the standard at present, others do not trail far behind. Chile's national strategy was launched in November 2020, which outlined ambitious goals to become the world's cheapest hydrogen producer by 2030 with a remarkable hydrogen production cost of less than $1.50/kg outlined in the plan. The Netherlands have aimed for at least 30% and up to 50% of final energy consumption in 2050 to be given via gaseous energy carriers such as hydrogen.[30]

Increased funding globally within the Hydrogen industry and the need for other nations to remain competitive against current Hydrogen leaders, should allow for the advancement of hydrogen uses and continued progression of standards required for countries to attain gold medals in the Hydrogen Olympics.

This is the second article in our Hydrogen Olympics series, exploring global hydrogen uses and its implementation at some of the world's biggest events, with an eye towards how Paris 2024 and Los Angeles 2028 can contribute to creating a roadmap for Brisbane 2032.

read more

29 Hydrogen Council (2017): Hydrogen scaling up. A sustainable pathway for the global energy transition. Hydrogen Council, November 2017
30 https://www.powermag.com/countries-roll-out-green-hydrogen-strategies-electrolyzer-targets/

H2 How? – The Uses and Applications of Hydrogen

Authors:
Matt Baumgurtel, David O'Carroll and Chanum Torres

First published:
25 November 2021

In light of its recent commitment to achieve net zero emissions by 2050, Australia aims to grow its domestic hydrogen industry and position itself as a major player in the new global green economy. As the Commonwealth Scientific and Industrial Research Organisation (CSIRO) has noted, if hydrogen can be produced using low or zero emissions, it can unlock deep decarbonization possibilities right across the economy.[8]

As we have seen in a previous article by us on the topic (link), there have been various Government funding and support incentives available in the hydrogen sector, both at State and Federal levels. The purpose of this article is to explore some of the potential uses and markets for clean hydrogen, both domestically and internationally.[9]

The role of Hydrogen in Australia's Plan to Achieve Net Zero by 2050

The Australian Government has committed to net zero emissions by 2050, relying heavily on a 'technology led approach'. In its Long *Term Emissions Reduction Plan*[10] (the **Plan**), the Government has set out how it will meet this commitment, with hydrogen featuring heavily in the Plan.

The Plan builds on the existing National Hydrogen Strategy agreed to by the Commonwealth and State Governments in 2019. One of the main aims of that strategy is to build a strong hydrogen export industry in Australia, which is now all the more salient given the fact that Australia's key trading partners – including Japan, South Korea, the EU and USA – have also made commitments to increase their usage of clean hydrogen. [11]

Oil Refining

The International Energy Agency (**IEA**) has described in its *Future of Hydrogen Report* [12] how hydrogen is an important resource in the oil refining process, especially in the removal of sulphur. As countries around the world legislate to reduce sulphur content in fuel in order to further reduce emissions, the need for hydrogen will correspondingly increase. The IEA notes that the production of hydrogen for use in refineries contributes to around 20% of total refinery emissions. [13] Therefore cleaner production of hydrogen will be an important part of emissions reduction strategies.

Transportation

Hydrogen-fuelled heavy vehicles have no exhaust emissions and are well placed to help slash carbon emissions. The IEA has noted: "The theoretical potential for future use of hydrogen in road transport is very large. Any road transport mode can technically be powered using hydrogen, either directly using fuel cells or via hydrogen-based fuels in internal combustion engines." [14] Indeed, hydrogen appears to be critical for industries such as aviation and shipping, which will be unable to fully decarbonize without it. [15]

With the rail, trucking and aviation industry set to be radically altered by hydrogen technology in the coming years, heavy transport will likely experience huge growth as a result. Hydrogen-fueled trains have been used in Germany for over a year and have received glowing praise from local governments. They are quiet, cost-effective and can travel at speeds of up to 140km/h. [17]

In England, the first hydrogen fuel-cell plane capable of carrying passengers took its maiden flight in 2020, shortly followed by Airbus releasing the details of three hydrogen-fueled concept planes expected to be in service by 2035.[17] In Australia, Andrew Forrest has announced all Fortescue trucks will be powered by clean energy before the end of the decade and eventually powered by hydrogen. [18]

Hydrogen may also be utilised to power public transportation. The NSW State Government intends to shift the state's 8,000 diesel public buses to zero emissions vehicles by 2030 and is currently trialling electric buses. This reflects the broader shift to green public transport across the country, with Brisbane City Council introducing a fleet of zero emissions buses called the "Green Mobility Megawall". Currently, these trialled buses are solar powered, however, hydrogen is predicted to be a future consideration. [19]

It is important to note however that the competitiveness of hydrogen-powered vehicles depends critically the economic viability of fuel cells and on the appropriate infrastructure being available such as easily accessible refuelling stations. Government can play a pivotal role here in stimulating investment and facilitating risk-sharing with the private sector in order to kickstart a hydrogen-powered clean energy future.

18 https://www.abc.net.au/radionational/programs/boyerlectures/oil-vs-water-confessions-of-a-carbon-emitter-v1/13072410
19 https://www.afr.com/companies/transport/hydrogen-buses-to-hit-the-roads-soon-20210203-p56z2w

8 CSIRO, *National Hydrogen Roadmap: Pathways to an economically sustainable hydrogen industry in Australia* (2018) 1.
9 https://www.industry.gov.au/policies-and-initiatives/growing-australias-hydrogen-industry
10 https://www.industry.gov.au/sites/default/files/October%202021/document/australias-long-term-emissions-reduction-plan.pdf
11 https://www.industry.gov.au/sites/default/files/2019-11/australias-national-hydrogen-strategy.pdf
12 https://iea.blob.core.windows.net/assets/9e3a3493-b9a6-4b7d-b499-7ca48e357561/The_Future_of_Hydrogen.pdf
13 Ibid, page 95.
14 Ibid, page 130.
15 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1011283/UK-Hydrogen-Strategy_web.pdf, page 64.
16 https://www.energynetworks.com.au/news/energy-insider/all-aboard-the-hydrogen-train/
17 https://www.bbc.com/future/article/20210401-the-worlds-first-commercial-hydrogen-plane

Ammonia Storage

Ammonia, a compound of hydrogen and nitrogen, can efficiently transport and store hydrogen at a low cost. Ammonia production requires hydrogen as a feedstock, generally provided in the form of fossil gas. In 2019, ammonia represented nearly 43% of global hydrogen production, with China the largest producer followed by India and Russia. [20]

Ammonia, as an alternative to direct hydrogen use, does not contain carbon and can be produced from any energy resource. Ammonia storage for hydrogen energy also has a low cost per unit of stored energy. Given that ammonia storage is like that of propane, the infrastructure for ammonia storage has already been developed and ready to use, making supply more efficient and therefore financially attractive. Ammonia is also safer to store given it has a smaller flammable range.

Australia has a huge surplus of wind and solar energy to export. Shipping ammonia is currently the only viable option for Australia to export large quantities of renewable energy around the world.

Making Fertiliser

Ammonia is the second most produced chemical on the plant, with most of the production used in the global agriculture industry. Approximately 88% of ammonia produced annually is consumed in the manufacturing of fertiliser used by farmers to maximise crop growth.[21] In 2020, French renewables company Engie and Australian fertiliser producer Yara announced plans for large-scale renewable hydrogen and ammonia development known as the 'Pilbara Hydrogen Hub.' [22]

Ammonia Co-firing

In addition to its role as an energy carrier, ammonia can be directly used as fuel in thermal power generation. Interest in exploring ammonia as a decarbonising fuel has soared because it does not emit carbon dioxide when burned. As we have seen in a previous article (see link), JERA, Japan's largest power generation company, announced plans in May 2021 to begin using ammonia as a fuel source in a co-firing demonstration project.

The demonstration project is designed to establish ammonia co-firing technology by burning both coal and ammonia at one of its existing large-scale commercial coal-fired power plants. The demonstration project will then be able to evaluate boiler heat absorption and the environmental impact of co-firing, including the impact of exhaust gases.

The trial could have knock-on effects for Australia's largest wind and solar project, the 26GW Asia Renewable Energy Hub, by generating demand for Australian green energy imports. The Hub is exploring the viability of the green ammonia market, initially as a substitute for coal in power generators such as JERA's. [23]

Heating Buildings

The IEA points out that the building sector accounts for 30% of global final energy usage. Nearly ¾ of this is for heating of buildings and is largely powered by fossil fuels. [24] Hydrogen, as a low carbon gas, can theoretically be a cleaner source of heating. There is great potential in using hydrogen as a source of clean energy for heating in order to dramatically reduce emissions, by decarbonising the heating of buildings.

In its Hydrogen Strategy, the UK Government points out that meeting its net-zero targets will require switching to low carbon heating alternatives in order to heat the "30 million residential commercial, industrial and public sector buildings in the UK." [25] Part of its strategy to reduce emissions in this area includes trialling hydrogen as a key component of heating systems. This may include blending hydrogen into natural gas or even the use of 100% hydrogen for heating. However, this would rely on technology still in development such as fuel cells and hydrogen boilers.

Conclusion

The examples discussed in this article are just some of the potential uses hydrogen (and hydrogen products) can have in playing a part in the transition to a truly renewable energy sector. Not only are the sustainability opportunities clear, but so too are the economic opportunities for both Government and the private sector.

read more

20 https://www.iea.org/reports/the-future-of-hydrogen
21 https://www.aiche.org/resources/publications/cep/2016/september/introduction-ammonia-production
22 https://www.pv-magazine-australia.com/2020/12/03/engie-and-yara-partner-to-develop-pilbara-hydrogen-hub/
23 https://reneweconomy.com.au/japan-to-use-ammonia-at-coal-plant-in-boost-for-australias-biggest-wind-and-solar-project/
24 https://iea.blob.core.windows.net/assets/9e3a3493-b9a6-4b7d-b499-7ca48e357561/The_Future_of_Hydrogen.pdf, page 144.
25 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1011283/UK-Hydrogen-Strategy_web.pdf, page 61.

