UNDER PRESSURE

Can Australia's great hydrogen dream become a reality?

Produced by

AFRIntelligence

ABOUT THIS PROJECT

Under pressure: Can Australia's great hydrogen dream become a reality? is an AFRIntelligence report published by the thought leadership division of The Australian Financial Review. Based on expert interviews, independent research and proprietary data provided by Wood Mackenzie, it examines Australia's push to become a green hydrogen superpower. The report's findings and analysis are editorially independent and managed by AFRIntelligence.

The report was commissioned by Westpac and written by The Action Exchange, a thought leadership and stakeholder engagement agency. We thank the following people (listed alphabetically by surname) interviewed for this research:

- **Flor Lucia de la Cruz**, principal research analyst, hydrogen and derivatives, Wood Mackenzie
- **Dr Alan Finkel**, Australia's chief scientist from 2016 to 2020 and chair of the National Hydrogen Strategy
- **Mark Hutchinson**, chief executive officer, Fortescue Energy
- **Dr Fiona Simon**, chief executive officer, The Australian Hydrogen Council
- **Deger Saygin**, industry programme lead, Clean Energy Finance and Investment Mobilisation Programme, Organization for Economic Cooperation and Development (OECD).

Written by The Action Exchange

AUSTRALIA'S GREEN HYDROGEN SUPERPOWER AMBITION

Fever-pitch hype, billions in federal funding and unbridled optimism all suggest that Australia has the potential to develop a lucrative hydrogen industry that will boost the sluggish domestic energy transition, grow export markets, and spark a thriving new industry.[1] But is it time for a reality check?

Despite attempts over the past 50 years to scale up global hydrogen production, green hydrogen technology is nascent.[2] Scientific experts and industry leaders remain divided on its role in achieving Australia's green energy ambitions.

Advocates tout the country's abundant access to water, land, and sunshine as natural comparative advantages. But questions remain whether these will be enough to keep Australia competitive as the global hydrogen industry—buoyed by overseas competitors with increasingly generous subsidies—booms.

Well executed, and with an essential balance between the supply and demand sides of the market, hydrogen could help to solve the decarbonisation challenge at speed. Yet roadblocks remain. Can Australia's great hydrogen dream become a reality?

Key findings:

- Australia has distinct natural advantages that support a domestic and export-focused hydrogen industry. But it is not unique and faces competition from better-funded markets like the US, the Middle East and Europe.
- Hydrogen's success remains unproven and is an evolving technology. A lack of infrastructure and cheaper alternatives for low-emission energy supplies make its future uncertain.
- Australia's hydrogen industry progress is starting to stagnate compared to its global competitors. The Federal Government is updating its hydrogen strategy to determine priority investment areas, but industry remains split on whether domestic use or exports are the best place to focus.
- Global demand for green hydrogen is growing, driven in some cases by ambitious government targets. Yet, as an export, price will be the ultimate determinant of Australia's success. At present, the costs of production and transport far exceed what is needed to make the industry viable, although this is expected to change rapidly.
- Green hydrogen has the potential to underpin the decarbonisation of hard-to-abate domestic sectors and could give rise to new industries such as onshore green steelmaking. Yet for other sectors, such as household use and transport, renewables such as wind and solar will continue to be more efficient, making hydrogen's domestic use case less clear.

