

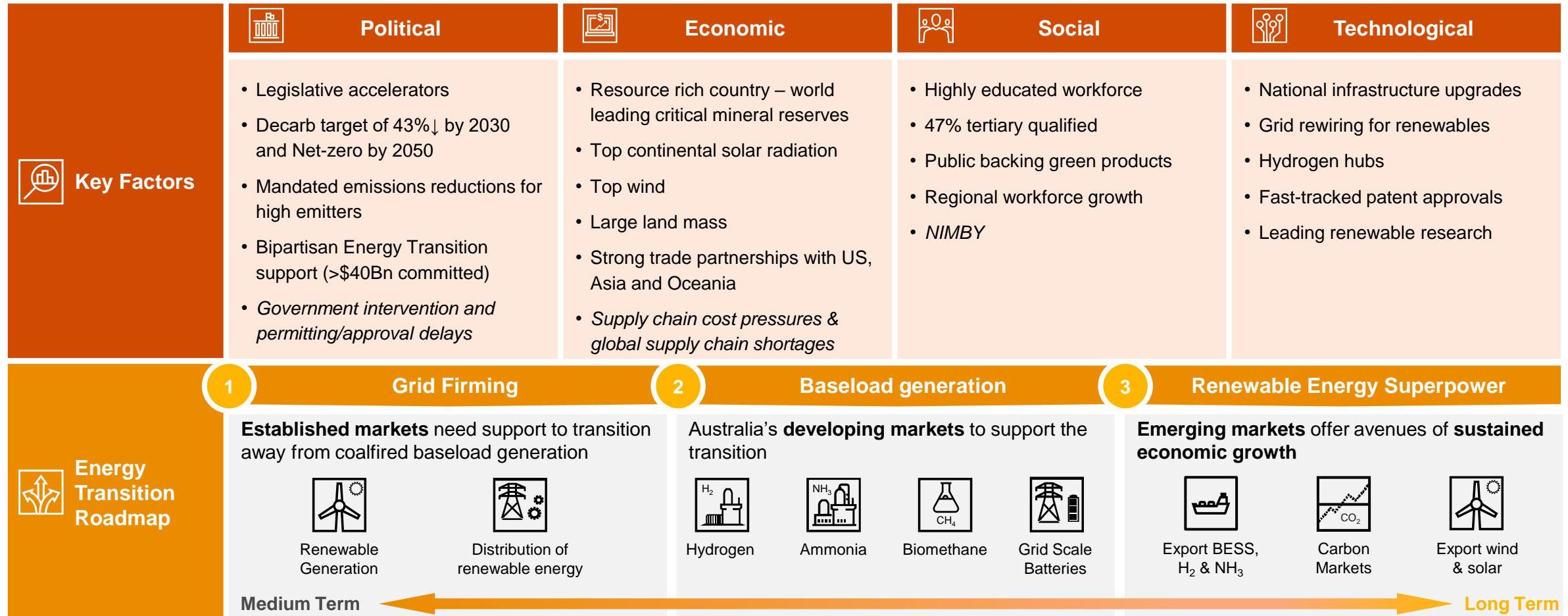
Enabling the Energy Transition – Australia's Hydrogen Story

Varya Davidson



Australia is ripe for energy transition investment – can it turn its natural comparative advantage into a competitive advantage?