Net-zero by 2050: The Green Light for Green Energy

Authors:
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First published:
02 November 2021

In this latest New Energy Expert Insights article and with COP 26 in full swing, Hamilton Locke sat down with Richard Mathews, the former Consul-General for eastern Indonesia in Makassar, Deputy Representative to Taipei and Deputy Ambassador to Greece, to discuss the importance of an Australian commitment to the net-zero by 2050 to Australian renewable energy businesses' inbound and outbound investment opportunities.

With COP 26 underway and Australian Prime Minister Scott Morrison in attendance armed with the Nationals recent agreement to provide in-principle support for the Australian Government to commit to net-zero by 2050 (**net-zero**), Hamilton Locke took the opportunity to discuss with Richard Mathews Australia's reluctance to commit to a net-zero target has affected Australian renewable energy businesses' ability to invest in overseas markets and attract inbound investment.

Having recently retired, Richard Mathews corralled the support of over 70 former Department of Foreign Affairs and Trade officials and diplomats under the banner "Diplomats for Climate Action Now" to deliver a letter to the Australian Government expressing their collective concern regarding the risk to Australia's key strategic and economic interests that was being caused by the Government's failure to commit to net-zero. And as a former diplomat, Richard Mathews saw firsthand how failure has hampered Australian businesses looking to export their renewable energy technology and expertise to overseas markets, including in Indonesia.

Below we discuss with Richard some of the practical issues faced by Australian renewable energy businesses, particularly in the green hydrogen industry, as a result of Australia arriving late to the net-zero party and the opportunities that now present themselves with Australia committing to net zero.

What changes for Australian renewable energy businesses, and particularly the green hydrogen industry, now that the Australian Government is attending COP26, and has now committed to a net-zero target?

Essentially, Australia can talk the talk all it wants but without that commitment to net-zero our overseas partners, both governmental and corporate, were always questioning our commitment to the renewable energy industry. Without that commitment, there was always going to be doubt and uncertainty amongst our partners. Now with the Australian Government's commitment to net-zero, the perception that Australia is not committed to the renewable energy industry will recede and countries will be more open to working with our renewable energy businesses.

Richard provides a real-life example of the interest international communities have in Australia's capabilities in the renewable energy space and the opportunities Australia must capitalise on:

"When I was Consul-General in Makassar, we hosted a renewable energy seminar and there was considerable interest from across Indonesia's provinces in Australia's capabilities to support renewable energy projects, especially in isolated communities where importing fossil fuels was expensive. These communities had plenty of wind and sunshine, so were very interested in renewable energy. But at the time there was little government support for renewable energy exporters. Now, with the commitment to net-zero by 2050, that should change for the better."

How has the lack of long-term emissions targets affected Australian renewable energy companies' ability to attract inbound international investment? How has that outlook now changed?

The lack of a long-term emissions target was a problem for not only investors but also communities. Coal mining communities around Australia such as those in Gippsland were none the wiser on what their future was going to look like. Or what the future for Hunter Valley coal miners was going to look like during the transition, and this seems to be an overlooked factor in the transition process. Now with the commitment to net-zero, communities such as these can begin to plan their transition to renewable energy technologies with the certainty that there is an international market for these technologies in terms of exports and inbound investments.

Until recently, the lack of a firm commitment to net-zero from the Government had created an inverse sovereign risk in terms of whether or not to make an investment in Australia's renewable energy industry.

For example, look at international companies like Adani. Adani invests not only in coal but also in renewable energy projects. Australia's reluctance to commit to net-zero has resulted in these international companies making a bet each way in Australia. As a result, there has been continued investment in coal at the same time money has been going into renewables. Therefore, the lack of a net-zero commitment had been diverting investment dollars that would have otherwise been bound for the renewable energy industry into the fossil fuel industry.

Adani's current investment in Queensland is an example of this, while more recently their announcement of $20 billion investment into renewable energy gives us a taste for the international investment opportunities that await the Australian renewable energy industry as confidence grows in our commitment to net-zero.

This hesitancy by international groups to invest in Australian renewable energy due to our lack of policy commitment to achieving net-zero is supported by the recently released report by The Investor Group on Climate Change which provides that, along with Saudi Arabia, Australia is one of the least attractive destinations for green investment among the G20 countries.

How does it affect Australian businesses' ability to export renewable energy technologies and their expertise? How important are strong diplomatic relations regarding Australian renewable energy businesses' ability to deal with international counterparts and operate internationally?

Australia's reluctance to commit to net-zero has historically affected our ability to export renewable energy technologies and expertise in two ways:

- Without the access and support of the Australian diplomatic core which required a commitment to net-zero to be 'unlocked', Australia's ability to export renewables has been more difficult than it needed to be; and
- If Australian renewable energy businesses have managed to get their foot in the door internationally, they have come up against renewable energy businesses from countries that had already committed to net-zero, which had resulted in Australian businesses essentially fighting with one hand tied behind their backs. Host countries have tended to prefer renewable energy businesses which had the backing (both financial and political) of their home country.

This issue is not only prevalent at a political level, but also at higher corporate levels as well. With government backing, potential partners will be more interested in what Australia is doing and know that we are not just talking the talk, so to speak. It increases confidence that government support is available if problems arise, and it also opens opportunities regarding complex cost problems associated with imports and tariffs. Without government backing and funding, it remains difficult for potential partners to feel confident that Australian renewable energy companies can effectively do business without any constraints which then provides a transact execution risk.

What are some practical steps Australian renewable energy companies can make to forge strong ties with international companies and governments?

The Australian renewable energy industry needs to keep pushing the Government to commit to stronger short-term emissions targets. Groups like the Al Group and Business Council of Australia continue to push hard to try to get the Government to commit. While a commitment to net-zero will make it a lot easier for renewable energy companies to build stronger international ties, this process will be accelerated by stronger short-term targets that leverage Australia's current superior natural resources such as solar and wind.

In the meantime, renewable energy companies should also be looking internally to State and Territory government incentive schemes and grant programs. Most State and Territory governments, for example, have released green hydrogen funding programs and are looking to reduce emissions significantly by 2030, which is a massive practical step for Australia internally. For example, NSW has progressed immensely over the past year and a half under the guidance of Matt Kean in their proposal and developments of different state-wide hydrogen hubs and New England specifically as a renewable energy hub.

How should Australia make climate change, renewable energy and the green economy a broad focus of our foreign policy?

We have been competing with other international renewable energy businesses and other countries who have diplomatic support because they are in the "net-zero circle". Now that Australia has committed to net-zero by 2050, entry into this circle will open doors that have otherwise been shut to Australian renewable energy businesses.

While Australia has been slow to commit to net-zero, in many ways change is occurring with the technology plan that the Government is looking to implement, with most of the funding being directed towards green hydrogen developments. In relation to foreign policy, with the direction that net-zero provides, the Department of Foreign Affairs and Trade and Austrade should start gearing up to support Australian renewable energy businesses' efforts to export green technology and our green expertise.

The Australian diplomatic core must channel the expertise and firepower they used to drive Australia to be a major player in the coal industry, to catapult Australia into being a major global player in the renewable energy sector. For many years one of the critical KPI's for our diplomats related to their success and support for the coal and gas industry. There is the will and capacity to shift this focus to the renewable energy sector. Building bilateral and regional relationships in these areas and building capacity to negotiate and support Australian renewable energy businesses will play a critical role in helping Australian renewable energy businesses crack international markets.

We risk missing out on opportunities if we do not act effectively on promoting Australian renewable energy capabilities. In recent months, the Green Economy Agreement with Singapore has been a good start and hopefully, there are more positive outcomes ahead. Now the green light has been given, the Department of Foreign Affairs and Trade and Austrade should move quickly and become a proactive supporter of Australian renewable energy businesses throughout the world and within the region which will help to secure new opportunities.

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Australian Hydrogen Funding Programs

Authors:
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14 October 2021

Federal, State and Territory, including government agency funding, can be hard to keep track of in a rapidly evolving new energy industry such as hydrogen, particularly green hydrogen (**GH2**). With the announcement of NSW's Hydrogen Strategy on 13 October 2021, we take an in depth look into the relevant funding programs administered by the Federal, State and Territory Governments as well as the ARENA and CEFC funding arrangements. (see link)

The GH2 train has well and truly left the station. Over the last few months, the flow of announcements regarding various GH2 projects has been thick and fast. With Fortescue Future Industries' Andrew "Twiggy" Forrest playing the GH2 field over the last few days, from announcing with the QLD Government the first world scale GH2 manufacturing centre – which will build 2GW worth of electrolysers, to standing alongside NSW Premier Dominic Perrottet as he announced his Government's new Hydrogen Strategy, one could be forgiven for thinking we are witnessing a new type of NSW and QLD rivalry – the GH2 State of Origin.

NSW's Hydrogen Strategy

The NSW Hydrogen Strategy is backed by up to $3 billion worth of incentives to grow the hydrogen industry, particularly in the Illawarra and Hunter hydrogen hubs. These incentives – which are hoped to attract between $50 and $80 billion worth of investment – include:

- Exemptions for green hydrogen production from government charges;
- A 90% exemption from electricity network charges for green hydrogen producers who connect to parts of the network with spare capacity;
- Incentives for green hydrogen production; and
- A hydrogen refuelling station network to be rolled out across the State

The NSW Treasurer, Matt Kean, believes that this Hydrogen Strategy "is forecast to more than half the cost of green hydrogen production in NSW". If this forecast proves to be accurate this will bring GH2 closer to cost parity with fossil fuel produced forms of hydrogen, unlocking the demand side of the GH2 market and turbo charging the large-scale production of GH2.

