



UNIVERSITY
OF WOLLONGONG
AUSTRALIA

UOW Submission in response to the Inquiry into the development of a hydrogen industry in New South Wales

February 2021

INTRODUCTION

The University of Wollongong (UOW) welcomes the opportunity to provide input in response to the Legislative Council's Standing Committee on State Development's Inquiry into the development of a hydrogen industry in New South Wales (NSW).

UOW is strongly placed to help the NSW government achieve its ambitions of developing a successful hydrogen industry in NSW. It has a strong foundation and is a renowned expert in the research and development (R&D) of clean energy, including hydrogen, has demonstrated commitment to help drive the development of clean energy futures, and long standing relationships with regional industries, councils and the community, and capacity to help the development of future jobs through training. In addition, the geographic location of the University and its surrounding manufacturing industrial base, notably Port Kembla, provide strong competitive advantages to assist in growing this important and rapidly emerging industry.

This Submission broadly addresses the Inquiry Terms of Reference, outlining UOW's R&D expertise in the energy sector, including hydrogen, the competitive advantages and capabilities of the Illawarra region to assist in the development of a hydrogen industry in NSW, and the existing relationships that exist between key organisations of the Illawarra region that would help maximise efforts to effectively grow this industry in the region. The Submission also aims to emphasise UOW's desire to work with the NSW government to help grow the hydrogen industry, capitalising on the opportunity that exists to contribute to NSW and Australia's clean energy goals, and to deliver significant economic, environmental and social benefits.

ABOUT THE UNIVERSITY OF WOLLONGONG

UOW is a leading global university powered by its people, partnerships and communities. Throughout our global network, UOW works together with industry, research partners, governments, communities and other universities to address society's critical economic, environmental, social and medical challenges. Together with our partners we are delivering impact for a better world.

UOW is a global community of learners, researchers, experts and leaders. A benchmark for Australia's new generation of universities, UOW is recognised internationally for the quality of our education, research impact, and industry and community engagement.

A research-intensive university, UOW is an international network of campuses and regional learning centres. In addition to its Australian metropolitan and regional campuses, UOW delivers world-class teaching to students in the United Arab Emirates, Hong Kong, China, Malaysia and Singapore. UOW has formal agreements with more than 400 overseas institutions in 46 countries spanning research collaborations, teaching collaborations, credit arrangements, articulation arrangements, study abroad and exchange programs and offshore program delivery.

As the Australasian member of the University Global Partnership Network (UGPN), UOW's strong international outlook is demonstrated by partnerships with peers and industry, government and community-based organisations across the world.

UOW continues to provide solutions that support emerging businesses and transform existing industries by helping them to adopt advanced technologies and innovative systems. The University is committed to creating environments where entrepreneurship and innovation can thrive so research can be rapidly transferred into commercial products and services.

A dynamic university renowned for being innovative and agile, UOW plays a fundamental role in driving social and economic change in communities across NSW and Australia.

Generating over \$2.5 billion in gross output annually, UOW is leading locally by competing globally. Strategic partnerships between the University, entrepreneurs, industry, business and government are accelerating innovation and our transformative projects are reshaping communities, research, education, healthcare and industries for the future. The University continually works closely with its communities to create a positive future from the new opportunities that will arise during the challenging times ahead. UOW inspires a better future through education, research and partnership.

UOW has also developed the Innovation Campus in Wollongong, which is an education, research and technology precinct. This state of the art facility provides strong linkages between business and research, and complements the University's leading research and innovation institutes.

The award-winning research, innovation and commercial precinct contributes enormously to the Illawarra economy each year, helping to activate new economic activity and regional jobs and enhancing the region's competitive edge in the marketplace.

The precinct is home to a number of UOW's multidisciplinary research institutes, along with a well-established community of innovation companies that are strongly engaged with the University.

