

Executive Summary

The Illawarra is ideally positioned for the creation of a Hydrogen Hub for NSW, as part of Australia’s National Hydrogen Strategy. An Illawarra Hydrogen Hub will leverage existing infrastructure for the production and distribution of hydrogen at Port Kembla, initially building and servicing domestic demand whilst delivering export capacity and capability by 2030.

CSIRO has identified fifty-six Australian hydrogen-related projects; of these, only four are currently operating, nine are under construction and 43 are in planning or feasibility stages and may never come to fruition. By comparison, Port Kembla has been at the centre of industry and transport for over a century and **has a 30-year history in the generation of hydrogen**, through the existing Coregas facility.

The Port of Port Kembla is a major gateway to and from Greater Sydney and will be only 60 minutes travel time from the new Western Sydney Airport. The Wilton Growth Area – just 30 minutes from Port Kembla – has a rapidly growing population and need for energy, connectivity and employment.

The proximity of Port Kembla to Sydney allows fast and easy access to the largest transport market in NSW, as well as renewable energy stakeholders, key peak industry bodies and major events - providing a chance to connect, target and convert international investors into partners for NSW and the Illawarra. NUW Energy is already capitalising on this proximity through a collaboration of the best researchers from UNSW Sydney, the University of Wollongong and the University of Newcastle who are exploring our energy future.

The location of a Hydrogen Hub in the Illawarra will **provide immediate opportunity for the use of hydrogen in existing industrial processes; gas injection** to decarbonise the natural gas grid; **transport**, with specific prospects in heavy haulage; and a longer-term opportunity for **export** through the expansion of existing port facilities.

The Illawarra already has the requirements for the further development as a key Hydrogen Hub. **In addition to the existing hydrogen production facility** at Port Kembla, the region has **abundant power infrastructure**; access to sources of **recycled water**; nearby **large-scale consumers**; **distribution network** by road, rail and sea; and **extensive industrial land**. Other advantages of the Illawarra include **significant research and development capability** through the University of Wollongong and other collaborators, planned **manufacturing capability for hydrogen-fuelled vehicles** and significant **human capital**.

Plans are already developed for a regional strategy that will prove capability, build demand for hydrogen as an alternative fuel and increase production capacity, resulting in a low-cost alternative fuel source. The Illawarra Hydrogen Hub will

create a cost-effective supply chain as major hydrogen consumers are already concentrated in one industrial precinct.

A further competitive advantage for this location, which is a state designated Hydrogen Hub, is that the **stakeholders have the 'social license' to progress** to this new stage.

Based on available feedstock Port Kembla in **the Illawarra region of NSW has 5GW or 1,500 tonnes/day of hydrogen capacity.**

The **Illawarra has over \$2.4bn in transformative new investment opportunities** spanning large scale green hydrogen production, power generation, gas pipeline, advanced manufacturing, import and export terminal infrastructure. Delivery of this investment will result in the **creation of over 11,000 regional jobs.**

The current status of development for the Illawarra Hydrogen Hub shows that nearly **70% of the requirements for a successful hydrogen industry already exist** – and remaining requirements can be delivered within three years. This **advanced readiness places the Illawarra at the forefront for selection as a Hydrogen Hub** within the National Hydrogen Strategy.

Regional Development Australia–Illawarra is willing to assist in coordinating and facilitating the creation of a Hydrogen Hub in the Illawarra that will marshal users of hydrogen from industry, transport and energy markets – all of whom are currently co-located in the Illawarra.

Regional Development Australia-Sydney will provide support through its connection to Sydney-based inward investment initiatives and international markets who may not at this stage naturally think of the Illawarra for hydrogen interests.

As Federally funded 'neutral brokers' we will ensure all stakeholders (including Federal agencies) become familiar with the Illawarra region, its skills base, R&D, advanced manufacturing capability and other critical competitive advantages.

1) Size of Economic & Employment Opportunity

(a) Emerging International & Domestic Trends

Australia's National Hydrogen Strategy was published in November 2019 as it became clear that other economies - especially China and Europe - are leading Australia in the adoption of hydrogen. The potential of hydrogen is gaining an increasing profile in the Australian media and at all levels of government, but many States are yet to finalise their own strategies to develop and support the use of hydrogen for domestic use.