GH2 funding landscape

Like its predecessors, wind and solar, government dollars whether they be grants, loans or incentives, such as the NSW Hydrogen Strategy, will play an integral role in the development of the budding GH2 to the industry in Australia as we aim to scale up GH2 production and tap into various export opportunities. The New Energy team at Hamilton Locke has reviewed the various funding programs and incentives at all levels of government and distilled the key features of each program.

Click here for a detailed breakdown

to access our comparative analysis of the various GH2 funding regimes.

While many of the programs are currently closed, it will be important for GH2 project developers to track the relevant programs (particularly the various eligibility and merit criteria) to allow them to tap into the government dollars when the programs inevitably re-open for applications.

Government funding will be a crucial component in any GH2 project. It is important that project developers do not "self-select" themselves out of funding programs. Therefore, we strongly recommend project developers seek out professional advisors to help assess their GH2 project's suitability under the relevant funding program. We at Hamilton Locke are already engaged with our clients in relation to these programs and we will be assisting in preparing applications to all levels of government in the coming months and years. Please get in touch with our New Energy lead, Matt Baumgurtel, should you wish to discuss.

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The Colours of the H2 Rainbow

Authors:
Matt Baumgurtel, David O'Carroll, and Bridget Hudson

First published:
07 October 2021

Hydrogen contains roughly 2.4 times as much energy as natural gas, making it a resource that many are eager to capitalise on. However, for hydrogen to be utilised as a source of energy, it must first be broken down into its pure form, requiring processes to extract it from the water, biomass, fossil fuels or minerals that it is commonly a part of. It has been classified using increasingly colourful names as new technological developments produce different combinations of "hydrogen +". These names given to the different forms of hydrogen correspond to the processes used to extract it. With billions of dollars now being invested in the global hydrogen economy, the proper classification – and with that, the divergences in price and carbon content - of the various forms of production, is now more important than ever.

Brown and black hydrogen

Brown hydrogen, made from brown coal methane gas and other fossil fuels, and black hydrogen, made from black coal, are produced via gasification.

A coal to hydrogen gasification plant produces synthetic hydrogen gas generated by partially oxidising brown coal feedstock. The resulting carbon monoxide is then converted into carbon dioxide with steam and the hydrogen is separated out through a refining process.

It is expected that for every 150 tonnes of brown coal used during this process, three tonnes of hydrogen will be produced.

While brown hydrogen has long been the most abundant in use for its affordability, the shift towards environmentally friendly alternatives now means this extraction process is no longer viable in the long term.

For every tonne of brown hydrogen produced, the by-product is between 10 and 12 tonnes of CO2. This environmental impact is worsened when you take into account the CO2 produced by transporting the hydrogen to and from the plant and the CO2 produced in driving the process.

Overall, the production of brown and black hydrogen is inefficient and extremely damaging to the environment and has resulted in significant research and investment into alternative extraction processes.

Grey hydrogen

Grey hydrogen is the most common form of hydrogen production and is extracted from natural gas using a process called steam methane reforming which releases carbon dioxide into the atmosphere. This form of hydrogen is referred to as "grey" to indicate it was created from fossil fuels without capturing the greenhouse gases. The main difference compared to brown or black hydrogen is the fewer emissions generated in the process.

Blue hydrogen

Blue hydrogen uses the same process as grey hydrogen except that the carbon emissions are captured and stored underground using carbon capture, utilisation and storage (CCUS) technology leaving nearly largely pure hydrogen. Often, the CO2 is then transported by a pipeline and stored deep underground, often in salt caverns or depleted oil and gas reservoirs.

It is often considered a carbon neutral energy source, however, "low carbon" would be more accurate since around 10 – 20% of the generated CO2 cannot be captured. Blue hydrogen is often seen as a stepping-stone from grey to green, however, it has proven to be extremely contentious among stakeholders in the industry.

Green hydrogen

Green hydrogen (**GH2**) is a relatively new development in the hydrogen fuel industry and involves extracting hydrogen in an environmentally sustainable way via a process called electrolysis.

Through electrolysis, water is split into hydrogen and oxygen. The electricity that powers the electrolyser comes from renewable energy sources, such as wind and solar. Hydrogen and oxygen are the products of the process, meaning that no greenhouse gas emissions are produced.

Clear hydrogen

Clear hydrogen – a nascent form of hydrogen production - is produced by extracting hydrogen from water, like GH2, but rather than using electrolysis, it does so using water that is subjected to external influences coupled with extremely rapid variations in pressure, temperature and motion. There is no heat, and therefore, no carbon is used or generated in the process.

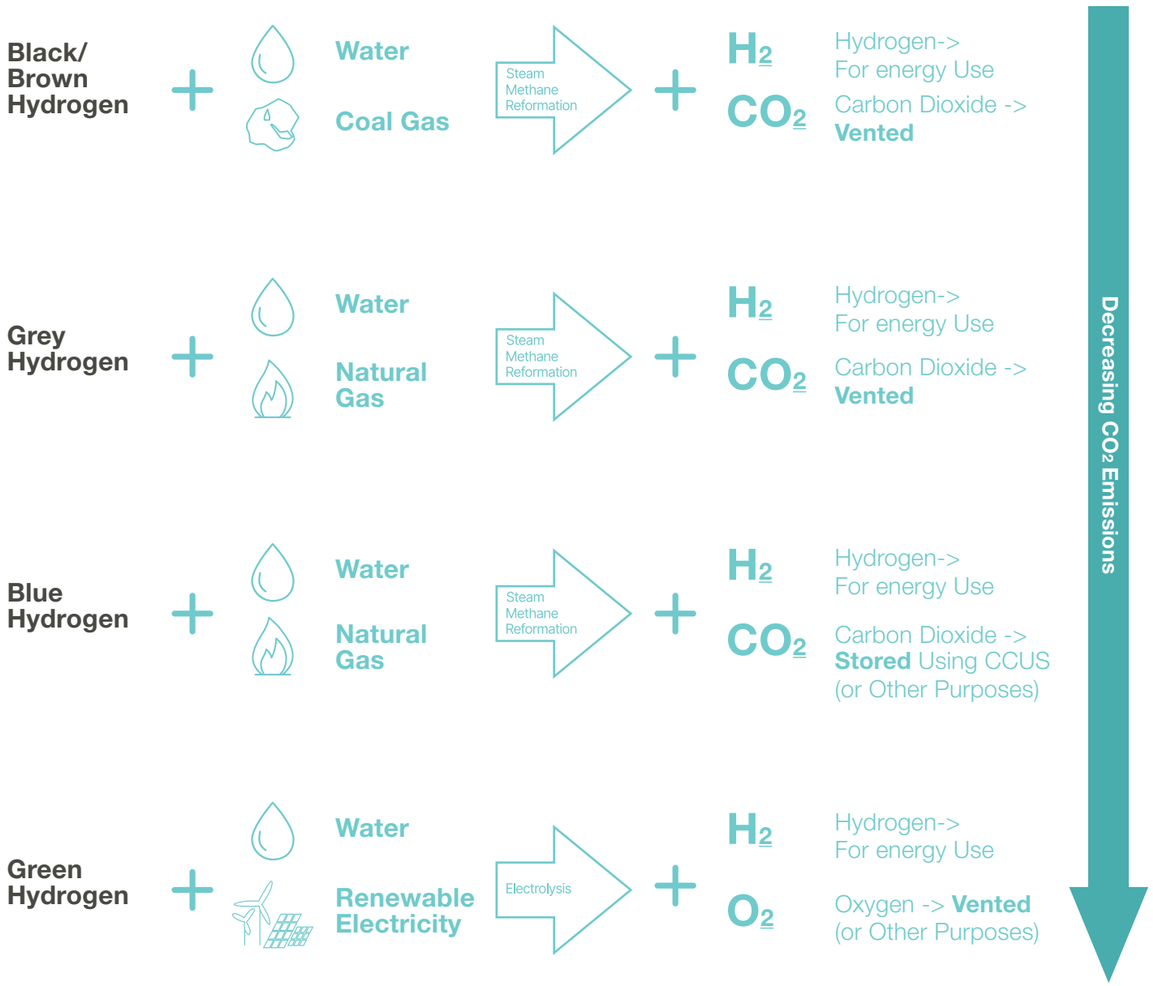
The goal is that this should enable hydrogen production at a significantly reduced cost, without the carbon impact. In addition, this process is proposed to be much less capital intensive than other hydrogen technologies, further reducing production costs.

Turquoise hydrogen, pink hydrogen, yellow hydrogen and others.

Turquoise hydrogen is produced by breaking methane down into hydrogen and solid carbon using a process called pyrolysis. While it was initially thought that this process produced relatively low emissions because the carbon by-product can be buried or used for industrial processes, recent research shows that turquoise hydrogen is no more carbon-free than blue hydrogen.

Pink hydrogen is extracted through nuclear-powered electrolysis. Nuclear-produced hydrogen can also be referred to as purple hydrogen or red hydrogen.

Yellow hydrogen is a relatively new process for hydrogen extracted through electrolysis using solar power.