- Australian Institute for Innovative Materials (AIIM) - a key national laboratory for medical and energy material to help transform multi-functional materials research into commercial reality. The multi-disciplinary focus of AIIM brings together biologists, clinicians, chemists, physicists engineers and materials scientists. AIIM comprises the following research organisations:
 - The Intelligent Polymer Research Institute
 - The Australian Research Council Centre (ARC) of Excellence for Electromaterials Science (ACES)
 - The Institute for Superconducting and Electronic Materials
 - The University of Wollongong Electron Microscopy Centre
- iAccelerate - an incubator for new business start-ups
- The Australian National Centre for Ocean Resources and Security (ANCORS) - Australia's only multidisciplinary university-based centre dedicated to research, education and training on ocean law, maritime security and natural marine resource management
- Sustainable Buildings Research Centre - a 6 Star Green Star- Education Design v1 accredited, multi-disciplinary facility that hosts a wide range of research and industry collaborations to address the challenges of making buildings sustainable
- Illawarra Health and Medical Research Institute - a joint venture with the Illawarra Shoalhaven Local Health District
- SMART Infrastructure Facility - a key national laboratory for research on infrastructure

In addition UOW, in conjunction with development partner Lendlease, is currently developing the innovative \$500 million Health and Wellbeing Precinct to be built at the Innovation Campus. The Precinct will integrate research and training environments with non-surgical health care and aged-care facilities, delivering significant benefits to the Illawarra community and beyond. Pending final planning approvals, construction of the Precinct is proposed to commence in 2022 and the facilities be fully operational by 2024.

ENERGY RESEARCH AND DEVELOPMENT AT UOW

The UOW has strong established connections to the energy industry. Research and policy development cooperation with energy industry partners combined with economic, environmental and social studies has traditionally been a core UOW activity.

In partnership with other universities, industry and government, UOW is working to find new ways to generate, distribute, store and utilise energy in all sectors of society. UOW is delivering innovative solutions for sustainable energy supply to lessen Australia's reliance on traditional energy sources such as fossil fuels. It has a range of research capabilities and areas of expertise helping to drive research and development in this space.

Australia is transitioning to new energy sources, including renewables, natural gas blends and hydrogen. UOW is uniquely equipped to undertake research and development to support utilities, regulators, equipment suppliers, government and communities.

Energy-related research at UOW includes renewable energy systems and integration, power systems, sustainability, power quality and reliability, battery energy storage systems, and infrastructure modelling and economics. UOW has a range of research capabilities that are developing materials technologies which are delivering lower cost, longer lifecycle and higher energy capacity solutions.

UOW's point of differentiation in its research is that it is energy sector and industry-focused, impacting along the energy supply chain.

Research and development at UOW addresses the issues of decarbonisation of the energy sector through the development of reliable and affordable hydrogen, syngas and biogas supply chains accompanied by economic modelling on the impact of hydrogen on various sectors of the economy.

UOW researchers have also provided significant advances on the engineering and management of pipelines for carbon capture and storage projects. The headquarters of the Energy Pipelines Cooperative Research Centre (CRC) was at UOW for 10 years, as is its current successor, the Future Fuels CRC. This long-term collaboration has led to close engagement with all the natural gas and other energy suppliers in Australia, along with regulators, industry associations and government agencies. The Future Fuels CRC is a leader in research into alternative fuels, including hydrogen. It has also supported the development of internationally renowned modelling and technical infrastructure at UOW covering natural gas and hydrogen related research, and has led to substantial influence over the current national and international standards governing gaseous energy supply and distribution.

UOW is also working closely with the NSW State Government, the Future Fuels CRC, Wollongong City Council (WCC) and Illawarra industries and energy suppliers on a proposed Hydrogen Hub in the region. This initiative means that UOW is very well placed to be a leading R&D provider into the broader hydrogen energy drive within Australia.

Wollongong and Port Kembla, which is also home to BOC, Coregas and NSW's first liquefied natural gas terminal, could become key players in new energy storage sources for transport. UOW's SMART Infrastructure Facility is also looking to develop hydrogen solutions for transport, including trains and buses. The 'Green H2 for Transport' initiative in Port Kembla is getting momentum with the relocation of H2X manufacturer in the port precinct and BOC confirming its intention to build a large electrolyser at their local facility.

A team of researchers from UOW's Institute for Superconducting and Electronic Materials (ISEM), in collaboration with other researchers at Beihang University in China, have fabricated a high-performance electrocatalyst using a low-cost metal that is proving suitable for use in water splitting. ARC ACES research into energy conversion and the formation of hydrogen from water into important fuels, hydrogen and oxygen, has led to the successful formation of an ACES spin-off company, Aquahydrex.