International

Commitment to reduce greenhouse emissions in line with the 2015 Paris Accord is driving the demand for alternate energy sources and green manufacturing processes. International interest in hydrogen as an alternative to carbon-based inputs is extensive, with nineteen other hydrogen strategies and roadmaps in place according to the 2019 *National Hydrogen Strategy*. Japan, the Republic of Korea, China, Britain, the European Union and New Zealand all have plans to develop hydrogen-based industries, and more are under development.

Japan has developed a Basic Hydrogen Strategy that estimates their hydrogen procurement requirements at 300 kilo tonnes (kt) by 2030 and more than 10 mega tonnes (Mt) by 2050. China intends to use hydrogen in its transition to distributed-energy systems and decarbonisation of its transport network, whilst the EU proposes the introduction of a carbon border tax on non-EU countries unless they commit to lowering their emissions.

A recent ARENA report (*Opportunities for Australia from Hydrogen Exports*) stated that the current global hydrogen production is relatively stable at 55 million tonnes per year with non-energy uses dominating consumption. Hydrogen used in the production of ammonia accounts for 50% and energy use for only 1-2%.

In that same report, it was highlighted that the competitive advantages for Australia include our proximity to substantial regional markets; well-established energy trading relationships; and our experience in large scale energy infrastructure construction. However, in 2017, the United States was the leading global exporter of hydrogen with trade valued at around \$2,200 million compared to Australia's \$130 million.

The production of hydrogen in Australia is at a stage that it needs to grow exponentially to secure international markets.

Domestic

One of the key features Australia's National Hydrogen Strategy are port-based hubs (or clusters) that can build scale and capacity by leveraging existing

infrastructure. The intent is that the hubs initially service domestic demand and build export capacity and capability by 2030. Domestically, several projects have recently been publicised, including:

- ▶ Western Australia is progressing planning on the Arrowsmith Hydrogen Plant. Under development by Infinite Blue Energy, it is proposed as the first of several similar projects to be built across the State. The Hazer Group is also developing biogas-to-hydrogen production facilities. The Fortescue Metals Group has partnered with ATCO Australia to construct and operate the first combined green hydrogen and refuelling facility in Western Australia.
- ▶ In Tasmania, the Fortescue Metals Group is conducting a study to develop a green ammonia plant in Bell Bay.
- ▶ Victoria has announced that a Japanese-Australian consortium (Kawasaki Heavy Industries, J-Power, Shell Japan and Australia's AGL Energy) are partnering to produce, liquefy and ship hydrogen to Japan. This pilot project will use brown coal to produce hydrogen with a plan for carbon capture to be injected into under-sea basins in Bass Strait.
- ▶ The South Australian Government has backed a \$250 million Eyre Peninsula Gateway Hydrogen Project funded by Mitsubishi through H2U Investments.
- ▶ Queensland's government-owned Stanwell Corporation has formed a consortium with Iwatani Corporation to progress planning on a new renewable hydrogen export facility in Gladstone.

In NSW, several hydrogen initiatives have been announced:

- ▶ Infinite Blue Energy has announced its 'Project Neo' with an initial target of 1GW of reliable baseload power generated using a combination of solar, wind turbines and hydrogen fuel cell technology. The Hunter Region will be the target area for a feasibility study.
- ▶ Jemena's Western Sydney Green Gas Project, a \$15million demonstration project co-funded by Australia Renewable Energy Agency (ARENA) will convert solar and wind power into hydrogen gas that will be stored for use across the Jemena Gas Network (JGN) in New South Wales.
- ▶ H2X Australia has plans to manufacture cars powered by hydrogen and electric technology, creating up to 5,000 jobs in the Illawarra. Timing is contingent on hydrogen refuelling infrastructure being ready to support such vehicles in Australia, especially in major cities. If the market can be supported, H2X plan to start production of the first hydrogen passenger vehicle at Port Kembla by 2022.
- ▶ Steel giant BlueScope has announced that it will invest \$20 million in a new BlueScope Renewable Manufacturing Zone (BRMZ) at Port Kembla in the Illawarra.

Nationally, a consortium of Transit Systems, Ballard Power Systems, BOC Limited, Palisade Investment Partners and ITM Power will further investigate deploying an

initial 100 hydrogen fuel cell electric buses in cities across Australia. In February 2021, NERA announced a \$1.85M investment in 13 hydrogen clusters across all Australian states, the Hunter Hydrogen Technology Cluster, as the only Regional Cluster for NSW, is supported by several local businesses.

