



Department of
Jobs, Tourism, Science
and Innovation

Western Australian Renewable Hydrogen Roadmap

November 2020

A large, stylized graphic of the chemical formula H₂. The 'H' is rendered in a light blue color, and the '2' is in a light purple color. Both are outlined with a glowing effect. The graphic is positioned in the lower right quadrant of the page and has a faint reflection below it.

Contents

Minister’s foreword	3
Renewable Hydrogen Industry in Western Australia	4
Building on Western Australia’s natural advantages.....	5
Western Australia’s hydrogen projects.....	6
The Western Australian Renewable Hydrogen Strategy	7
Strategic focus areas and goals.....	8
Progress to date	9
Renewable Hydrogen Fund	10
Action plan	11
Export	13
Remote applications.....	14
Hydrogen blending in natural gas networks	15
Transport.....	16
Western Australia’s renewable hydrogen timeline	17
Vision	17
Mission	17
Renewable hydrogen links	18
Western Australia	18
National	18



Minister's foreword

Western Australia has an extraordinary opportunity to become a leader in the emerging renewable hydrogen industry.

As the world moves to a decarbonised future, a key challenge is to ensure the resilience of our state and its industries by transitioning and diversifying our economy using cleaner fuel sources.

In 2019, as a part of the drive for innovation and economic diversification, the Western Australian Government released the Western Australian Renewable Hydrogen Strategy. The aim of the strategy is to support industry efforts to grow the emerging renewable hydrogen industry in practical and strategic ways.

The Western Australian Renewable Hydrogen Roadmap is the next step in this government's commitment to supporting this emerging industry.

Hydrogen provides a means to harness our world-class solar and wind resources for energy export, and help our international partners meet emissions reduction goals.

It will aid our domestic industry transition to a low carbon future and improve the competitiveness of projects through the availability of cheaper energy. It also provides an opportunity to reduce our reliance on imported fossil fuels for remote areas, especially the state's resources sector.

To support development, we need to build both our domestic hydrogen market and our skill base. We must act now to build on our existing skills and capitalise on this opportunity for Western Australia's economy, supporting regional jobs and growth.

We want Western Australia to have a significant stake in this bold new industry that will help build a sustainable economy.

A handwritten signature in black ink that reads "Alannah MacTiernan". The signature is fluid and cursive, with a large loop at the end of the last name.

Hon Alannah MacTiernan MLC

Minister Assisting the Minister for State Development, Jobs & Trade

Renewable Hydrogen Industry in Western Australia

The Department of Jobs, Tourism, Science and Innovation is leading the Western Australian Government's work to develop a renewable hydrogen industry in Western Australia.

Hydrogen first presented as a credible alternative energy source in the early 1970s, but wasn't competitive at the time against lower cost fossil fuels. With the world now placing greater value on a low-emissions future, demand for clean energy sources is increasing. Hydrogen produced from renewable energy (renewable hydrogen) has significant potential to be part of this new landscape for transport, feedstock and clean energy.

Renewable hydrogen is an emerging technology that will play an important part in Western Australia's energy future. Western Australia has many attributes that provide a strong comparative advantage in the growing global renewable hydrogen market including world-class renewable energy resources, a large unpopulated land-mass, established energy infrastructure and strong trading partnerships with Asia.



Building on Western Australia's natural advantages

Western Australia is one of the best places in the world for a renewable hydrogen industry. We have an exceptional competitive advantage for the production, use and export of renewable hydrogen.

We have vast areas of land – at 2.5 million km² our state is equivalent to the size of the whole of Western Europe.

Western Australia boasts excellent solar and wind resources, and well established infrastructure connections including world-class ports.

The Pilbara region, in the north west of our state, enjoys solar irradiance of 2350 kilowatt hours per square metre per year, and our Mid West region sees wind capacity factors of up to 50 per cent - some of the highest in the world. Some locations have excellent wind and solar resources combined.

In addition, we have a long and proud history of exporting our energy to international markets and proximity to key Asian trading partners.

Western Australia is the second largest exporter of LNG in the world, with the state's total export capacity exceeding 40 million tonnes per year. This gives us a significant LNG export industry with transferable skills and capability as well as strong established supply chains.