Overview of Australia's Energy Transition playing field

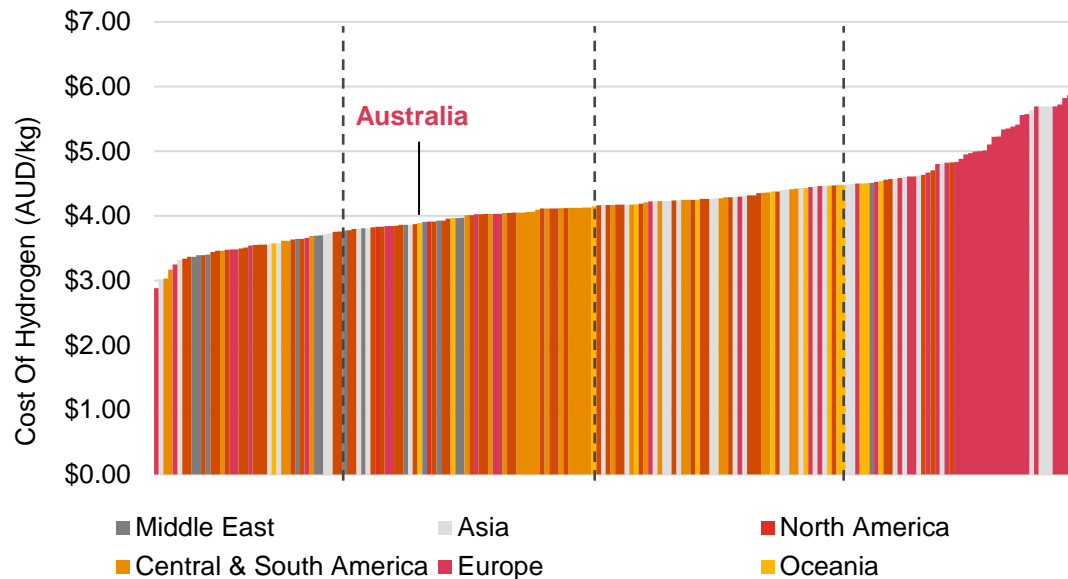


Australia is forecast to be a 1st quartile hydrogen producer

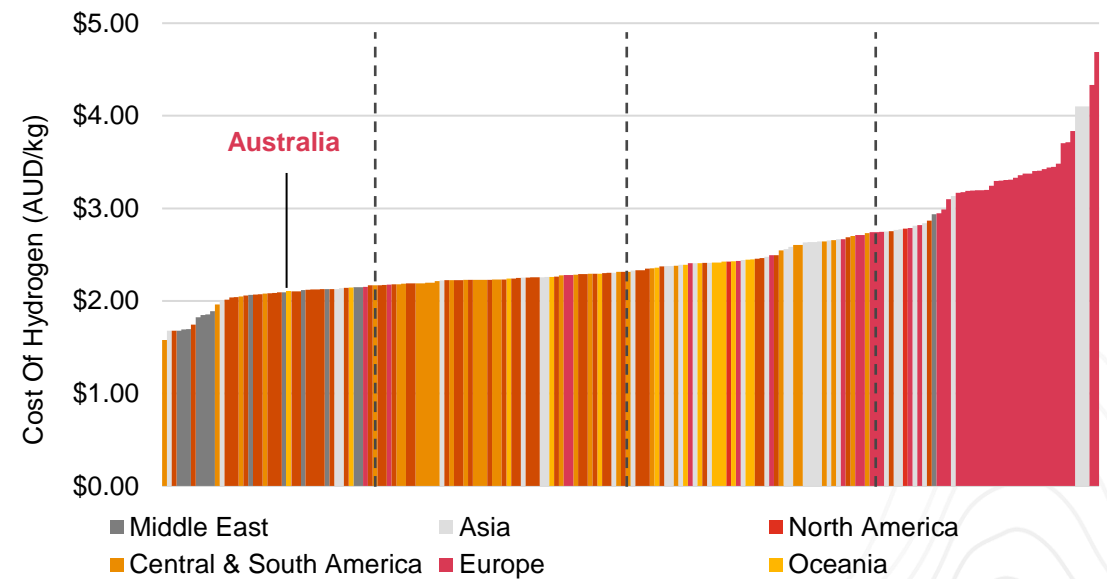
Globally, hydrogen production costs will decrease by around 50% through 2030, and then continue to fall steadily at a slightly slower rate until 2050

- Green hydrogen production costs are projected to be lowest in parts of the Middle East, Africa, Russia, China, the US and Australia
- Even regions with good renewable resources but densely populated areas will import hydrogen, as land constraints limit the production of green electricity for direct use and conversion to hydrogen
- Export and import hubs will develop around the world, like current oil and gas hubs, but with new players in renewable-rich regions

World Green H2 2030^[1]



World Green H2 2040^[1]