CSIROⁱ has identified and monitors progress of 56 hydrogen-based projects in Australia; of these, four are operating, nine are under construction and 43 are in development or feasibility stages and may never come to fruition. However, NSW already has a well-established facility at Port Kembla has been producing hydrogen for over 30 years and is currently the largest facility on the East Coast.

(b) NSW's Existing and Potential Linkages

Pre-existing relationships to international markets strengthen potential for future projects. One example is Australian Industrial Energy (AIE) in the Illawarra was originally formed as a consortium comprising Australia's Squadron Energy, Japan's Marubeni Corporation and Japanese energy giant JERA Co. In October 2020 full ownership passed to Squadron Energy but long-term relationships with partners will strengthen the potential for future projects.

Sydney is the financial markets capital of Australia with renewable energy stakeholders Macquarie Capital, John Laing, Acuris and Marubeni Australasia located in its CBD. It is home to many of the international market's economic arms of key peak industry bodies such as the Australian Hydrogen Council, Engineers Australia, the Australian Institute of Energy and others invested in the hydrogen industry.

In addition, Sydney is also the major event capital for NSW and key events such as the Australian Hydrogen Conference are scheduled to re-commence in the middle of 2021 providing a chance to connect, target and convert international investors into partners for NSW and the Illawarra.

This concentration of essential partners places NSW in a competitive position to attract investment and international project partners.



Figure 1: Port Kembla is well placed to become a key Hydrogen hub due to its location and existing hydrogen production facility.

The Port of Port Kembla is a major gateway to and from Greater Sydney and is only 60 minutes travel time from the new Western Sydney Airport. The Wilton Growth Area – just 30 minutes from Port Kembla – has a rapidly growing population and need for energy, connectivity and employment.

Port Kembla is a NSW Port of Growth, the largest vehicle import location on the East Coast and will become the second largest import/export container Terminal in the next 20 years.

Port Kembla has been at the centre of industry and transport for over a century and has a 30-year history in the generation of hydrogen, through the Coregas facility; for these reasons, Port Kembla is listed as a potential hydrogen hub in the National Hydrogen Strategy. The NSW Government, through the Department of Regional NSW, is facilitating the development of the Port Kembla Hydrogen Hub in a collaboration that includes industry partners, research institutions and RDA Illawarra Board Members. Use of content from Regional NSW's 'H2Hub@PK' prospectus in this submission is acknowledged.

2) Existing Hydrogen capability

(a) Research & Development

NUW Energy is a collaboration of the best researchers from three leading universities - the University of Newcastle, UNSW Sydney and the University of Wollongong, to explore one of the most significant challenges facing Australia – our energy future.

The NUW Energy project is working closely with Government and industry to provide a data and research-driven approach to policy-setting and decision-making, and to create regional economic growth and jobs in the sector.

Star Scientific, a Sydney based company, has signed an MOU with the Philippines' Government to investigate its reliance on fossil fuels for power generation. There is potential to transition to green hydrogen using their Hydrogen Energy Release Optimiser (HERO®) technology. Star Scientific are considering the establishment of a Hydrogen Production Plant in the Hunter Region.

(b) Energy & Industrial Infrastructure

The well-established Coregas facility at Port Kembla has been producing hydrogen for over 30 years and with a capacity of 1000m³/h it is the largest facility on the East Coast. In addition to hydrogen, Coregas also produces oxygen, nitrogen and argon for medical and industrial uses, with one of its largest customers being the adjacent BlueScope steelworks.

Potential uses for hydrogen from the Port Kembla Hydrogen Hub fall into the four categories of:

1. Alternative ('Green' or carbonless) feedstock for industrial processes
 - ▶ Steelmaking
 - ▶ Fertiliser Production
2. Decarbonising the Gas Grid (natural gas injection)
3. Export markets (in bulk)
4. Transport
 - ▶ Heavy Goods Vehicles
 - ▶ Buses
 - ▶ Local fleet transport

Hydrogen is produced from water through electrolysis, and the key requirements for a hydrogen hub are:

- A. Source of cheap (and preferably renewable) power
- B. Water (preferably recycled)
- C. Consumers of sufficient scale (to reduce cost)
- D. Distribution capability
- E. Suitable industrial location.

Why a Hydrogen Hub for the Illawarra?

Based on available feedstock Port Kembla in the Illawarra region of NSW has 5GW or 1,500 tonnes/day of hydrogen capacity.

The Illawarra has over \$2.4bn in transformative new investment opportunities spanning large scale green hydrogen production, power generation, gas pipeline, advanced manufacturing, import and export terminal infrastructure.