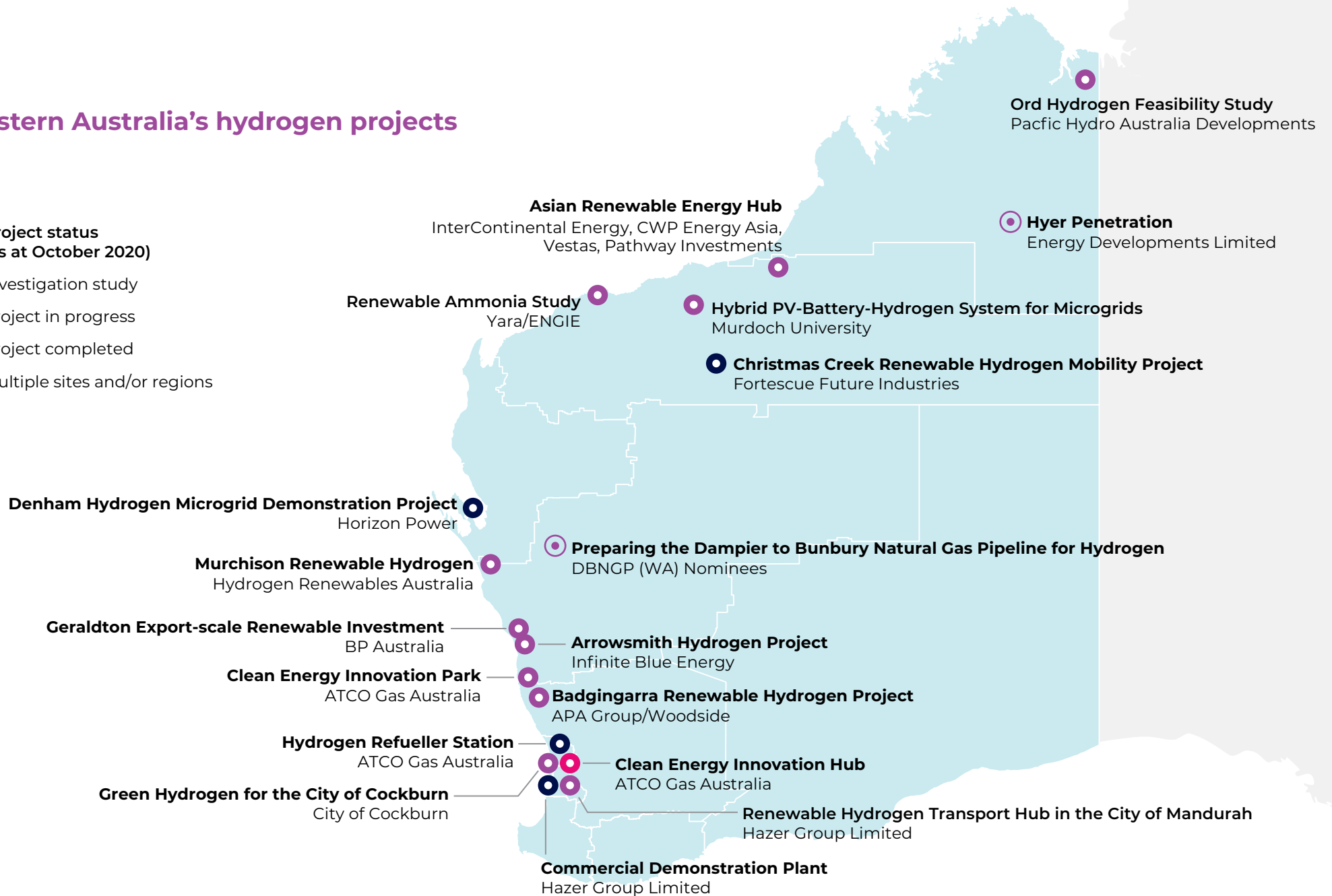
For Western Australia, the export of renewable hydrogen represents an exciting new industry that can build on, and leverage off, our existing LNG sector and skilled workforce.



Western Australia's hydrogen projects

**Project status
(as at October 2020)**

- Investigation study
- Project in progress
- Project completed
- Multiple sites and/or regions



The Western Australian Renewable Hydrogen Strategy

The Western Australian Renewable Hydrogen Strategy was launched by the Minister for Regional Development, the Hon Alannah MacTiernan MLC, in July 2019. The strategy sets out the WA Government's strategic areas of focus for the development of the industry in Western Australia.