[1] the estimated cost of hydrogen by region has been calculated assuming the following: standard electrolyser cost of EUR473/kW in 2030 and EUR262/kW in 2040, electrolyser capacity of 50 MW in 2030 and 100 MW in 2040, hydrogen production of 8.3 million kgs in 2030 and 17.7 million kgs in 2040 and electricity requirement of 416.1 MWh in 2030 and 823.2 MWh in 2040. The renewable energy and capacity factor of renewable energy costs have varied depending on region, refer source 1 for renewable energy data. These numbers represent cost of production only and do not consider shipping/transport. Source: PwC, Global hydrogen analysis tool

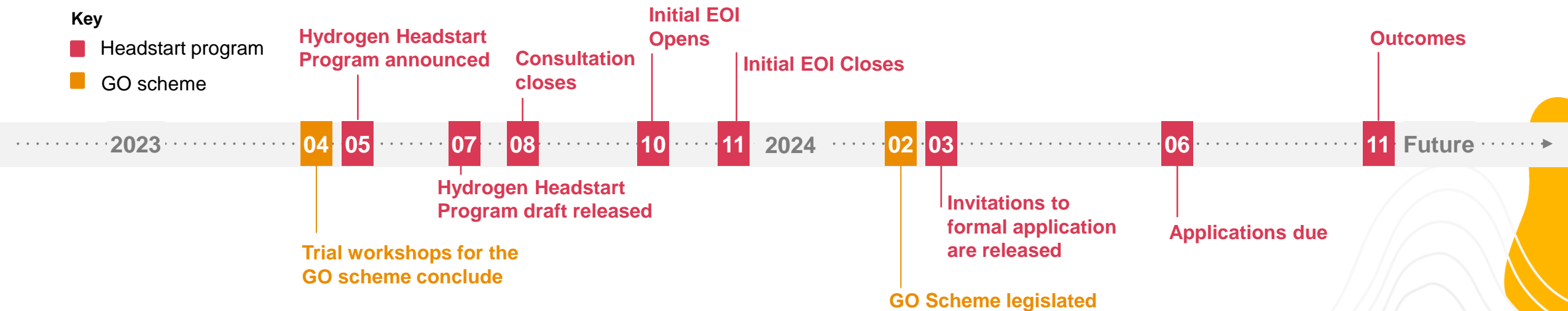
Initial Expression of Interest for the Hydrogen Headstart Program opened in October 2023

The program will provide AUD \$2b in funding as part of a supply-side incentive which will bridge the gap between the cost of producing and selling green hydrogen

- Program aims to facilitate 1GW of electrolyser capacity by 2030
- Developed by ARENA and DCCEE
- Involves a 2 stage competitive process which aims to select at least 2 large-scale projects
- Projects supported by the program will report under the proposed (Guarantee of Origin) GO scheme
- Eligible projects must have a minimum 50MW electrolyser and be on a single project site, SMR and carbon capture is not eligible