Port Kembla's strategic location makes sector coupling possible with road, rail, and pipeline connections to 80% of Australia's population and industry, and existing connections to export markets in South-East Asia.

A competitive advantage for this location, which is a state designated Hydrogen Hub, is that the stakeholders have the 'social license' to progress to this new stage.

The Illawarra, and Port Kembla, have several existing advantages as a Hydrogen Hub in NSW:

- i. **Availability of renewable electricity and recycled water.** The current 132kVA power network provides multiple renewable energy options and 15ML of recycled water is available from two separate sources – Sydney Water and BlueScope Steel - which provides redundancy and reduces risk.
- ii. **Consumers of sufficient scale** are available in transport, industry and gas injection. Port Kembla is served by rail and road and much of the road haulage is short distance; examples being coal from local mines to the port and imported vehicles from the port to destinations in Greater and Western Sydney. Hydrogen-powered heavy goods vehicles could be used for these purposes with a minimal requirement for refuelling infrastructure. There is the capability to inject hydrogen into the Eastern Gas Pipeline at Port Kembla and use blended gas in the existing gas-fired power station at Tallawarra A, and its planned extension Tallawarra B. The NSW Government has set a target of 10% gas injection into the Eastern Gas Pipeline. The Australian Industrial Energy (AIE – owned by Squadron Energy) Import Gas Terminal to be built at Port Kembla makes Port Kembla the optimal location for hydrogen injection into natural gas. The Gas Terminal had its modified planning approval granted in April 2020 and Squadron are expected to announce the start date for construction in 2021. AIE are also proposing an additional gas-fired power station linked to their Gas Terminal project, and this has been shortlisted in the Underwriting New Generation Investment (UNGI) scheme.
Finally, the Wollongong region has several potential large-scale users in manufacturing, processing and steelmaking. Research into the use of hydrogen in steelmaking (to replace the use of coke and blast furnace technology to produce iron) is progressing in Sweden. A joint venture comprising SSAB, LKAB and Vattenfall is developing a pilot project based on Hydrogen Breakthrough Ironmaking Technology (HYBRIT), which could reduce CO2 emissions by 98% when compared to the blast furnace-coke method. Work started on the construction of a pilot plant in 2018 with a goal to have a solution for fossil-free iron by 2035. The technology is yet to be proven at scale and its economics would depend on low-cost renewable electricity or higher penalties for carbon emissions.
- iii. **Distribution Capability** by road, rail and sea. Over 80% of Australia can be reached from Port Kembla within 24 hours using existing road and rail networks and Port Kembla's deep-water port gives access to export markets in South East Asia and beyond. Port Kembla lies on the Eastern Gas Pipeline,

facilitating easy hydrogen injection into the natural gas network.

- iv. **Suitable industrial location.** Port Kembla is a heavy industrial precinct that is already used to produce hydrogen and other gases. Coregas has over 30 years' expertise in the production, storage and distribution of hydrogen.

The region has a skilled labour pool and a jobs deficit of 26,000 and many of these skilled and experienced employees are looking for work closer to where they live.

Against this background of a community that welcomes industry, gaining a social licence to increase hydrogen output should not be difficult.

Other Advantages

The Illawarra Hydrogen Hub is supported by - and will support - manufacturing capability, services and research.

- ▶ H2X Australia has announced it will establish manufacturing facility at Port Kembla to build hydrogen fuel cell vehicles for the commercial industry and mining sectors, before potentially moving on to taxis, vans and passenger cars.
- ▶ BlueScope, the Steel Research Hub, the University of Wollongong (UOW) and partners are collaborating on the use of hydrogen in steelmaking.
- ▶ Transport for NSW (TfNSW) are working with the Department of Regional NSW on hydrogen-powered trains.
- ▶ The UOW has an established research program in Electrolyser Production Technology and the University of NSW is collaborating with Coregas and H2 Store to develop Metal Hydride Hydrogen storage solutions.