The strategy aims to harness Western Australia's comparative advantages which include world-class renewable energy

resources, vast land mass and proud history of exporting energy to international markets. The strategy will drive Western Australia's position as a major producer and exporter of renewable hydrogen.

The strategy details the WA Government's commitment to support and facilitate industry efforts to develop a renewable hydrogen industry in Western Australia.

Vision

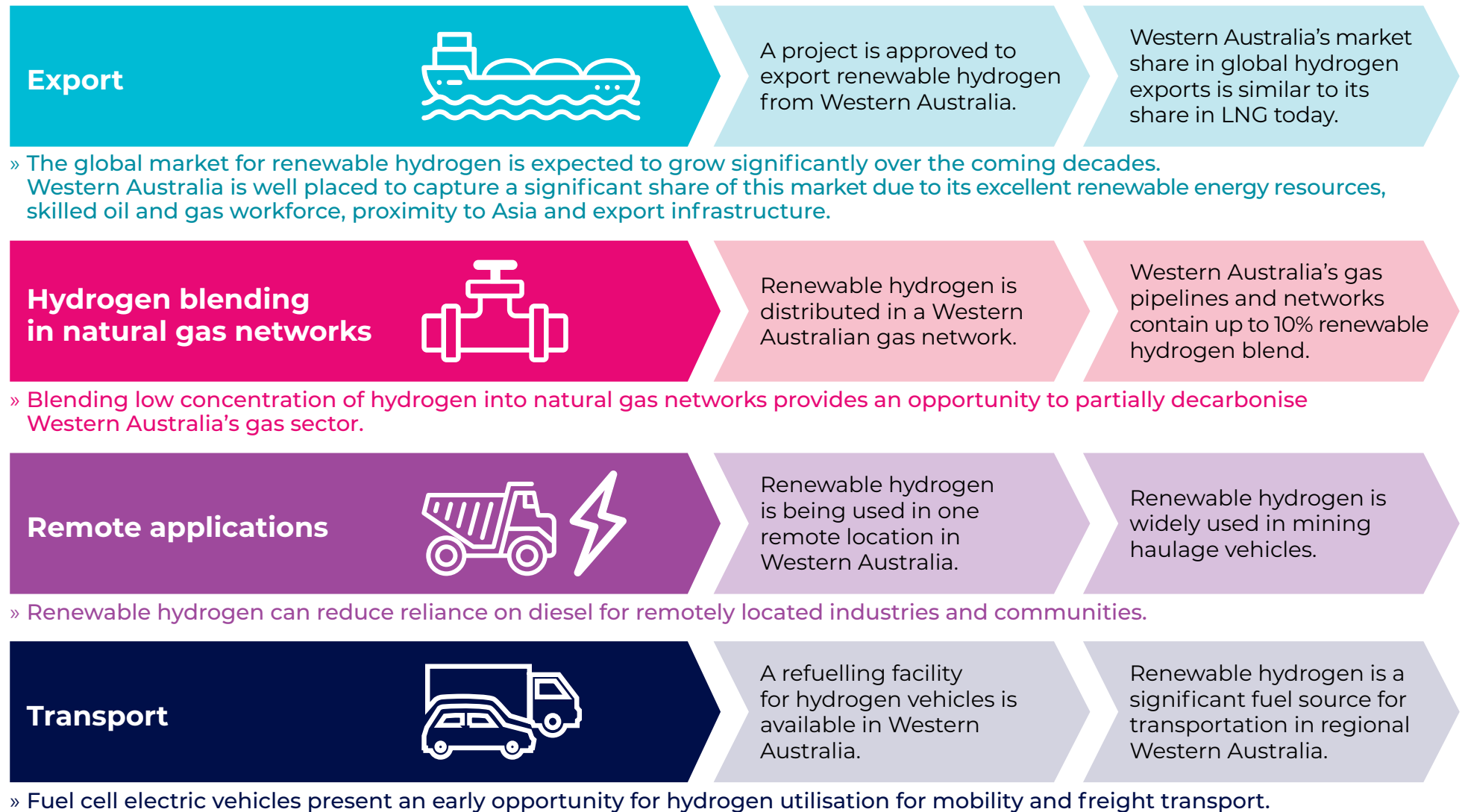
Western Australia will be a significant producer, exporter and user of renewable hydrogen.