Other Hydrogen Colors (No CO_2 Emissions):

- Pink Hydrogen ▶ Electrolysis of water using nuclear energy
- Yellow Hydrogen ▶ Electrolysis of water using solar energy
- Turquoise Hydrogen (Experimental) ▶ Pyrolysis of methane producing hydrogen and solid carbon
- White Hydrogen (Low Occurrence) ▶ Natural occuring hydrogen deposits

Source: National Grid Group plc, Nyan Cat courtesy of imgur

Promotion of GH2 - certification and standardisation

Global concerns over climate change, air pollution and the environment have pressured governments to reduce their carbon footprint, and GH2 is being coveted as playing an instrumental part in achieving this. GH2 is the only truly carbon-zero extraction process with no carbon footprint. However, it does face its limitations.

Currently, GH2 is more costly to buy per USD / kg than other dirtier forms of hydrogen.

Demand creation is also unfortunately still lagging behind what is needed to help in reaching a net-zero emissions renewables economy with GH2 as a key component.

There are a variety of measures that still need to be taken to help with its adoption such as policy instruments like auctions, mandates, quotas and hydrogen requirements in public procurement can help de-risk investments and improve the economic feasibility of low-carbon green hydrogen.

Central to this will be establishing appropriate certification, standardisation and regulation regimes internationally to ensure that hydrogen production is truly low carbon. This in turn will give consumers the confidence they require that by investing in GH2, they are getting exactly what they have paid for, ie hydrogen produced using zero greenhouse gases.

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Range of Hydrocarbon Production Costs by Type (USD/ kg H_2)

Coal (Black Hydrogen)	$1.20 – $2.20
Natural Gas with Carbon Capture (Blue Hydrogen)	$1.50 – $2.90
Natural Gas (Grey Hydrogen)	$0.90 – $3.20
Renewables (Green Hydrogen)	$3.00 – $7.50

Source: The International Energy Agency

The Deep Green Sea

Authors:
Matt Baumgurtel and Andrew Smith

First published:
30 September 2021

Update: the development of an offshore wind industry in Australia has achieved a major milestone with the Bill passing both Houses of Parliament on 25 November 2021. There are currently 10 to 15 proposals for offshore wind developments, with the most advanced proposal being the Star of the South offshore wind development off the coast of Victoria's Gippsland coast. A further feather in the cap for offshore wind's offering in the GH2 space, is the execution of an agreement that will see the Singaporean company, Enterprise Energy, develop a USD$10 billion wind farm off the coast of Ireland to power an onshore GH2 facility.

On 2 September 2021, the Offshore Electricity Infrastructure Bill (the **Bill**) was introduced to the Australian Parliament. The Bill establishes a regulatory framework for the offshore wind industry.

Specifically, it provides a framework to licence the exploration, construction and operation of renewable energy and transmission projects in Australia's offshore exclusive marine economic zone.

The unlocking of Australia's offshore wind capacity not only paves the way for existing proposed offshore wind farm projects but also provides a new pathway for the development of a large-scale Australian green hydrogen industry.

For years, Australia's vast high-quality offshore wind energy has gone to waste as there has not been the regulatory framework needed to develop the industry. While not a silver bullet, the proposed law is the first step to unlocking the enormous potential of Australia's abundant offshore wind resources.

The framework

- In July AEMO included in its 2021 Inputs, Assumptions and Scenarios Report (IASR) Offshore Wind Zones, triggering the tabling of the Bill.
- The Bill provided a framework for the regulation of "offshore renewable energy infrastructure" which includes "fixed or tethered infrastructure".
- "Fixed or tethered infrastructure" is defined as any infrastructure, structure or installation that:
  - rests on the seabed;
  - or is fixed or connected to the seabed (whether or not the infrastructure, structure or installation is floating);
  - is attached or tethered to any other fixed or tethered infrastructure, but does not include a vessel that is temporarily moored or anchored to the seabed.
- The Bill provides for the following categories of licences:
  - feasibility: a competitive process is proposed whereby the Minister will select applicants based on suitability and merit criteria to undertake investigation activities for up to 7 years;
  - commercial activities: following successful feasibility studies large scale, generation-focused projects may apply for a commercial licence for up to 40 years, with an ability to extend the term for a further 40 years;
  - research and demonstration; designed to facilitate research, testing technologies and early stage technology assessment. With a term of 10 years (with a possibility of extension) these licences cannot be converted into a commercial licence. As such we anticipate size limitations will be applied to this licence category, all infrastructure installed under this licence must be removed at the end of the licence period; and
  - transmission and infrastructure: a separate licence will be required to construct and operate infrastructure used for transmission. The term of this licence will not be fixed and will be linked to the life of the asset.
- The Bill is based upon the Offshore Petroleum and Greenhouse Gas Storage Act 2006 (Cth). The framework will be regulated by The National Offshore Petroleum Safety and Environmental Management Authority (**NOPSEMA**), while the National Offshore Petroleum Titles Administrator (**NOPTA**) will administer the licencing scheme.
- The licence fee structure and quantum has not been determined and will likely be part of NOPSEMA and NOPTA's role.

Importantly, offshore proponents will need to navigate state and/or territory requirements for licensing infrastructure in coastal waters (ie within 3 miles of shore), in addition to the usual grid connection processes in order to participate in the National Electricity Market.

A such, we understand State and Territory legislation to support the development, construction, and operation of generation and infrastructure assets in state and territory coastal waters are currently being drafted. Legislative structures vary however it appears key States will apply similar schemes to the Renewable Energy Zone frameworks and hence provide another dimension to the ongoing competition between States and Territories for renewable energy investment.

We are currently engaging with clients in relation to the mechanics of the Bill. In particular, we note international offshore wind farm developers are particularly focused on the potential gap and/or overlap between Federal and State regulation. This is a common concern from international IPPs however the regulation of coastal and Commonwealth waters adds yet another layer of complexity.

The Bill is a "framework" in the purest sense – it is a skeleton around which the specifics and detail are to be fleshed out. These specifics and details will be critical to the success of an Australian offshore wind industry. Australia has the benefit of precedent regulatory regimes in the US, UK, Europe and North Asia – learning of these jurisdictions will be critical to developing the detail and specifics required in an Australian context.

This framework has been referred to the Senate Environment and Communications Legislation Committee for inquiry who are due to report on 14 October 2021. The outcome from this review will likely set the medium term trajectory of the framework and the development of an Australian offshore wind industry.

Offshore wind opportunities

Offshore wind turbines can be constructed taller and with much larger blades compared to their onshore relatives, which boosts efficiency and capitalises on the stronger, more consistent ocean winds. Currently, offshore wind turbine designs can produce up to 15MWs each. Research conducted by the Blue Economy Cooperative Research Centre found that in some parts of southern Australia, the capacity factors of offshore wind turbines could exceed 80 % which matches the output of many of Australia's baseload generators. For the rest of Australia, the study found that capacity factors up to 50% could be achieved.

However, as the overseas experience indicates, offshore wind provides its own significant development and operational challenges. First, offshore wind does not necessarily solve the intermittency issues that its onshore siblings face. While the quality of offshore wind is more consistent than onshore wind, there are still times where the wind does not blow. Second, the capex and opex requirements of offshore wind farms are significant. In particular, the cost of constructing the infrastructure to connect to the electrical grid, and the cost to maintain that connection can be prohibitive. This deep-water electrical infrastructure is costly to maintain and difficult to fix when it breaks. One just has to look at the Basslink outage in 2015/16 which took 6 months and a team of 100 cable experts to fix with a cost to Hydro Tasmania estimated at AUD140 to AUD180 million.

An opportunity for H2

The capex and opex costs of connecting offshore wind to the grid provide a niche for the hydrogen industry. Why connect offshore wind to the grid at all? With an abundant, chemically consistent water source co-located with the reliable (very high capacity factor) and low-cost green electricity produced by offshore wind turbines, green hydrogen could be produced offshore either on power islands or at each wind turbine.

The oil and gas industry has already developed much of the technology required to produce and export offshore hydrogen such as semi-floating production facilities and floating production storage offloading. Australia should leverage its existing offshore oil and gas expertise to further utilise its competitive advantage in the renewable energy industry to supercharge its development as a major exporter of green hydrogen.

On the demand side, the appetite for green hydrogen is increasing. Apart from electrification, the global shipping industry is increasingly looking to green ammonia produced using green energy to fuel the shipping fleet. Currently, the shipping industry accounts for 2.9% of global CO2 emissions as an end user of fossil fuels, and with the International Maritime Organization's (a United Nations agency) energy efficiency measures due to come into force in 2023, the shipping industry's demand for cleaner fuels will increase dramatically.

Global examples

Internationally, offshore wind has traditionally been connected to grid-connected utility markets. However, developers are now looking at how offshore wind can be used to power decarbonisation in off-grid scenarios. Many high-profile companies are exploring the use of offshore wind to produce green hydrogen in the North Sea.

For example, Norway has identified two zones in the North Sea for the development of up to 4.5 GW of offshore wind capacity to assist the Norwegian oil and gas industry transition to a low-carbon business model. Other countries such as Denmark, Germany and the Netherlands have large-scale industrial projects underway, all of which are focusing on how green hydrogen can decarbonise their respective economies. Presently, however, offshore green hydrogen production is cost-prohibitive relative to grey hydrogen production, but GW scale offshore wind farms may provide the economies of scale required to reduce the cost of green hydrogen.

Japan is another jurisdiction where there are plans to utilise offshore wind to produce green hydrogen. The construction of a 110 MW offshore wind farm and hydrogen facility is planned in the coastal city of Ishikari. The plan is for commercial operation to begin in March 2024 with the production of up to approximately 550 tonnes of hydrogen a year. The project participants are Hokkaido Electric Power, Green Power Investment, Nippon Steel Engineering and Air Water.