Jobs Impact – Illawarra Projects

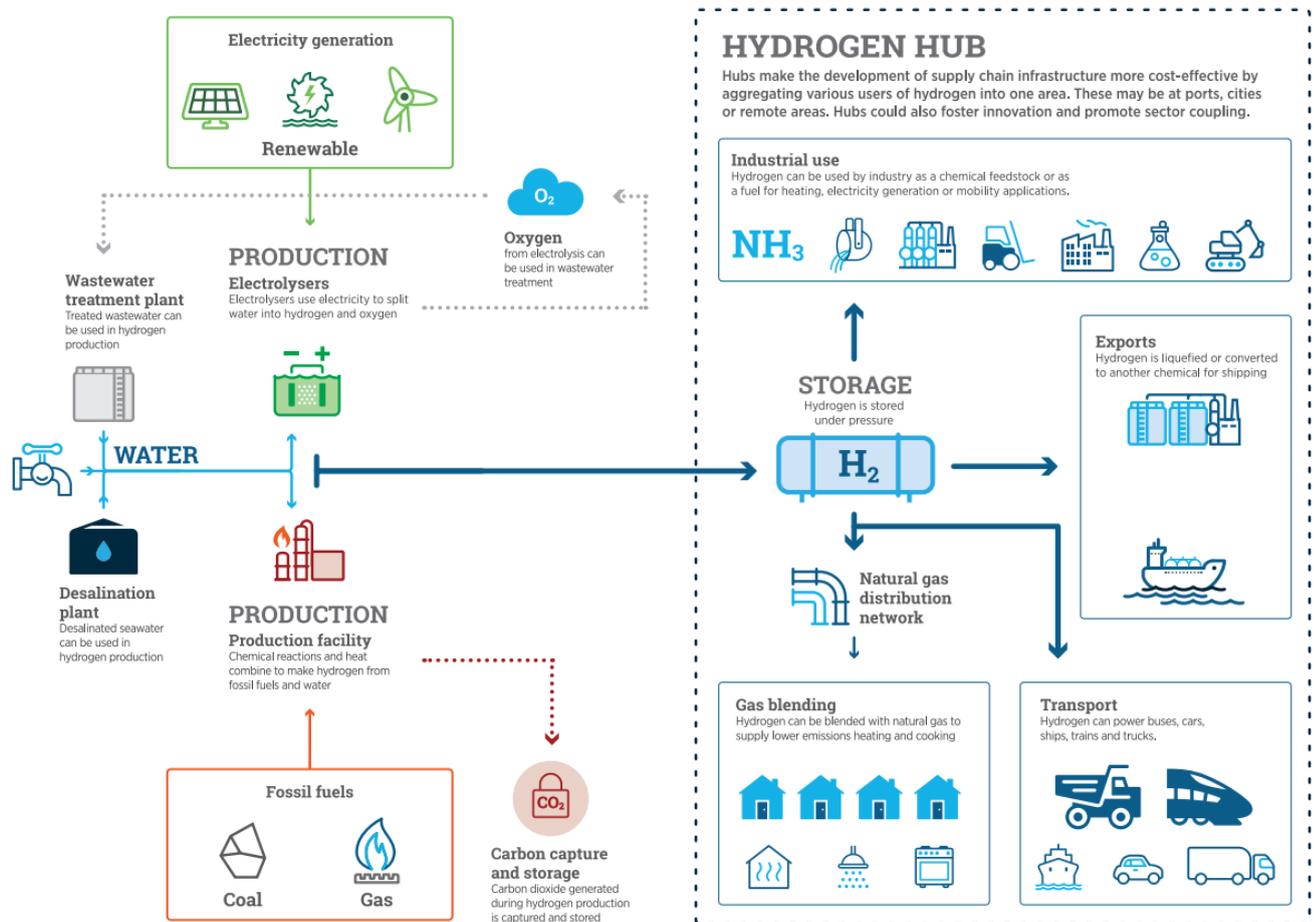
The EY Report 'Australian Renewable Export COVID-19 Recovery Package' released in 2020 estimated that every \$1 million spent on renewable energy and exports creates 4.8 full-time jobs. By comparison, \$1 million on fossil fuel projects has been found to create 1.7 full-time jobs. Based on these estimates the Illawarra Hydrogen Hub Investment of \$2.4bn would generate over 11,000 full time jobs during construction, commissioning and operation.

Project	Est Value (\$M)	Projected Jobs
Additional Green Hydrogen Production	1,000	4,800
Vehicle Maunufacture	600	2,800
Hydrogen Export from Port Kembla	300	1,400
Power Generation Increase	300	1,400
Gas Pipeline Enhancements	200	900
TOTALS	2,400	11,300

3) Capacity and Barriers

NSW has the capacity to become a major production, storage and export hub, with existing hydrogen-producing infrastructure at Port Kembla a key to the growth of a hydrogen-based industry in the State.