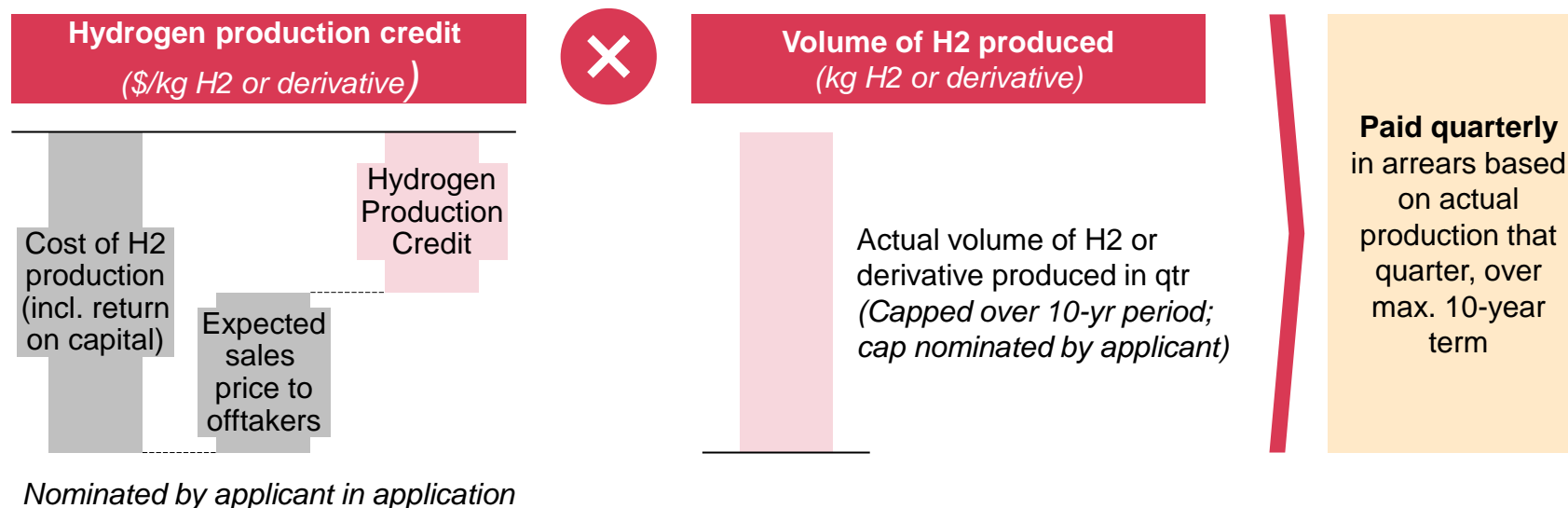
Key

- Headstart program
- GO scheme



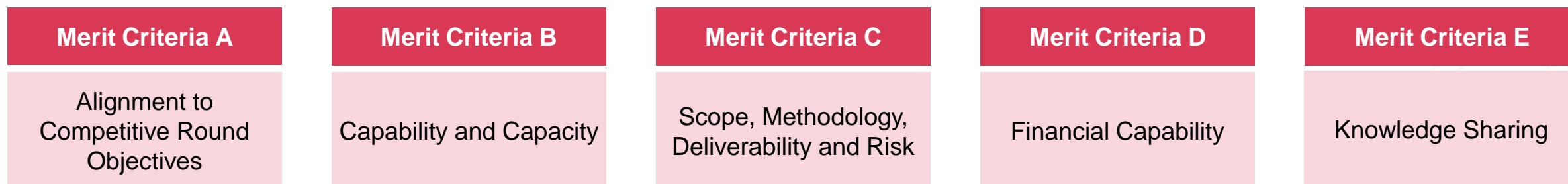
The Government has indicated how funding will be provided and what criteria will be used to assess proponents