These international examples show that rather than being connected to the grid, the larger opportunity for offshore wind energy is to service the mass electrification required by the future green hydrogen industry. Offshore wind energy has the potential to be a strategic resource for offshore hydrogen production or a source of electricity for hydrogen production at port-based export facilities and local heavy industry.

So why not in Australia

With the recent announcement of the Federal Government's Clean Hydrogen Industrial Hub grant program which will award grants up to AUD$ 3 million for feasibility and design work, and a further AUD$ 70 million for the rollout of projects, Australia is in a perfect position to capitalise on the growing global consensus that green hydrogen is the fuel of the future. Offshore wind provides a unique opportunity for Australia to produce offshore hydrogen which can be exported both domestically and internationally to electrify households or used to fuel the global shipping fleet moving goods around the globe.

read more

The beginning of a Hydrogen Gas Network?

Authors:
Matt Baumgurtel and Andrew Smith

First published:
28 September 2021

In what is the first step towards an Australian hydrogen gas network, Energy ministers have requested the Australian Energy Market Commission (**AEMC**) review the National Gas Rules (**NGR**) and National Energy Retail Rules (**NERR**) to determine what changes are necessary to include low-level hydrogen blends and renewable gases in the NGR and NERR frameworks.

Formal consultation will begin on 21 October 2021 with the release of a consultation paper inviting formal submissions however we understand the AEMC have been working on this review for some time, with soft sounding by AEMC of various stakeholders being conducted in recent months.

While there are significant technical and regulatory challenges in blending hydrogen into the existing network, pilot programs and demonstration projects have been successful in Western Australia, North America and Europe.

Accessing existing gas networks will be key to Australian green hydrogen projects unlocking global export markets – and potentially supercharge the Australian green hydrogen sector.

The release of the consultation paper on 21 October 2021 will also mark the commencement of the AEMC rule change request process for the National Gas Rules which apply to the Victorian DWGM. This will assess a request made by the Victorian Minister for Energy, Environment and Climate Change that seeks to enable that market to recognise distribution connected facilities. These facilities may include hydrogen and renewable gas facilities as well as others such as storage.

Scope of AEMC's review

In conducting its review, Energy Ministers have asked AEMC to:

- Have regard to the findings of the desktop review that was conducted for the Department of Industry, Science, Energy and Resources as the starting point for the identification of potential gaps in the NGR and NERR that could emerge if low level hydrogen and renewable gas blends are permitted to be supplied through gas distribution networks
- Consult with market participants, industry, consumers, other market bodies and government officials, as appropriate, to identify any other material gaps in the NGR and NERR.
- Develop the initial rules that are required to address the identified gaps in the NGR and NERR, and consult on the draft initial rules.
- Advise officials working on the legislative reforms of any gaps in the NGL and NERL identified by the AEMC in its review of the rules.
- In their review, AEMC will consider:
  - The economic regulatory framework, including:
  - Connection and access by facilities for the production, injection and blending of hydrogen, biogas and other renewable gases into distribution networks (and other facilities as necessary) to ensure that:
    - access for these facilities is available on reasonable terms;
    - these facilities are covered by the dispute resolution provisions; and
    - hydrogen blending facilities only connect in parts of the network suitable for the injection of hydrogen; and
  - ensuring that any cap on the level of blending that may be set by a jurisdiction is implemented consistently in the regulatory framework.
  - The facilitated markets and regulated retail markets, including:
    - addressing any matters that AEMO identifies in its review of the NGR, AEMO made Procedures and other AEMO made subordinate instruments that are required to ensure that settlement and metering in the Short-Term Trading Markets (STTM), the DWGM and regulated retail markets operate as intended
    - registration categories for the STTM, the DWGM and/or regulated retail markets; and
    - responsibility for the creation of the blend (as between distributors and retailers) and whether and how that should be accounted for in the regulatory framework.
  - The NERR and whether any additional consumer protections may be required, such as the provision of information to customers and any minimum contract terms or bill content requirements.
  - The regulatory sandbox provisions in the national gas and retail regulatory frameworks.
  - Any other material aspects of the NGR and NERR necessary to support low-level gas blends under the regulatory framework.

We at Hamilton Locke are already engaged with clients in relation to this review and we will be assisting in preparing submissions in response to the consultation paper.

We are keen to hear from other stakeholders in the sector. Please reach out to our New Energy lead, Matt Baumgurtel, should you wish to discuss.

read more

Federal Government Unveils their Clean Hydrogen Industrial Hubs Grant Program worth $464m

Authors:
Matt Baumgurtel and Andrew Smith

First published:
21 September 2021

On 20 September 2021, the Federal Government released a statement unveiling their AUD$464m Clean Hydrogen Industrial Hubs grant program (the **Program**). An additional AUD$150m and a further two locations now extends the Program to seven prospective locations across Australia which include: Bell Bay (TAS), Darwin (NT), Eyre Peninsula (SA), Gladstone (QLD), Latrobe Valley (VIC), Hunter Valley (NSW) and Pilbara (WA).

The Program provides for up to $3m grants for project consortia to undertake feasibility and design work, and up to $70m for the completion of projects. The Minister for Energy and Emissions Reduction, Angus Taylor stated that "The development of Clean Hydrogen Industrial Hubs would help the emerging industry work towards achieving the stretch goal of hydrogen production at under $2 a kilogram under the government's Technology Investment Roadmap."

The Program applies to all parts of Australia, but these seven locations have been identified by the Federal Government following strong interest and activity from industry participants and based on each location's existing infrastructure and capabilities.

Eligibility Criteria

Eligible entities

To be eligible applicants must have an Australian business number (ABN).

Applicants must also be an entity incorporated in Australia, or an Australian State/Territory Government agency or body.

Joint applications

An application must be a joint application with at least one project partner. However, the Federal Government would prefer applications with multiple project partners.

Joint applications must have a lead organisation. They will be the main driver of the project and must be eligible to apply.

If an application is successful, the lead applicant must manage the project on behalf of the consortium.

Project requirements

Applicants must be able to certify that their board supports the project. If there is no board, then the chief executive officer or equivalent must support it.

Applicants must also certify they can complete the project and meet the costs not covered by the grant funding.

Knowledge sharing

Applicants must agree to publicly share knowledge and information about and resulting from their project.

How to apply

To apply for a grant under this Program, applicants must submit their application through the online portal. For more information, please visit https://business.gov.au/grants-and-programs/hydrogen-hubs-development-grants

We at Hamilton Locke are already engaged with our clients in relation to this Program and we will be assisting in preparing applications to the Federal Government in the coming weeks. Please get in touch with our New Energy lead, Matt Baumgurtel, should you wish to discuss.

read more

Ammonia Energy Conference 2021 – Australia's Role in the Green Ammonia Industry

Authors:
Matt Baumgurtel and Andrew Smith

First published:
09 September 2021

On 26 August 2021, the Ammonia Energy Association held the virtual Ammonia Energy Conference with speakers from across the industry spectrum who presented on clean ammonia export projects, innovations in the Australian ammonia value chain, certifying clean ammonia, and ammonia fuel bunkering and infrastructure in Singapore.

Hamilton Locke Partner and head of Hamilton Locke's Energy, Resources and Infrastructure practice, Matt Baumgurtel, spoke at the conference on Australia potential future export markets and the issues along with competitive advantage Australia faces in the development of green ammonia projects.

Export opportunities

Recently, a grant application made in Japan by JERA Co Inc and IHI Corporation to conduct a demonstration project related to co-firing of ammonia with LNG was accepted. The Project will be the world's first demonstration project in which a large amount of ammonia will be co-fired in a large-scale commercial coal-fired power plant. The Project will support Japan's strategy of converting power capacity to green ammonia fired instead of natural gas or coal.

Projects like these are the footholds Australia needs to push into the global hydrogen economy as a major exporter of green hydrogen and help to build the industry's long-term commercial viability.

Australia's competitive advantage

Australia already has much of the required infrastructure and government policies required to successfully produce green ammonia. These include:

- a large domestic market across heavy transport, ammonia, steel and gas;
- access to low-cost renewable energy resources;
- existing hydrogen production, industrial bases and skilled workforces;
- potential for hydrogen export terminals in Port Kembla and the Port of Newcastle to access large scale export market opportunities;
- access to 30 day planning approvals through Special Activation Precincts in NSW.

In NSW in particular, there is an integrated hydrogen economy with the development of the New England REZ, Hunter Valley REZ/Hydrogen Hub and Illawarra Hydrogen Hub/REZ.

It is clear Australia already has much of the infrastructure required to become a major exporter of green ammonia. However, the challenge from a project development point of view is lining up and complementing our existing renewable energy resources with the components needed to create green hydrogen and green ammonia.

Development pathways

Option 1

There are a number of different project development structures that could be utilised in Australia.

One such example is using brackish water sources in close proximity to existing / future wind and solar farms to create green hydrogen through electrolysis and transporting this green hydrogen through hydrogen gas pipelines to existing ports where nitrogen can be added to create green ammonia.

Ammonia is an efficient and low-cost alternative to transporting and storing hydrogen as liquifying hydrogen for transport uses up 30% of its contained energy and needs to be stored at minus 250 degrees Celsius. Importers can then use the green ammonia as an alternative fuel source or decide to extract the green hydrogen to help power households.

While achievable, this development pathway will require significant investment into existing port infrastructure in Australia to enable port facilities to produce green ammonia on site.

Increased investment in existing and future renewable energy facilities will also be required to allow the production of green hydrogen on site.

Option 2

An alternate structure is to send renewable electricity through the grid to the port where it is electrolysed using seawater to create green hydrogen and converted to green ammonia by adding nitrogen.