Establishment of an Illawarra Hydrogen Hub will fulfill a key element of the National Hydrogen Strategy by leveraging existing port infrastructure to develop domestic market demand and creating a scaleable export capability. It also creates a cost-effective supply chain as all hydrogen consumers are already concentrated in one industrial precinct.



Source: Commonwealth of Australia *Australia's National Hydrogen Strategy*

Immediate priorities for the Illawarra Hydrogen Hub are to further develop and commercialise hydrogen technologies:

Prove Capability. Build at least two hydrogen-fuelled prime movers to deliver heavy goods (coal, vehicles, gases) between Port Kembla and Greater/Western Sydney. This will allow establishment of refuelling infrastructure at point of departure and points of delivery.

Build Demand. Increase the number of hydrogen-fuelled heavy goods or transport vehicles, with Coregas having sufficient existing capacity for 50-60 HGV

and buses. Creation of a refuelling network in the Illawarra, Sydney and Newcastle could provide sufficient momentum for H2X to begin local hydrogen-fuelled vehicle manufacture at Port Kembla in 2022.

Increase Capacity. Build a larger electrolyser (>10MW) and increase capacity to 150+ HGVs and transport vehicles. Begin low level gas injection and industrial use, build scale for export.

Status of Current Capability

Current status of the Illawarra Hydrogen Hub:

Requirement	Existing	Short Term (1-3 yrs)	Long Term (4-10 yrs)
100% renewable energy	○	✓	
Recycled water	✓		
Hydrogen electrolyser	✓		
Hydrogen storage	✓		
Industrial use of hydrogen		✓	
Gas Blending		✓	
Exports			✓
Distribution Network	✓		
Industrial Land	✓		
Manufacturing & Support Services	✓		
Research & Development Capability	✓		
Managing safety of hydrogen utilisation	✓		
Human Capital (production, use, R&D)	✓		

Other Barriers

A growth and commercialisation strategy is ready for immediate implementation, using existing infrastructure. The barriers to the establishment of an Illawarra Hydrogen Hub are considered to include:

- ▶ No clear and consistent emissions reduction strategy from government
- ▶ Australian Design Rules for HGVs reducing availability and increasing cost of hydrogen vehicles (different width requirements from vehicles built overseas mean that each vehicle is custom-made for Australian use)
- ▶ Availability and cost of hydrogen fuel
- ▶ Size of the Australian market for hydrogen technology
- ▶ Uncertainty about uptake timelines (e.g. blended gas)
- ▶ Public education about the benefits of hydrogen and alternative fuels
- ▶ Success in using hydrogen for short-distance, heavy haulage transport will create the capability and refuelling network for other transport options, though heavy haulage and volume passenger transport (bus fleets) will remain the most viable opportunities until the price of green hydrogen is reduced to below \$2 per kilogram

- ▶ The cost of green energy and electrolyser capacity are considered the major barriers to achieving to goal of 'H2 under \$2'.

RDA Illawarra is ready and willing to collaborate with other stakeholders to address the barriers to the development of an Illawarra Hydrogen Hub and create an industry that will deliver regional growth and a more diverse industrial base.

Summary

The Illawarra is at the forefront of hydrogen generation in Australia, having a well-established hydrogen production facility at Port Kembla, supported by local skills and expertise in safe operation as well as R&D through the University of Wollongong. The Illawarra is also perfectly positioned to utilise increased volumes of hydrogen in other existing applications including natural gas injection, industrial feedstock, and heavy haulage.

Regional Development Australia–Illawarra is willing to assist in coordinating and facilitating the creation of a Hydrogen Hub in the Illawarra that will marshal users of hydrogen from industry, transport and energy markets – all of whom are currently co-located in the Illawarra.

Regional Development Australia (RDA) Sydney will provide support through its connection to Sydney-based inward investment initiatives and international markets who may not at this stage naturally think of the Illawarra for hydrogen interests. As Federally funded 'neutral brokers' we will ensure all stakeholders (including Federal agencies) become familiar with the Illawarra region, its skills base, R&D, advanced manufacturing capability and other critical competitive advantages.

The objective is to create a dynamic Hydrogen Hub that is scalable and will build demand and volume in a staged, strategic manner. The creation of an effective and functioning Hydrogen Hub requires coordination and facilitation of a complex network of local, State and Federal stakeholders, and it is this value that RDA Illawarra and Sydney are ideally positioned to deliver.



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ⁱ CSIRO HyResource web page accessed at www.research.csiro.au/hyresource/projects/facilities on 22 February 2021