Mission

Western Australia will develop industry and markets to be a major exporter of renewable hydrogen. To enable the export of renewable hydrogen, Western Australia will develop domestic production capabilities and applications of renewable hydrogen, thereby improving the state's hydrogen industry expertise, contributing to global decarbonisation and decarbonising Western Australia's economy. It will also contribute to improving air quality across the state.



Strategic focus areas and goals



Progress to date

The Western Australian Government is actively supporting the industry efforts to accelerate the development of the emerging renewable hydrogen industry in Western Australia.

The WA Government's actions and investments in partnerships, seed funding and fit-for-purpose regulatory support, as well as efficient approval processes, is assisting the hydrogen industry to overcome economic, regulatory and technical challenges.

This industry will help diversify the economy, support regional development and create new, long-term jobs.

The WA Government is supporting industry efforts to accelerate the growth of a renewable hydrogen industry.

Western Australian Renewable Hydrogen Fund

Implementation of the WA Government's Renewable Hydrogen Fund is helping to facilitate private sector investment and leverage financial support to the renewable hydrogen industry. (see page 10)

Renewable Hydrogen Unit

The Department of Jobs, Tourism, Science and Innovation, through its new Renewable Hydrogen Unit, is leading the WA Government's work on growing the industry, both domestically and for export. The unit is now a central point of contact for industry and is coordinating activities across relevant WA Government agencies to embed the strategy's vision.

Regulations and standards

The WA Government is working closely with the Australian Government and relevant bodies to support regulatory reform that will enable growth of the renewable hydrogen industry, while ensuring strong safety and consumer protections. Work around certification of origin processes and potential for incentive programs is being undertaken.

Building relationships

The WA Government is engaging with industry, governments and research bodies to support and facilitate the development of the industry, nationally and internationally.



Renewable Hydrogen Fund

The WA Government's initial \$10 million Renewable Hydrogen Fund will drive a new job-creating industry harnessing the state's renewable resources.

1. Ord Hydrogen Feasibility Study

Feasibility study for hydrogen production facility near Kununurra utilising existing hydro generation.

Applicant: Pacific Hydro Australia Developments
Grant amount: \$370,000

2. Hyer Penetration

Feasibility study for the integration of renewable hydrogen production with isolated power stations.

Applicant: Energy Developments Limited
Grant amount: \$370,000

3. Hybrid PV-Battery-Hydrogen System for Microgrids

Feasibility study for 100% renewable energy standalone power system for an indigenous community in the Pilbara.

Applicant: Murdoch University
Grant amount: \$75,000

4. Christmas Creek Renewable Hydrogen Mobility Project

This project will develop and deploy onsite renewable hydrogen generation (via electrolysis) and refuelling infrastructure to support a fleet of fuel cell coaches at Fortescue's Christmas Creek mine.

Applicant: Fortescue Future Industries
Grant amount: \$2 million

5. Denham Hydrogen Microgrid Demonstration Project

This pilot project will test and demonstrate the suitability of hydrogen generation in Horizon Power's systems, before executing a full renewable system.

Applicant: Horizon Power
Grant amount: \$1 million

6. Preparing the Dampier to Bunbury Natural Gas Pipeline for Hydrogen

Feasibility study examining the compatibility of the transmission pipeline with blended hydrogen.

Applicant: DBNGP (WA) Nominees
Grant amount: \$216,000

7. Clean Energy Innovation Park

Feasibility study for a 10 MW electrolysis hydrogen production plant.

Applicant: ATCO Gas Australia
Grant amount: \$375,000

8. Green Hydrogen for the City of Cockburn

Feasibility study for solar hydrogen production for waste collection and light vehicle fleets.