The green ammonia can then be shipped to various export markets.

This pathway shifts much of the capital expenditure from renewable energy facilities onto existing and future port facilities that will have to accommodate both hydrogen and ammonia production facilities.

The downside of this development structure is that projects will bear the grid connection costs for sending the required electricity to the port. The process of certifying the ammonia as "green" will also be complicated by this structure as the green electrons from renewable energy facilities will be mixed with other non-green electrons in transportation through the grid.

Roadblocks

Some of the key roadblocks in the development of green ammonia projects in Australia discussed during the conference were the lack of global consensus on the definition of "green" ammonia, and the funding shortfall in Australian projects.

"Green" Ammonia: currently, there is no global consensus on what constitutes "green" ammonia which is resulting in a high-risk premium for green ammonia projects across the world. Europe, for example, has a strict interpretation of what constitutes green ammonia. To be classified as green in Europe, the ammonia must be produced using only electrons from new renewable energy facilities. While in other jurisdictions, electrons from existing renewable energy sources may be used to produce ammonia that is classified as green. As a result, existing and future projects developed based on the European interpretation of "green" ammonia may become commercially unviable in a scenario where Europe relaxes its interpretation of "green". Conversely, projects developed based on a more relaxed interpretation of "green" ammonia may become commercially unviable where that interpretation becomes stricter. Whether the green ammonia industry succeeds and powers the future needs of a zero-carbon world will depend much on the international community's ability to provide certainty through an agreed definition of "green" ammonia.

Lack of funding: an issue raised by Partner Matt Baumgurtel is the lack of funding that is required to make the economics of green ammonia projects stack up. As it currently stands, the gap between the capex required to construct green ammonia projects and the market price of ammonia is commercially unviable. Government funded agencies such as the Clean Energy Finance Corporation and the Australian Renewable Energy Agency are keen to help fund projects through grants and concessional loans but currently lack the necessary government funding to provide this assistance. Until such agencies have the financial resources to provide funding to green ammonia projects (like seen in the USA and Germany), project sponsors face too high a cost of production to get these projects off the ground.

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We didn't Start the Fire, but we'll Keep it going – The Legacy of the 1st Hydrogen Olympics

Authors:
Matt Baumgurtel, David O'Carroll & Rahul Tijoriwala

First published:
07 September 2021

Following the gold rush of Olympic medals for Australia and the admirable performances of the athletes in these Covid times, it wasn't too long before we all felt a sense of Olympic hangover.

It is now nearly a month since the closing ceremony and the conversation has shifted towards determining what legacy the Tokyo Games will leave behind. The 1964 Tokyo Olympics Games introduced us to the bullet train, and some 57 years later, we look to see what Japan's next global footprint will bring.

Australia's highest tally of gold medals since Athens 2004 and the birth of a new generation of sporting heroes worldwide may hold the most significant in terms of short-term relevance. Amid all the success, there is an understated accomplishment, one which may just come to be one of the most important legacies of the 2021 edition of the Games.

What happened?

In 2016, the Governor of Tokyo Yuriko Koike promised that the Olympic Games would "leave a hydrogen society as its legacy".[6] This consisted of expansive plans to power most of the event's infrastructure with the clean burning gas, including:

- An Olympic Village run purely on hydrogen; and
- 100 fuel cell powered buses and 500 Mirai hydrogen fuel cell vehicles to transport competitors and staff between venues.

In one of the more iconic Olympic moments, for the first time ever, the Olympic torch and cauldron were both ignited by a hydrogen powered flame with zero emissions.

After the use of propane, magnesium and even olive oil to burn previous flames, the use of hydrogen and the absence of carbon dioxide production when burned was welcomed. The majority of the renewable hydrogen used to fuel the flame and all of the fuel burned to transport the competitors was based on the Fukushima Hydrogen Energy Research Field, which includes a 10MW electrolyser and a 20MW on site solar farm.[7]

The flame presented considerable challenges as the hydrogen used was almost colourless and transparent when burned. However, experts made use of the perfect mix of sodium carbonate solution (SCS) and hydrogen to allow for the creation of the familiar orange yellow glow of the Olympic flame.

The Legacy

The Japanese Olympic Committee must be commended on promoting locally developed hydrogen technologies and its production of renewable hydrogen fuels. Whilst pre-Covid plans had indicated a larger scale project, the overall success of a cleaner and more energy efficient Olympics is unquestionable.

The Olympic village in Tokyo was designed with long term sustainability in mind and the idea of how the template for a 'hydrogen city' could be implemented in future Games. It is now in the process of being converted into residential accommodation where all the properties will be powered by renewable hydrogen rather than traditional fossil gas.

While there was undoubtedly considerable success in the implementation of hydrogen as one of the fuels of the Games, its costly nature proved to be one of the major difficulties (for example, the hydrogen powered buses). Japan relies on the importation of hydrogen from countries such as Australia and the success of future 'hydrogen cities' will rely on its accessibility and how economically efficient it will be to consistently reproduce.

Such difficulties provide the opportunity needed for countries like Australia to increase its own hydrogen production industry at home. Very recently, a grant application made in Japan by JERA Co Inc and IHI Corporation to conduct a demonstration project related to co-firing of ammonia with LNG has been accepted. This will be the world's first demonstration project in which a large amount of ammonia will be co-fired in a large-scale commercial coal-fired power plant. This is intended to support Japan's strategy of converting power capacity to green ammonia fired instead of natural gas or coal.

Projects like these are the footholds Australia needs to push into the global hydrogen economy as a major exporter of green hydrogen and help to build the industry's long-term commercial viability.

The first hydrogen Games can embody how we continue to implement similarly clever, sustainable ideas not just in future Olympics but other global tournaments as well. We didn't start the fire, but we must do our best to keep it alite.

This article is the first in a series that will explore how hydrogen uses can be implemented at some of the world's biggest events, with an eye towards how Paris 2024 and Los Angeles 2028 can contribute to creating a roadmap for Brisbane 2032.

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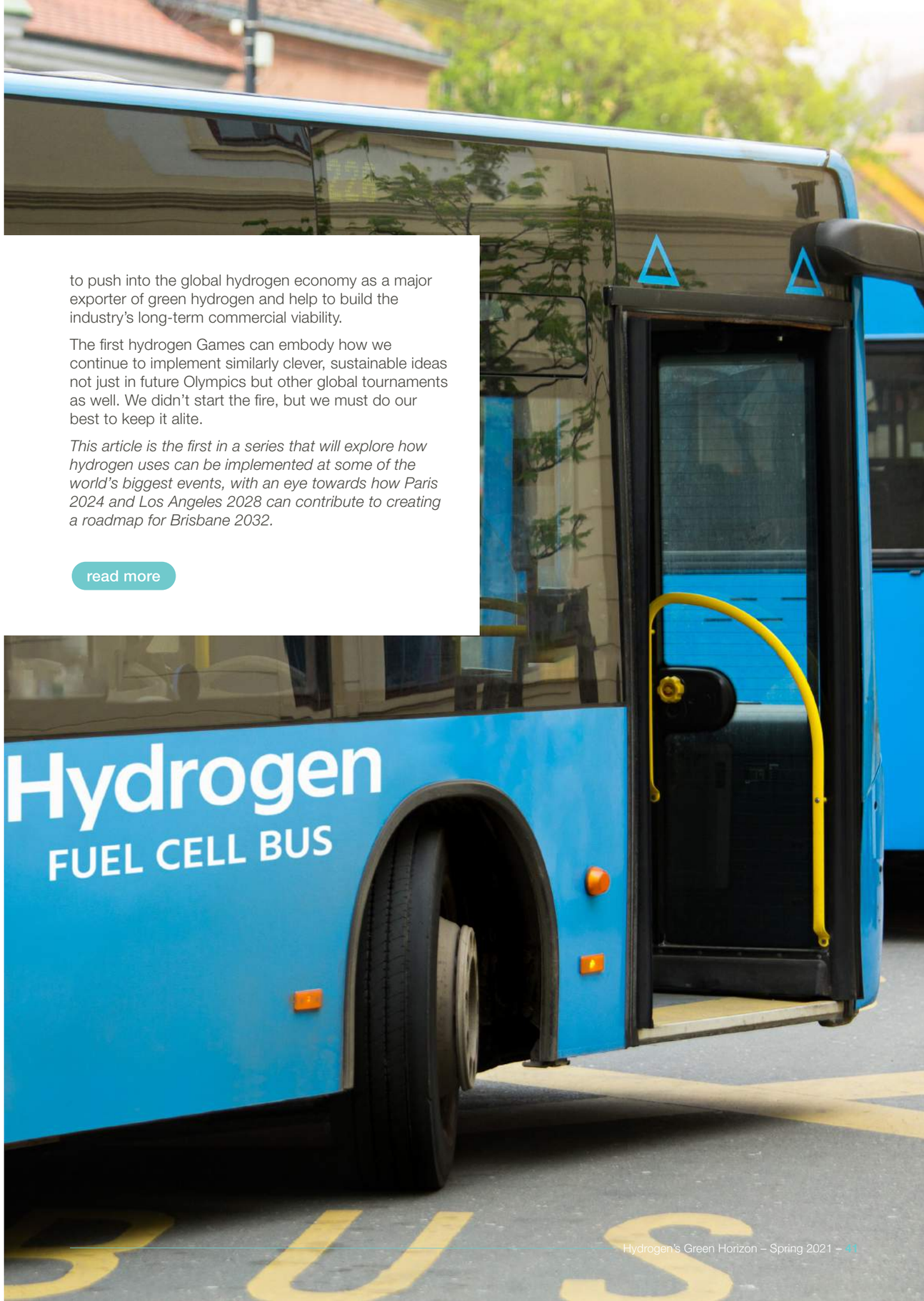


6 https://www.h2-view.com/story/2020-tokyo-olympics-showcasing-hydrogens-potential-to-the-world/
7 https://reneweconomy.com.au/olympic-flame-to-use-renewable-hydrogen-as-tokyo-makes-pitch-for-carbon-free-future/

Bulletin – German Fuelling of Hydrogen Sector Takes Off

Authors:
Matt Baumgurtel and David O'Carroll

First published:
01 June 2021

In Germany, the Government has announced the names of 62 initiatives that will receive €8 billion (over $12.5 billion) in state funding as part of a joint European hydrogen project (Important Projects of Common European Interest Hydrogen), together with up to 22 European partner countries. The funding projects are spread across four main areas: hydrogen production, infrastructure, industrial uses and mobility uses. In addition to the state aid, the projects are expected to trigger an additional €33 billion in private investment.