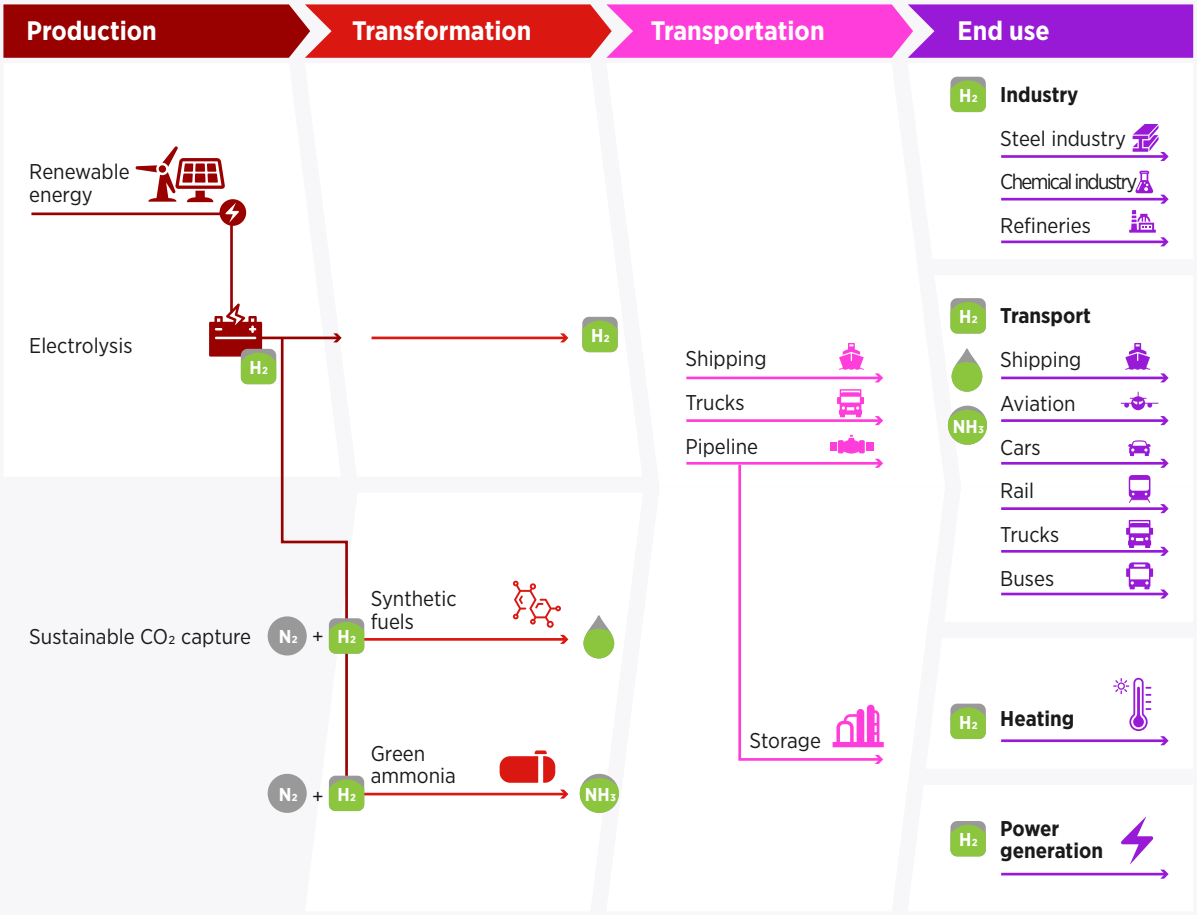
SNAPSHOT: WHAT IS GREEN HYDROGEN?

Creating hydrogen can be carbon intensive. Colour codes are used to distinguish between methods of production and carbon intensity, with the most common being grey, blue and green.

Until now, most hydrogen has been 'grey', and is generated from fossil fuels such as natural gas or methane. 'Blue' hydrogen is made when grey hydrogen emissions are captured, stored or offset. The cleanest hydrogen is defined as 'green' and is made through electrolysis, powered by renewable energy splitting water molecules into hydrogen and oxygen. Produced as a gas and converted into a liquid or solid, green hydrogen is emissions-free and has the potential to be an abundant energy source and chemical catalyst.

Australia produces grey and blue hydrogen, but almost all its future pipeline is green, with most projects currently slated for transport and mobility or for export in the form of liquid for energy or ammonia and metal hydrides for chemical use.

Figure 1: The green hydrogen value chain.



Source: IRENA[3]. Note: CO_2 =carbon dioxide. N_2 = dinitrogen.

REALITY CHECK: AUSTRALIA'S SUPERPOWERED HYDROGEN AMBITIONS

Dubbed the 'Swiss army knife' of climate solutions, green hydrogen's proponents say it can fast-track Australia's energy transition, decarbonise hard-to-abate sectors like steel manufacturing, reboot domestic heavy industry, create an export boom that powers the Asia-Pacific region's shift to green energy, and fuel the decarbonisation of both shipping and air travel. In theory, green hydrogen could be the fuel that enables Australia to leap from transition laggard to global green leader.