Applicant: City of Cockburn
Grant amount: \$149,000

9. Hydrogen Refueller Station

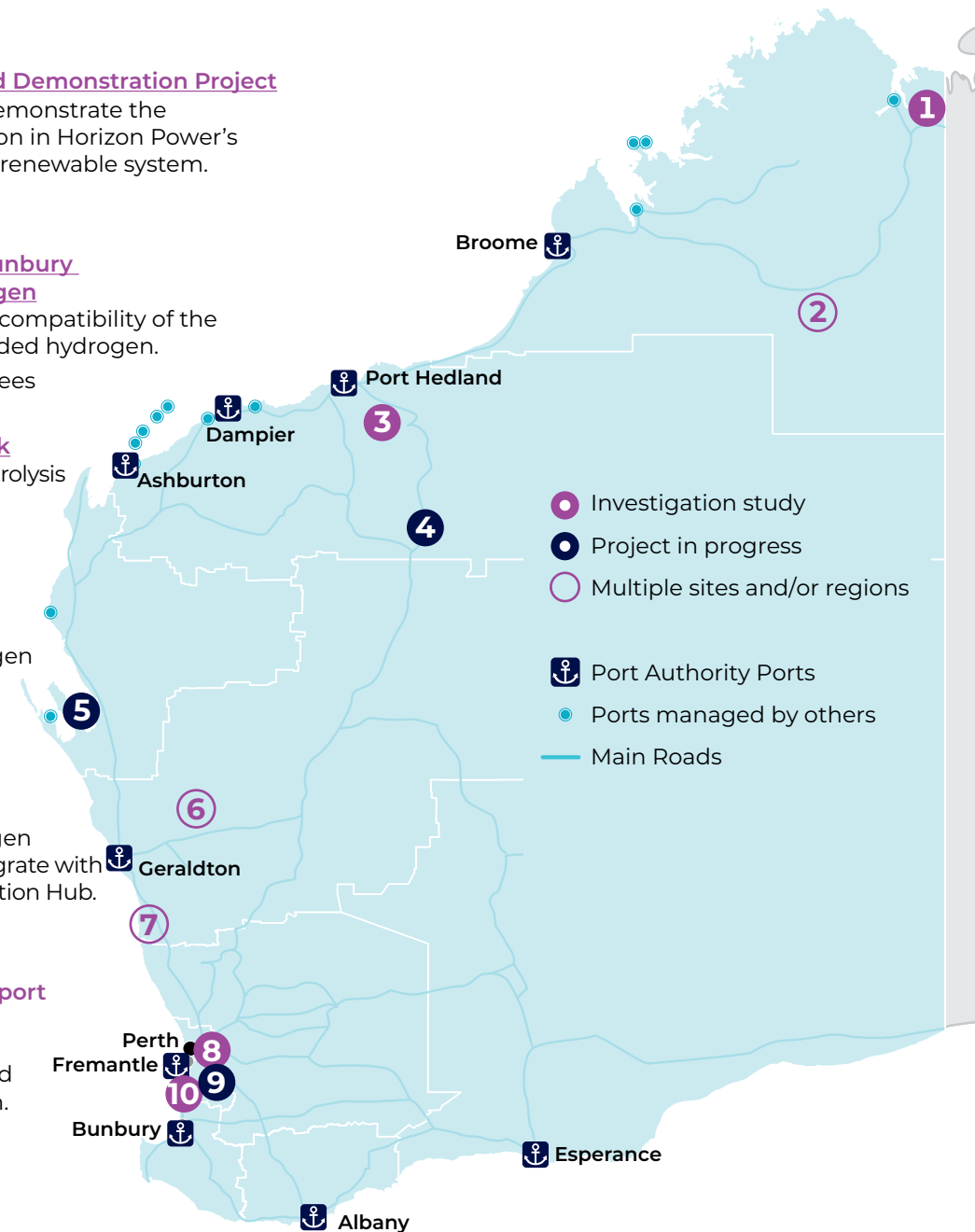
This project will deliver a hydrogen refuelling station in Perth to integrate with the existing Clean Energy Innovation Hub.

Applicant: ATCO Gas Australia
Grant amount: \$1 million

10. Renewable Hydrogen Transport Hub in the City of Mandurah

Feasibility study for a hydrogen refuelling infrastructure hub and associated transport application.

Applicant: Hazer Group Limited
Grant amount: \$250,000



Action plan

The WA Government's action plan outlines how the goals of the strategy will be delivered, via key projects and activities across the strategic focus areas of export, hydrogen blending in natural gas networks, remote applications and transport (see pages 12 to 15).

In addition, the Department of Jobs, Tourism, Science and Innovation's Renewable Hydrogen Unit is working across government and the private sector to ensure the state's policy and legislative framework supports rapid growth of this sector. This work includes the following initiatives.

Project facilitation services for hydrogen projects

The WA Government is providing project facilitation services for major renewable projects, assisting them to navigate government regulation and requirements.