Proposed Funding Mechanism

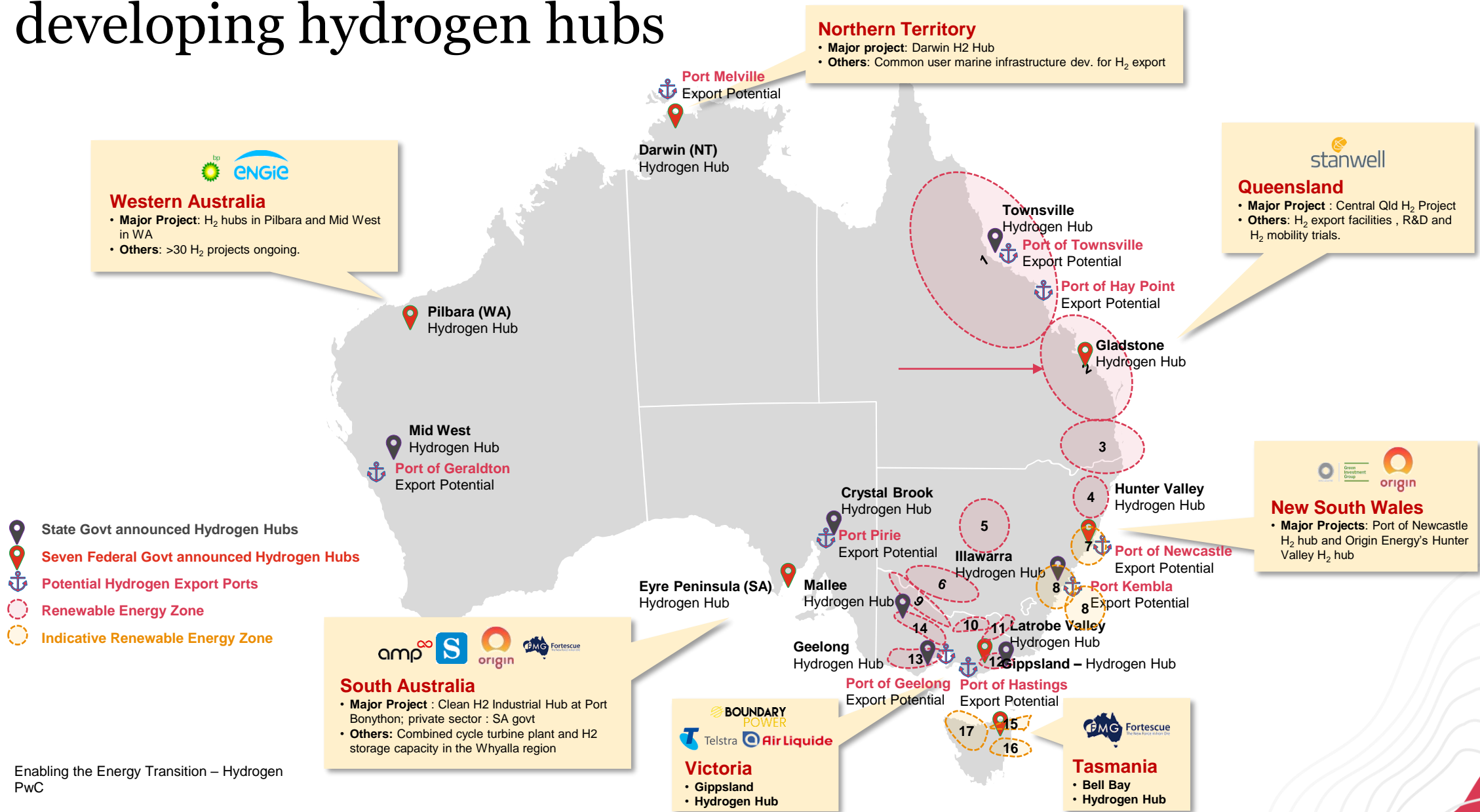


Source: Australian Government – Department of Climate Change, Energy, the Environment and Water

Proposed Merit Criteria



The Federal Government has invested over A\$500m to date in developing hydrogen hubs



Shifts in the expectations of hydrogen have been backed by federal and state regulation and policy

The Federal and State Governments are focused on supporting the growth of the hydrogen industry through various funding schemes^[3]

Federal Grants & Schemes

- **Low Emissions Technology Statement:**
Achieve clean hydrogen production cost <\$2/kg and invest \$525m
- **Hydrogen Guarantee of Origin and Certification:**
Trials to be completed in 2025 and internationally recognised by 2030
- **Fuel Emissions Standards:**
Federal government and associated authorities have signalled Standards to incentivise the production and selling of lower emissions vehicles. No clear framework or legislation has been released yet.
- **Australia's Long-Term Emissions Reduction Plan:**
\$1.3b to support green hydrogen
- **ARENA Hydrogen and Future Fuels Grants:**
\$281m in total, focusing on future fuels and project-specific support
- **German-Australian Hydrogen Innovation and Technology Incubator:**
AUD \$50m and EUR 50m investment
- **Clean Hydrogen Industrial Hubs program:**
\$464m over 5 years
- **NERA Technology Cluster Australia (H2TCA) (\$2.17m)**

Western Australia

- WA Government Renewable Hydrogen Fund (Hydrogen Fuelled Transport Program Fund (\$10m))

Queensland

- Energy and Jobs Plan (\$4.7b in Hydrogen investment)
- Queensland Hydrogen Industry Development Fund (\$15m)

NSW

- NSW Hydrogen Hub Initiative (\$70m)
- NSW Net Zero Industry and Innovation Program (\$750m - partially for hydrogen)

ACT

- Australian Capital Territory Renewable Energy Innovation Fund (\$12m)