The announcements coming from the German Government centre around making Germany a world leader in hydrogen technologies and to do this, massive investment in future hydrogen technology across the entire value chain is required.

"We're rethinking mobility in a European and holistic way – from the energy system to engine technologies to filling infrastructure… At present 95 percent of transportation is dependent on fossil fuels. We therefore urgently need more mobility based on renewable energies." - Transportation Minister Andreas Scheuer.

"We want to become number 1 in the world in hydrogen technologies. To do this, we are pooling our strengths in Europe and initiating massive investments in the future technology hydrogen with the first joint European hydrogen project. That secures competitiveness and jobs - in Germany as well as Europe. We are providing more than 8 billion euros in federal and state funds for the 62 German projects selected today and, with the selected projects, cover the entire value chain - from hydrogen generation and transport to industrial applications. We are taking a big step on the way to making our economy climate-neutral." - Federal Minister of Economics Peter Altmaier.

The German example proves that even in a country with relatively poor natural renewable resources in solar and wind and having been hit harder than expected economically by the COVID crisis, there appears to be no shortage of appetite for state aided investment in hydrogen technologies.

Looking closer to home, Australia has the potential to become a superpower in the global supply of hydrogen fuel, due to our world-leading renewable energy capacity and our existing strong networks of infrastructure for gas transport and storage. The cost of solar and wind power has also fallen dramatically in recent years and this trend is likely to continue.

Therefore, it is now time for Australia to push ahead and make crucial investment decisions for large scale hydrogen production. The Government has a key role to play early on in this regard in setting expectations and assisting pilot and demonstration projects. Otherwise, the risk is that we get left behind as other industrial powerhouses around the world power ahead and take advantage of the huge opportunities that can be realised through a large-scale hydrogen sector.

read more

Bulletin – New dawn of green ammonia in the Land of the Rising Sun – will Australia see the light?

Authors:
Veno Panicker and Alice Mason

First published:
28 May 2021

On 6 October 2021, JERA Co Inc and IHI Corporation began small volume utilisation of fuel ammonia at JERA's Hekinan Thermal Power Station.

In Japan, a grant application was made by JERA Co Inc and IHI Corporation to conduct a demonstration project under the New Energy and Industrial Technology Development Organization's "Development of Technologies for Carbon Recycling and Next-Generation Thermal Power Generation / Research, Development and Demonstration of Technologies for Ammonia Co-Firing Thermal Power Generation" program has been accepted (**Project**).

The Project will be the world's first demonstration project in which a large amount of ammonia will be co-fired in a large-scale commercial coal-fired power plant. The Project will support Japan's strategy of converting power capacity to green ammonia fired instead of natural gas or coal.

The Project provides Australia with an opportunity to develop an ammonia export industry.

Ammonia is an efficient and low-cost alternative to transporting and storing hydrogen. Liquifying hydrogen for transport uses up 30% of its contained energy, and then the liquid form needs to be stored at minus 250 degrees Celsius.

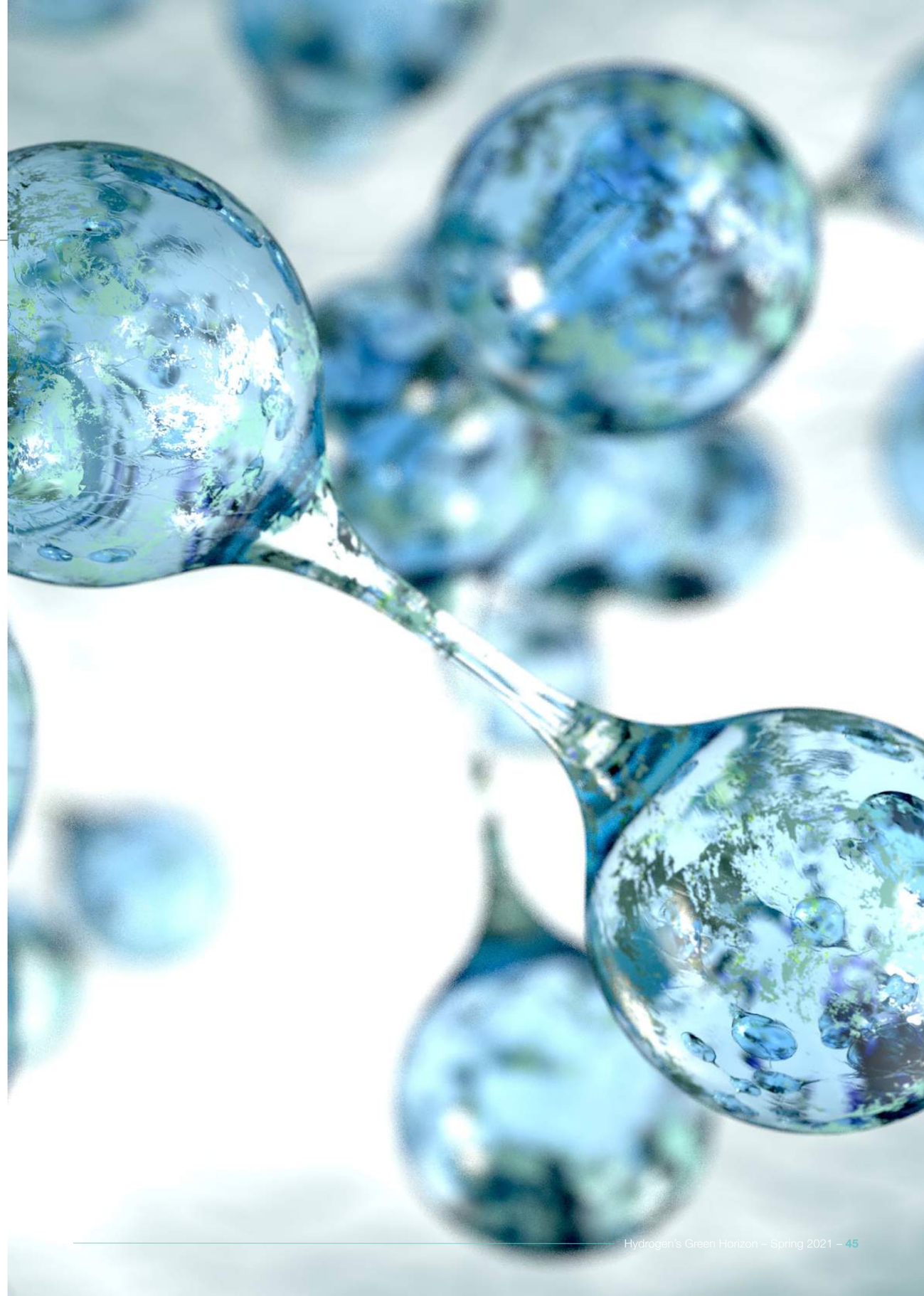
Australia should take this opportunity to use its existing and future hydrogen infrastructure to produce ammonia and export it internationally. This will help place Australia as a major exporter of green hydrogen and help to build the industry's long-term commercial viability.

"If we don't fund green hydrogen projects now, just like solar we will miss the export and innovation boat," says Veno Panicker.

"Hydrogen will enable the international trade in renewable energy the way hydrocarbons are traded today, and thereby become the energy export commodity of the future. This disruption will forever change global energy markets with lasting geopolitical implications. Australia and the entire Asia-Pacific region will be critical players in these developments as both exporters and importers of hydrogen" says Matt Baumgurtel.

To read more about ARENA's recent announcement to fund three commercial-scale hydrogen projects, click here.

read more



New Energy Insights: H2$

Authors:
Matt Baumgurtel and Alice Mason
First published:
27 May 2021

ARENA's Funding Announcement

On 5 May 2021, ARENA announced that it had conditionally approved a total of $103.3 million in funding for three commercial-scale hydrogen projects.

ARENA's funding has increased by $33.3 million from the $70 million planned when the funding round was first announced in 2019.

This allows ARENA's funding to support a third project, rather than two as initially planned. The three successful projects that will be funded, after a competitive round of applications from names that included BHP and Woodside, are:

Amount	Entity	Location	Technology to be funded	Function
$42.5M	**Engie Renewables Australia Pty Ltd** (French-owned)	Karratha, WA	10MW electrolyser	Production of green hydrogen to be used in the production of ammonia for export.
$28.7M	**ATCO Australia Pty Ltd** (Canadian-based)	Warradarge, WA	10MW electrolyser	"Gas blending": This site will produce green hydrogen which will then be blended with natural gas to decarbonise the natural gas network.
$32.1M	**Australian Gas Networks Limited** (a subsidiary of HK-listed Cheung Kong group)	Wodonga, VIC	10MW electrolyser	Similar function to the Warradarge, WA site.