Renewable Hydrogen International Engagement Strategy

The development and implementation of a renewable hydrogen trade and investment attraction strategy to promote



the opportunities in Western Australia for hydrogen exports, technologies, and research and development.

Renewable Hydrogen Fund 2.0

The WA Government will provide \$5 million for a second round of grant funding to support Western Australia's renewable hydrogen industry.

Renewable hydrogen supply chain modelling

The development of a renewable hydrogen supply chain model will allow

Western Australia to promote its renewable hydrogen capabilities, and identifies bottlenecks and limitations affecting the renewable hydrogen export industry.

Legal framework review

Aligned with the National Hydrogen Strategy, the WA Government is reviewing relevant existing legislation, regulations, and standards affecting the hydrogen industry in Western Australia to reduce barriers for this emerging industry.

Building a hydrogen ready workforce

Aligned with the work of the National Hydrogen Strategy, the WA Government is identifying and enabling training pathways to support the development of Western Australia's renewable hydrogen industry.

Oakajee Strategic Industrial Area call for expressions of interest

The Mid West region provides high solar and wind resources, and is ideally placed to support a large scale hydrogen industry. In September 2020, the [Oakajee Strategic Industrial Area call for](#)

[expressions of interest](#) was launched. The EOI sought interest from organisations across the world to identify the infrastructure requirements and operational frameworks to activate Oakajee as a premium location for renewable hydrogen projects.

Renewable Hydrogen Storage Project – Modelling of storage potential of depleted gas and oil fields

This project will assess the geological underground hydrogen storage options in Western Australia and undertake 3D static

and dynamic modelling of the state's depleted oil and gas fields to estimate their storage capacities.

Study of carbon reduction potential of renewable hydrogen

This project will analyse the carbon reduction potential of key elements and actions underpinning the Renewable Hydrogen Strategy to inform decision making and identify contribution to the WA Government's aspiration of net zero emissions by 2050.





Export

Hydrogen export infrastructure gap analysis

This project will review existing export infrastructure and identify infrastructure requirements to enable the export of renewable hydrogen from Western Australia. Results of

this infrastructure assessment will assist informing the WA government's investment decisions.

Support hydrogen projects linked to critical minerals

Western Australia has some of the world's best renewable resources, in addition to mineral reserves. There are few locations in the world where this combination of resources is co-located. The WA Government is supporting efforts to achieve a commercial project in Western

Australia that combines renewable hydrogen production or consumption and is linked through either production or consumption of a critical mineral or high value by-product.

Development of a hydrogen hub at the LNG Futures Facility

Supported by the WA Government, renewable hydrogen research conducted by the [Future Energy Exports Cooperative Research Centre](#) (FEnEx CRC) will help Western Australia, and Australia become a leading global hydrogen exporter.

2022 goal

A project is approved to export renewable hydrogen from Western Australia.

2030 goal

Western Australia's market share in global hydrogen exports is similar to its share in LNG today.





Remote applications

Hydrogen Penetration

This feasibility study investigates the integration of hydrogen production and renewables within thermal power stations servicing islanded grids in remote Western Australia. The staged approach initially focuses on hydrogen production, with hydrogen utilisation

displacing diesel in the existing assets. This feasibility study is a successful recipient from the Western Australian Renewable Hydrogen Fund.

Hybrid PV-Battery-Hydrogen System for Microgrids Feasibility Study

This feasibility study will identify the techno-economic viability of a hydrogen-based renewable energy storage system which leads to an investment decision for pilot project implementation. The project can be replicated in the transition towards 100% renewable energy-based standalone systems as

well as to increase Western Australia's market share in global hydrogen exports. This feasibility study is a successful recipient from the Western Australian Renewable Hydrogen Fund.

Ord Hydrogen Feasibility Study

The objective of this feasibility study is to develop a concept for renewable hydrogen utilising low cost, high availability, displaceable renewable generation from the operating Ord hydro facility. This feasibility study is a successful recipient from the Western Australian Renewable Hydrogen Fund.



2022 goal

Renewable hydrogen is being used in one remote location in Western Australia.

2030 goal

Renewable hydrogen is widely used in mining haulage vehicles.

Denham Hydrogen Microgrid Demonstration Project

This pilot project is to test and demonstrate the suitability of hydrogen generation in Horizon Power's systems, prior to executing a full renewable system with hydrogen providing the core firming capacity. This project is a successful recipient from the Western Australian Renewable Hydrogen Fund.