Victoria

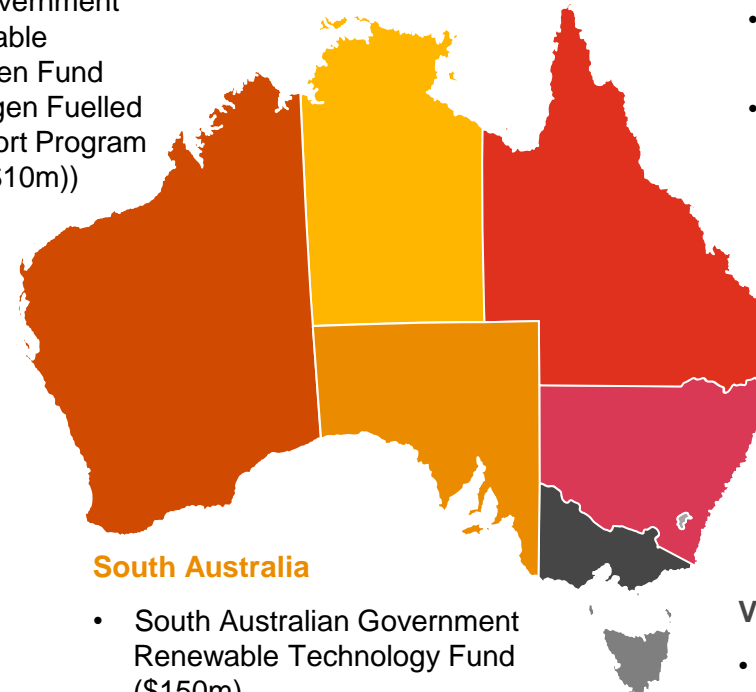
- Victorian Government Renewable Hydrogen Commercialisation Pathways Fund & Renewable Hydrogen Business Ready Fund (\$6.6m)

Tasmania

- Tasmanian Renewable Hydrogen Industry Development Funding Program (\$50m)

South Australia

- South Australian Government Renewable Technology Fund (\$150m)



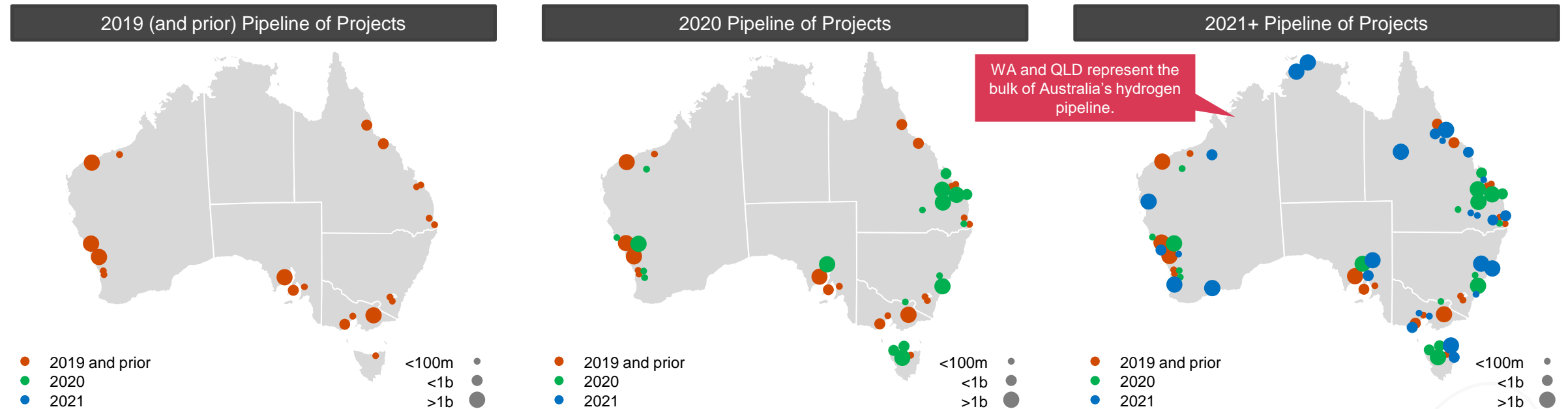
[3]: Government websites, CEFC, NERA
Enabling the Energy Transition – Hydrogen
PwC

The Green Hydrogen project pipeline has grown significantly – the majority of which is still in development

Australia's pipeline is estimated at \$265bn

- A total of ~22 projects were announced in the 5 year period between 2014 to 2019, while ~67 projects were announced in the two year period since 2020.