ARENA has declared that these projects would be some of the world's largest hydrogen electrolysers and focus on producing "green hydrogen".

Environmental groups prefer green hydrogen which is made from renewable sources. Blue hydrogen is made from fossil fuels whose small carbon output is managed through abatement strategies.

How does the industry view this announcement?

The funding announcement is being welcomed as a good start in cultivating a more globally competitive hydrogen industry in Australia.

The chief executive of the Australian Hydrogen Council, Fiona Simon, said that the funding was a "boost that the industry needs to progress commercial, large-scale projects".[4]

The Federal Energy Minister, Angus Taylor, hailed the announcement as a "huge step" in establishing Australia as a world leader in the hydrogen industry. He noted that the projects are estimated to create 8000 jobs and $11 billion in GDP by 2050.[5]

It is clear the funding announcement is being hailed as an exciting new opportunity that will help build the industry's long-term commercial viability.

As the hydrogen energy market is an emerging market, there are significant gains to be captured by Australian firms as early entrants. This announcement sends a clear signal to the market that Australia is becoming a viable destination for investment in commercial-scale renewables generation.

However, it must be noted that this is just one announcement. The need remains for greater certainty around energy policy to assist businesses with making investment decisions. A stable regulatory framework will be crucial in attracting long term and more large-scale investment.

The need for significantly greater funding is required if Australia is to have a globally competitive hydrogen industry. There will be an advantage for countries that prioritise this technology early – whether Australia will be part of this and develop a 'big' hydrogen industry that provides local jobs at all stages of the production chain while at the same time contributing to Australia's international emissions reduction commitments will, in significant part, be a function of government support of early large scale projects – as was the case with the Solar Flagships program for large scale solar projects in Australia.

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4 https://www.abc.net.au/news/2021-05-05/100-million-in-federal-grants-for-green-hydrogen/100117192
5 Ibid

"Partner Spotlight – Veno Panicker"

Career highlights

I lead the Construction and Infrastructure capability of the firm with a focus on renewables, real estate and civil projects in Australia. This has been my primary area of practice for almost 20 years. We support head contractors and developers across the major projects life cycle. Whilst my practice is predominantly on the 'back end' assisting with project delivery, early dispute resolution strategies, arbitration and litigation – we also assist with a significant amount of transactional project documentation from tender through contracting.

Throughout my career, there have been a number of renewable projects which have been highlights for me.

My first work in the renewables space was on the AGL Solar Flagships Program, acting for First Solar, on the delivery of the Broken Hill and Nyngan Solar Farm Projects (at the time the largest solar projects in the Southern Hemisphere). My work was primarily in the delivery of those projects – and solar work has since become a major part of my practice.

One of the other great things about working in the renewables space is the international element to the contracts – which means that I've had the privilege of working on cross-border arbitration disputes in the SIAC (Singapore), CEITAC (China), ICC (Paris, London, Geneva), HKIAC (Hong Kong) and BIAC (Lebanon) in matters relating to solar, wind and other energy projects.

Proudest career moment

I'm proud of the strong relationships I've been able to forge in the construction and energy industry. I've been proud to work for and continue to work with exceptional practitioners and mentors. I have been equally as proud to see former team members go on to the bar, academia and success overseas. Many of my closest friends are people I've met through the law – including initially as adversaries. I'm also very proud to be the first Construction and Infrastructure partner to join the firm– I'll be even prouder when we get our second and third!

Journey to becoming a lawyer

I started practice at Minter Ellison in Adelaide as a first year lawyer in 2002. After a few years of commercial litigation and professional indemnity work, I moved into construction litigation in 2006 during a period when the security of payment legislation was in its early stages in New South Wales. Construction and infrastructure have always been at the forefront of the Australian economy and it has and continues to be a privilege to work and develop relationships with clients and colleagues in the industry.

I enjoy many aspects of practising as a lawyer. Firstly, I enjoy being on the tools (no pun intended as a construction lawyer). From the intellectual rigour of preparing an argument to developing strategies and engaging in often difficult negotiations, I enjoy the 'cut and thrust' of the contentious side of the practice. In contrast, it feels like using another part of your brain when involved in negotiating project agreements and bringing parties together.

Secondly, I like the variety of industries I am involved in and the different situations contractors find themselves in – which keeps things interesting and engaging.

Thirdly, I have the privilege of working with leading silks and exceptional technical experts across a variety of primarily engineering disciplines as part of any disputes. The comradery from working through difficult periods and matters with clients and solicitors (including the other side) is also difficult to undervalue.

Da Vinci Development Program

I was delighted to participate in Hamilton Locke's annual Da Vinci program last year, our personal development program where all employees can opt in to participate in an activity to enhance their physical and mental well-being. I started with the firm just over a year ago and for my first Da Vinci program activity, I undertook a program of vinyasa yoga. I've always enjoyed many sports including, cricket (I'm tragic, I named my younger son Sachin after the little master) and Muay Thai – so I saw yoga as a very different challenge well outside my usual training.

Yoga required a lot more core strength and coordination than I had anticipated – and the first couple of months were very awkward. By the end of the program, I looked forward to the hour a week of 'flow' yoga – largely dynamic stretching, providing a complete break from any other distractions. To my surprise, I found it helped my posture and left me exhausted but more relaxed and focussed.

Since completing the Da Vinci program, I switched to a new dojo for Muay Thai which has yoga as part of its training regime.

Why I joined Hamilton Locke

I have worked at firms of all sizes throughout my career, from national and international to working at a boutique firm of two partners for six years prior to joining Hamilton Locke. When I moved back into 'Big Law', I chose Hamilton Locke because of its people and its genuine collaborative culture at the heart of the firm. The firm cultivates a positive and team focussed environment and has made my first year at the firm fly – despite the challenges presented by the second wave of COVID-19. There is an esprit de corps evident across all staff. The culture is infectious and this culture has been a big part of the firm's rapid growth.

Tips for aspiring lawyers seeking partnership

Specialise in an area you're passionate about. It's not enough to know the law, you need a niche or industry where you have a genuine interest– as clients need both.

Always hire the best and brightest – the best candidates are ones that you think will surpass you in the future – any mindset less than this is counterproductive.

It's a journey – the path is not linear, enjoy each step and celebrate your success and the success of others.

The Halo Group mentality

I was excited to join Hamilton Locke but being part of the Halo Group is the icing on the cake. To be a successful challenger brand like Hamilton Locke, the support of Halo Groups allied business and the specialist, complementary services provided by Source, the Fold, Emerson and MacMillan, is critical. Halo Group enables me to provide our clients with a more holistic and commercial suite of services tailored to their needs. Access to our allied businesses within our stable means that we have a natural inclination and ability to get a deeper understanding of a client's needs. When our clients work across different entities within the Halo Group, this is driven by a 'horses for courses' approach that results in working with the right person for any given matter. My observation has been that the culture within each company within the group has that same underlying drive and collaborative energy, resulting in strong synergies across the group.

**This is part of our Partner Spotlight series, profiling each of our partners, their background, expertise and insights. Stay tuned for our upcoming partner profiles.*

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Partner – Head of New Energy

Matt has over 17 years' experience, particularly focused in the energy sector. Matt approaches his work with a one firm, one team philosophy. He strives to deliver creative solutions in all of his representations, providing proactive ways to add value to client's businesses and to help achieve successful outcomes.

Matt's has considerable expertise in project development, construction, financing, joint ventures, and mergers and acquisitions transactions. He specialises in legal advice throughout the energy and infrastructure lifecycle, and acts for investors, developers, and constructors of solar, thermal, wind, hydrogen, electricity transmission, waste to energy and energy storage projects in Australia and the APAC region.

Matt's expertise also includes drafting and negotiating project and finance agreements, EPC and O&M agreements, connection and access agreements, and power purchase agreements. Matt also has extensive experience managing non-recourse project financing, including parallel bank negotiations, due diligence and transaction documentation.

Prior to joining Hamilton Locke, Matt was a partner and co-lead of the energy, infrastructure and resources group at K&L Gates. He was also previously the General Counsel at Fotowatio Renewable Ventures (FRV) for eight years. Prior to this, he worked for a number of leading global and national law firms, including Gilbert + Tobin and Clifford Chance.

About Andrew Smith

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Lawyer - Energy, Infrastructure and Resources

Andrew is a lawyer in the Hamilton Locke Energy Infrastructure and Resources team and specialises in renewable energy projects including wind, solar, energy storage and hydrogen.

Andrew has a passion for navigating complex issues, particularly in the Energy, Infrastructure and Resources space. Andrew thrives on helping clients navigate challenges and achieve commercial successes for businesses. He is fascinated with the positive impact the law can have on businesses and enjoys working collaboratively to accomplish favourable outcomes.

Prior to joining Hamilton Locke, Andrew worked at Ashurst in their Sydney and Dubai office.

About David O'Carroll

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Associate – Energy, Infrastructure and Resources

As an energy, infrastructure and resources specialist, David has a passion for law and looking at problems with a logical and strategic lens, using his extensive knowledge and skills of the market to find positive outcomes for clients. Through his collaborative, perceptive and diligent approach, David strives to provide meaningful counsel to find the best outcome for complex problems.

David has expertise in energy, infrastructure and resources, as well as project development and construction. In particular, David's expertise includes drafting and negotiating project agreements, EPC and O&M agreements, connection agreements and other construction contracts (including D&C and construct only contracts).

Prior to joining Hamilton Locke, David was a lawyer with Arthur Cox in Dublin, as well as with Ashurst in Sydney.

David is admitted in Ireland and not admitted in Australia.