Hydrogen blending in natural gas networks

Gas Blending Study

This study will analyse the technical, safety, economic and regulatory aspects of hydrogen and gas blending trials in Western Australia. This study will identify

the amendments required to the existing regulations to support renewable hydrogen blending.

Preparing the Dampier to Bunbury Natural Gas Pipeline for Hydrogen Feasibility Study

The Dampier to Bunbury Natural Gas Pipeline (DBNGP) is Western Australia's most significant gas transmission asset and provides natural gas to regional and metropolitan Western Australia. This study will investigate the compatibility of the DBNGP with blended renewable

hydrogen in order to assess the asset's readiness for Western Australia's emerging renewable hydrogen industry. This feasibility study is a successful recipient from the Western Australian Renewable Hydrogen Fund.

National Gas Review and Western Australia's adoption

This project will look at how the application of the National Gas Law (NGL) and National Gas Rules (NGR), enacted through the National Gas Access (WA) Act 2009 and other relevant laws, could be amended to achieve gas blending goals.

2022 goal

Renewable hydrogen is distributed in a Western Australian gas network

2030 goal

Western Australia's gas pipelines and networks contain up to 10% renewable hydrogen blend





Transport

Hydrogen Refueller Station

This project involves the construction and commissioning of a hydrogen refuelling station in the Perth metropolitan region. This project is a successful recipient from the Western Australian Renewable Hydrogen Fund.

Christmas Creek Renewable Hydrogen Mobility Project

This project will develop and deploy onsite renewable hydrogen generation (via electrolysis) and refuelling infrastructure to support a fleet of fuel cell coaches at a mine site. This project is a successful recipient from the Western Australian Renewable Hydrogen Fund.

Clean Energy Innovation Park Feasibility Study

This feasibility study aims to accelerate commercial readiness of a renewable hydrogen production system that establishes green energy production and

storage, test the limits of 'at-scale' plant operations, and improve access to green hydrogen for industrial use and refuelling infrastructure. This feasibility study is a successful recipient from the Western Australian Renewable Hydrogen Fund.

Renewable Hydrogen Transport Hub in the City of Mandurah Feasibility Study

This feasibility study will investigate the development of a hydrogen refuelling infrastructure hub and associated transport applications in the City of Mandurah and the region, focussing on identifying specific, implementable solutions capable of immediate deployment. This feasibility study is a successful recipient from the Western Australian Renewable Hydrogen Fund.

Green Hydrogen for the City of Cockburn

The feasibility study will investigate the green hydrogen supply chain including production, transport and end use options. The hydrogen produced could then be used for vehicle refuelling and/or be transported to points of use within the City of Cockburn. This feasibility study is a successful recipient from the Western Australian Renewable Hydrogen Fund.

2022 goal

A refuelling facility for hydrogen vehicles is available in Western Australia

2030 goal

Renewable hydrogen is a significant fuel source for transportation in regional Western Australia