Heatmap progression of announced projects over the past three years, adjusted for investment size - most of these projects are still in development



The first major green hydrogen projects were announced in 2014, including the Asian Renewable Energy Hub to be developed by a consortium. Over the next 5 years, an estimated \$73b of investment pipeline emerges.

In 2020, 22 green hydrogen projects were announced totalling an estimated \$32b of investment pipeline. Key projects announced in 2020 include the Central Queensland Hydrogen Project (~292ktpa H₂), H2-Hub Gladstone Project (~319ktpa H₂) and the Port Kembla Hydrogen Hub (~547ktpa H₂).

2021 represented another year of significant growth, with an additional \$154b of investment pipeline in relation to ~32 projects announced including Australia's largest project, the Western Green Energy Hub in Esperance, Western Australia.

Despite the large pipeline, Australia has only a handful of operational hydrogen projects today

Green hydrogen represents 35% of operational projects, but only 0.1% of actual production. This signals market interest, but a lack of demand and scale in the current state

Figure 1: Operational hydrogen projects in Australia, 6 (35%) of which are green hydrogen

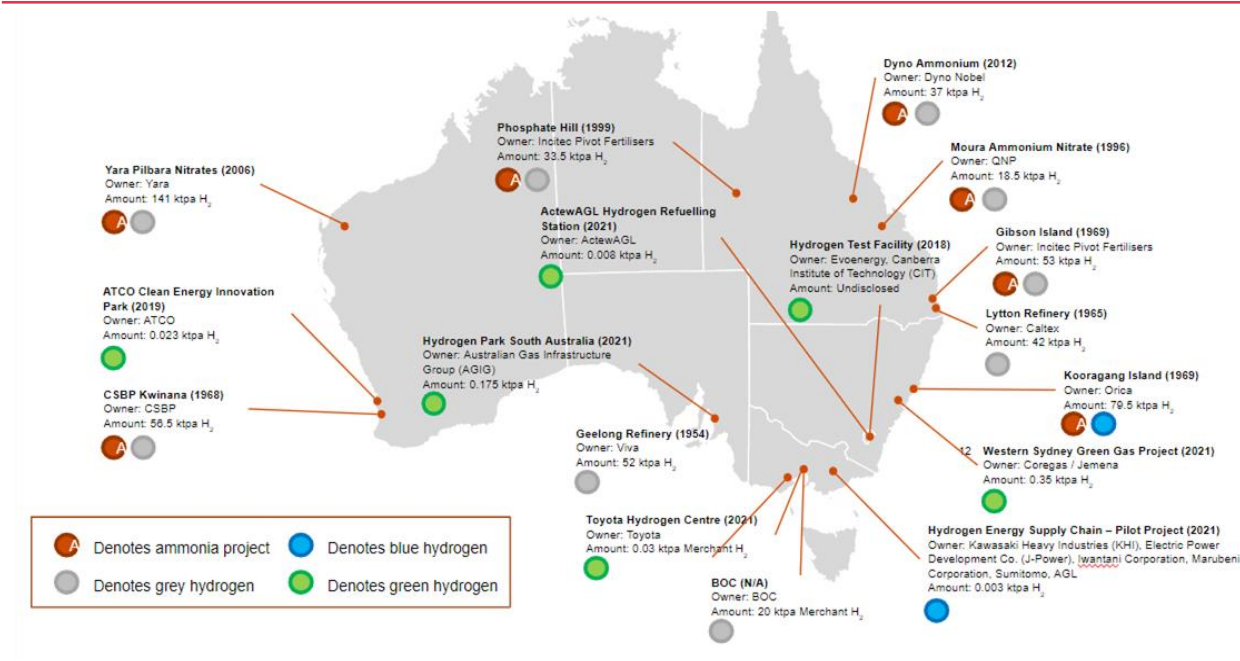
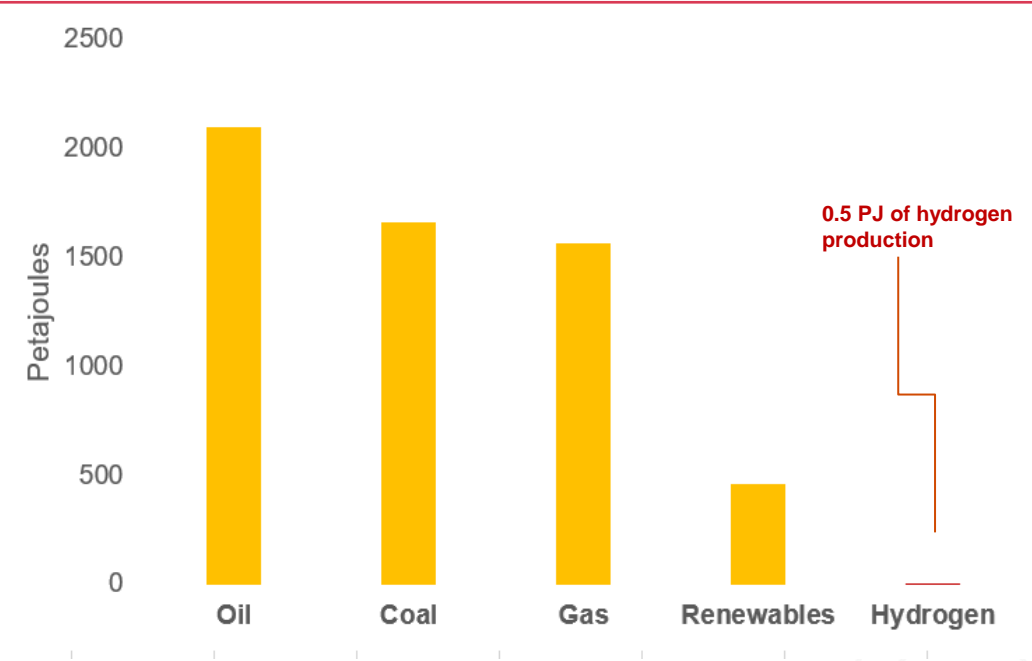