SMART (Simulation, Modelling, Analysis for Research and Teaching), a \$61M initiative at UOW, brings together experts from fields such as rail, infrastructure systems, transport, water, energy, modelling and simulation. It has a strong track record with government and industry in applying sophisticated modelling and analysis to develop cost effective strategies for complex system design and implementation. SMART is funded primarily from Government and Industry contracts. SMART's current research includes providing analysis to give insights to policymakers, network companies, operators, and regulators on how to develop long-term energy plans, make investment decisions, and interact with the National Electricity Market (NEM). This modelling capability allows the rigorous testing and development of how the interaction of economic,

technical, regulatory, policy and operations components will improve Australia's energy system security and cost effectiveness as the system transforms and evolves.

Other specific energy related initiatives

Energy Futures Network

UOW has established a National Energy Futures Network which will approach the energy futures institute concept with a holistic mindset, bringing together the social, economic and technical aspects of the energy future into a cohesive research and development environment.

The Network operates as a forum to share information on energy research initiatives and to facilitate collaboration across faculties. The Network will help lead energy futures research across existing and emerging energy futures programs and engage with external partners, including the NUW Alliance, the Illawarra Hydrogen Hub, State and Federal Government, other research partners and industry.

NUW Energy

The NUW Alliance comprises four leading Australian research-intensive universities, the University of Newcastle, UNSW Sydney, UOW and Western Sydney University. The mission of the NUW Alliance is to seek out the big collaborations that make a difference, collaborations that unlock new value, impact and benefit for our communities across NSW.

Through its involvement in the NUW Alliance, UOW is part of NUW Energy, an Australian first collaboration launched in November 2020 which represents the largest and most compelling Australian research cohort to be addressing current energy issues. Representing a global network of leading industry partners and allied research agencies, NUW Energy enables simple, streamlined and direct access to world-class research expertise, removing the traditional barriers that are inhibiting collaboration between academic, industry and government.

The overarching objectives of the NUW Energy collaboration include the development of:

- Integrated network technology to address future energy demands
- Close cooperation between researchers and industry to ensure NSW is at the forefront of the development of advanced energy solutions
- Opportunity to undertake high-quality research underpinned by the needs of the energy sector that drives global best practice and offers enhanced educational opportunities for industry and students.

WORKING TOWARDS A PORT KEMBLA BASED HYDROGEN CLUSTER

With an increasing number of countries setting targets to achieve net zero emissions by the middle of the century, there is an enormous growing demand for clean energy solutions, and thus significant opportunity for Australia to position itself as a supplier of clean energy for both domestic and international markets.

The International Energy Agency (IEA) identified hydrogen clusters as a way of lowering the cost of low-carbon hydrogen pathways, and noted that the creation of hubs would be an effective springboard to growing a hydrogen economy¹. According to a study by the Council of Australian Governments (COAG) Energy Council Hydrogen Working Group, Australia has the potential to be the world's largest hydrogen producer. In this report, the COAG Energy Council notes its vision is for Australia to be a major player in a global hydrogen industry by 2030.

¹ Australian Hydrogen Hubs Study, COAG Energy Council Hydrogen Working Group, Issue 2, November 2019, <http://www.coagenergycouncil.gov.au/sites/prod.energycouncil/files/publications/documents/nhs-australian-hydrogen-hubs-study-report-2019.pdf>

A key element of the Australian Government's National Hydrogen Strategy² is the development of a port based hydrogen hub that can build scale and capacity by leveraging existing infrastructure to service initially domestic markets, scaling into exports by 2030 as international demand builds and firms up. The port of Port Kembla in the Illawarra is listed as a hydrogen export hub in the Strategy. The Strategy sets a vision for a clean, innovative, safe and competitive hydrogen industry that benefits all Australians.

Furthermore, the recent Technology Investment Roadmap³ articulates the Government's R&D and technology deployment strategy, one that is based around the private (industry) sector and targeted public investment. The Government's first Low Emissions Technology Statement focuses on emerging technologies with the "potential for transformational economic and emissions outcomes" across the entire country. In partnership with industry, investors, researchers, governments and community, the strategy aims to accelerate the development of lower emission and cleaner energy technologies, making them competitive with established technologies.

UOW is working collaboratively with key stakeholders to encourage the development of a hydrogen cluster at Port Kembla in the Illawarra. This initiative provides the Illawarra with the explicit opportunity to be a leading research provider into the larger hydrogen energy drive within Australia. The development of a hydrogen hub in the Illawarra region will not only help this vision of COAG's and the National Hydrogen Strategy, but it would also deliver long lasting economic benefit to both the Illawarra region and NSW through export revenue, new industries and jobs, and supporting the transition to low emissions energy across various sectors.