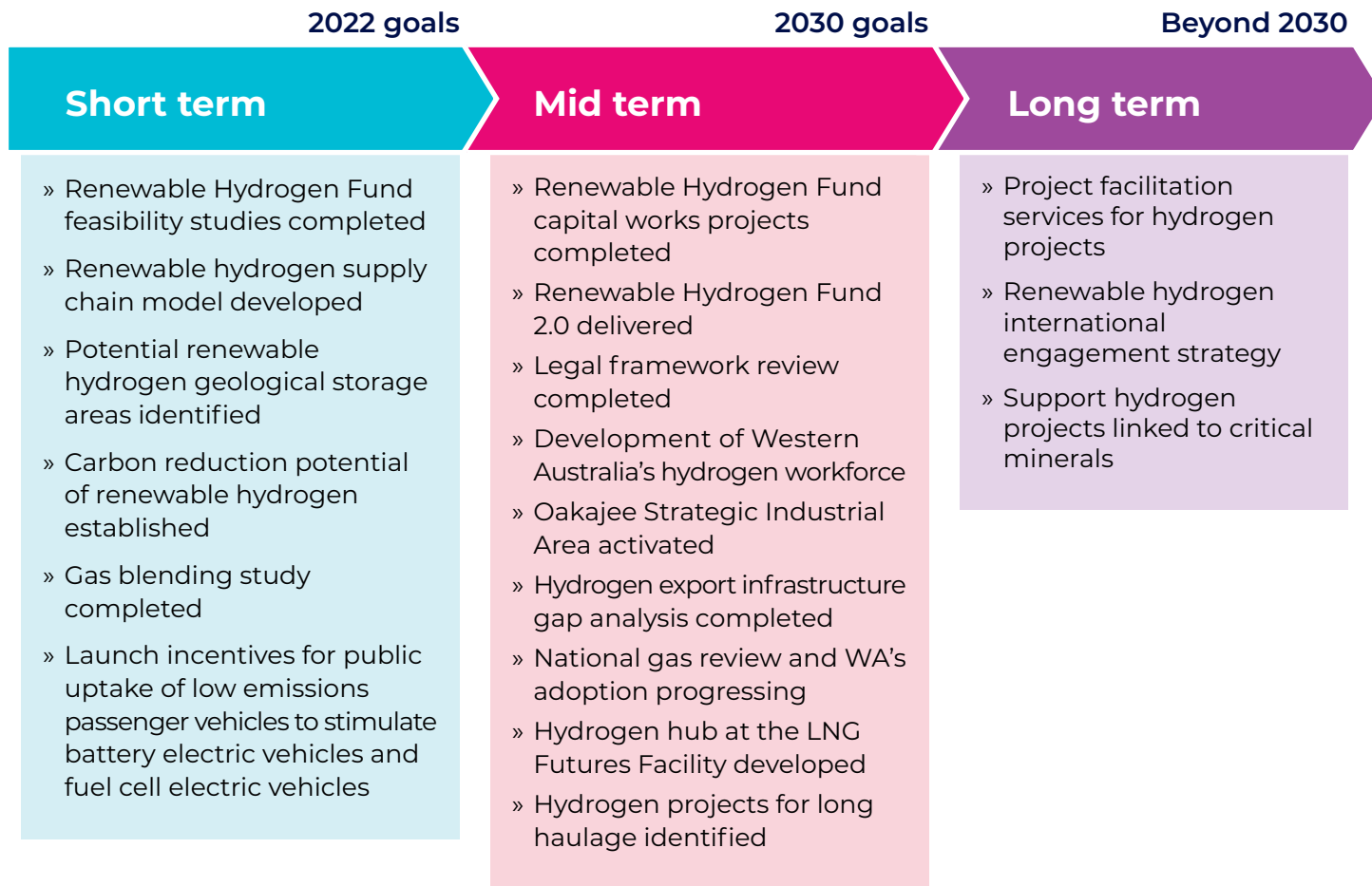
Investigate options for low emissions battery and fuel cell electric vehicles

Fuel cell electric vehicles present an early opportunity for hydrogen utilisation for mobility and freight transport, particularly for vehicles that require longer ranges, shorter refuelling times, or are weight constrained. The WA Government is looking to develop incentives to support the growth of public uptake of low emission passenger vehicles, including fuel cell electric vehicles.

Hydrogen projects for long haulage

The WA Government will assess the strategic potential of renewable hydrogen for long haul road freight.

Western Australia's renewable hydrogen timeline



Vision

Western Australia will be a significant producer, exporter and user of renewable hydrogen.

Mission

Western Australia will develop industry and markets to be a major exporter of renewable hydrogen. To enable the export of renewable hydrogen, Western Australia will develop domestic production capabilities and applications of renewable hydrogen, thereby improving the state's hydrogen industry expertise, contributing to global decarbonisation and decarbonising Western Australia's economy. It will also contribute to improving air quality across the state.

Renewable hydrogen links

The WA Renewable Hydrogen Roadmap links in with other Western Australian and National funds, strategies, and policies.

Western Australia

- » [WA Recovery Plan](#)
- » [Clean Energy Future Fund](#)
- » [Future Battery Industry Strategy](#)
- » [Western Australian Climate Change Policy](#)
- » [Electric Vehicle Strategy](#)

National

- » [Australia's National Hydrogen Strategy](#)
- » [Renewable Hydrogen Deployment Funding Round](#)
- » [National Hydrogen Roadmap](#)
- » [National Hydrogen Industry Cluster](#)
- » [National Freight Supply Chain Strategy](#)



Contact

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