Figure 2: Hydrogen still makes up a small portion of Australia's fuel mix



Green hydrogen comprises 0.1% of operational hydrogen project production

Green hydrogen will comprise a larger proportion of Australia's mix as the project pipeline is completed -- likely at a faster rate than blue and grey hydrogen. At the current rate, Hydrogen represented 0.5 PJ of energy consumption in 2020/21 -- considerably less compared to other sources. Substantial investment will be required for hydrogen to meet the forecasts and demand over the next 10 years and beyond

Earlier this month, POSCO and Engie announced a feasibility study for a major green hydrogen project in the Pilbara

A collaboration that leverages Australia's competitive advantages in renewable energy resources to support Korea's decarbonisation ambitions for its industrial sector

ENGIE and POSCO Holdings announce an important step towards a green steel industry in Australia

“Australia is one of the key strategic countries for achieving POSCO Group’s carbon neutrality and advancing green hydrogen businesses for a sustainable future”

“POSCO Group will do more than simply produce export-bound hydrogen in Australia. We will add value by investing not only in producing hydrogen but also in developing hydrogen-using industries.”

Mr Ju-ik Cho

Head of POSCO Holdings’ Hydrogen business team^[4]

[4] Engie and POSCO Holdings announcement, 16 October 2023, <https://engie.com.au/home/about-engie/news/engie-posco-holdings-announcement>

[5] Parkinson, G., Renew Economy, Engie and Posco pursue huge green hydrogen project in Pilbara to feed green steel, 15 October 2023

Overview

The project will supply green hydrogen to POSCO Group’s proposed Hot Briquetted Iron (HBI) plant for the production of green iron in Port Hedland, ultimately supplying green fuel to South Korea to decarbonise their industrial manufacturing sector:

- The study will support and refine development plans **for an integrated hub model**, co-locating hydrogen production with renewable energy sites (wind and solar generation)
- No indication of size has been provided, but the two companies are currently working on a 5GW to supply a green ammonia project in Oman with a capacity of 1.2 million tonnes per annum^[5]