The Illawarra region is particularly well suited to capitalise on both the use of hydrogen and the development of supporting technologies that will enable the adoption of the hydrogen supply chain. Companies in the region contain a mix of heavy industrial, engineering, technology and services based businesses that support a client base that extends across the region, NSW, Australia and internationally.

UOW and the broader Illawarra has a long history of innovation within the industrial sector, most notably in mineral resources and large-scale manufacturing, including steel. Development of a national hydrogen cluster will provide the opportunity for a number of these businesses to develop new manufacturing processes, their product and service value offering, as part of this new industry and creating new jobs.

The region has already attracted the attention of several significant projects that will provide early-stage opportunities for the adoption of hydrogen and development of a regional industry focusing on supporting the hydrogen supply chain.

Port Kembla is an ideal location for large-scale clean hydrogen production due to the following factors:

- Proximity to Sydney and existing global trade connections through the port of Port Kembla,
- Access to significant quantities of renewable electricity and recycled water
- Access to customers across the industrial, heavy transport, electricity generation, gas network injection sectors in the Illawarra and Sydney, and to the rest of NSW (through rail lines, the Princes Highway and local motorways roads), as well as to export markets such as Japan and Korea (through the internationally-connected port)
- Access to distribution infrastructure including road, rail, the Eastern Gas Pipeline, connecting to 80% of Australia's population and industry
- An industrialised precinct for 24/7 operations
- An existing supply-chain and skills base that could pivot to support large-scale hydrogen production

² Australia's National Hydrogen Strategy, Department of Industry, Science, Energy and Resources, November 2019, <https://www.industry.gov.au/data-and-publications/australias-national-hydrogen-strategy>

³ <https://www.industry.gov.au/sites/default/files/September%202020/document/first-low-emissions-technology-statement-2020.pdf>

- A community that welcomes industry.

In developing NSW's hydrogen industry, it is imperative to consider not only the industrial, environmental and economic elements, but the social aspects, including community understanding and support. UOW's existing, long standing relationships with key stakeholders, including industry and various tiers of government, would be critical to help inform communities about the hydrogen and broader energy industry, and to ensure related projects move forward in a collaborative, community supported way.

SUMMARY

Both State and Federal Governments have set ambitious targets aimed at significantly reducing greenhouse emissions and developed strategies which recognise the benefits of the use of hydrogen in achieving these targets. The NSW Government, through the Department of Regional NSW has recognized the benefits of hydrogen as an emerging major economic opportunity of the state to lead in the global transition to low emission sources of energy.

Australia is transitioning to new energy sources, including renewables, natural gas blends and hydrogen. However, the transition is currently lacking a well-defined strategy and involves complex interactions between vested interests, national markets, sometimes poorly understood technical constraints, and difficulties in understanding what the community benefits of various strategies might be. Additionally, there are many technical challenges to resolve. By not responding to the current opportunities of the growing demand for clean energy, NSW risks missing out on the opportunity to become a leader in the hydrogen market. It is important that NSW act strategically to identify its prioritization of which hydrogen niches has the best chance of being commercially viable.

The development of a hydrogen industry presents great potential for economic, environmental and social benefits to NSW, however it is important that industry, government and universities work together to help drive NSW's hydrogen agenda forward.

UOW is uniquely equipped to undertake R&D in the field, supporting utilities, regulators, equipment suppliers, government and the community. UOW's R&D strengths in the hydrogen space and its strong networks, including its Energy Futures Network and the NUW Energy collaboration, provide enormous resources for the NSW government to draw upon to help identify the best opportunities in the hydrogen industry for NSW. Further, UOW's main campus and its Innovation Campus, are in close proximity to and well connected with important industry and infrastructure that could be utilised to help the development of this industry.

FURTHER INFORMATION

The University would welcome further opportunities to elaborate upon, or further clarify, the matters raised within this submission. **The University would also welcome representatives of the Standing Committee on State Development to visit UOW's Wollongong and Innovation Campus to discuss UOW initiatives relating to hydrogen.** To do so, please do not hesitate to contact the UOW Director, Government Relations (Mr Canio Fierravanti) on Ph - 42215931 or via Email - caniof@uow.edu.au.