With so much at stake, it's little wonder that Australia's National Hydrogen Strategy aims to position the country as a significant global supplier by 2030.[4] Within a few short years, industry and government alike hope they can realise their ambitious plans to harness green hydrogen for fuel and industry at home, and to export it to countries including Japan, Korea and the European Union.[5]

But significant hurdles remain. Finance and hardware are two of the biggest. Despite A$127bn of investment announcements since the release of Australia's National Hydrogen Strategy in 2019,[6] the technology behind green hydrogen is nascent.

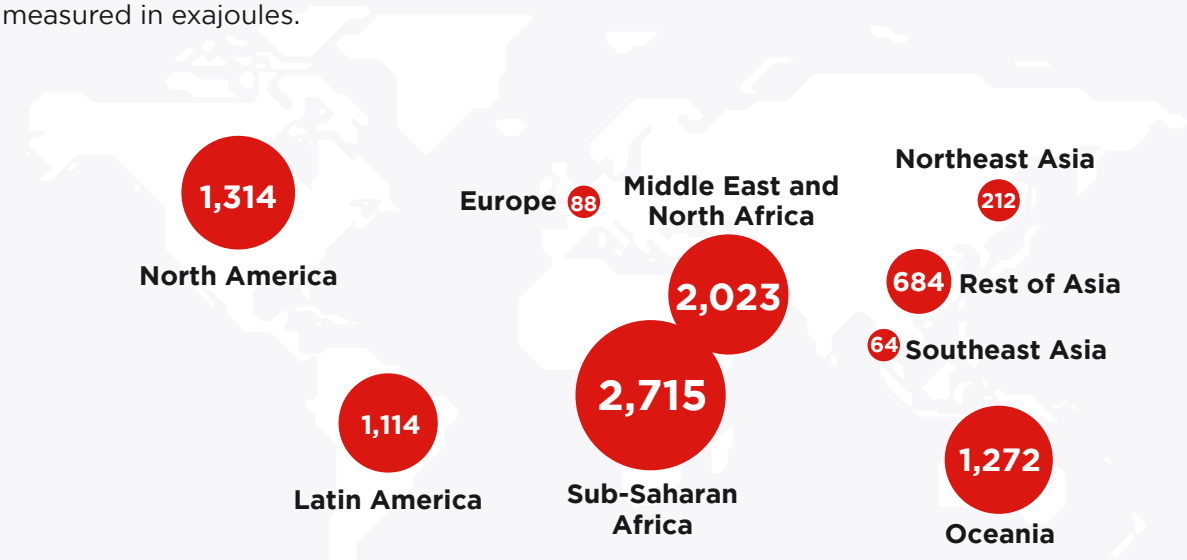
Producing the fuel is highly energy-intensive and expensive. The infrastructure and skills needed for green hydrogen's development and production are scarce. An intensely competitive and uneven global market and the cost of building the industry from scratch means the business case for green hydrogen remains hypothetical—it cannot yet be produced profitably and at scale, and it remains unclear whether demand will keep pace with projected supply.

Yet, despite these challenges, there are good reasons for optimism. Hydrogen's potential to radically accelerate the energy transition—at home and worldwide—means investment is pouring into the sector. This is highly positive for a land and resource-rich country like Australia, which has all the ingredients needed to support a green hydrogen industry.

"There are five to six countries with the potential to become hydrogen export superpowers, and Australia is one of them," says Mark Hutchinson, CEO of Fortescue Energy. "The key ingredients are land and a plentiful supply of quality renewable energy, both of which Australia has in spades."

Fig 2: Australia has the natural resources to become a green hydrogen superpower.

Technical potential for producing green hydrogen under USD 1.5/kg by 2050, measured in exajoules.



Source: IRENA[7]

Australia is well-positioned to capitalise on projected demand from Asia-Pacific countries, including Japan and South Korea. Both will require a consistent and growing supply of green hydrogen to meet government-mandated targets. For example, the revised version of Japan's Hydrogen Basic Strategy, released in mid-2023, aims to increase hydrogen supply six-fold by 2040.[8]

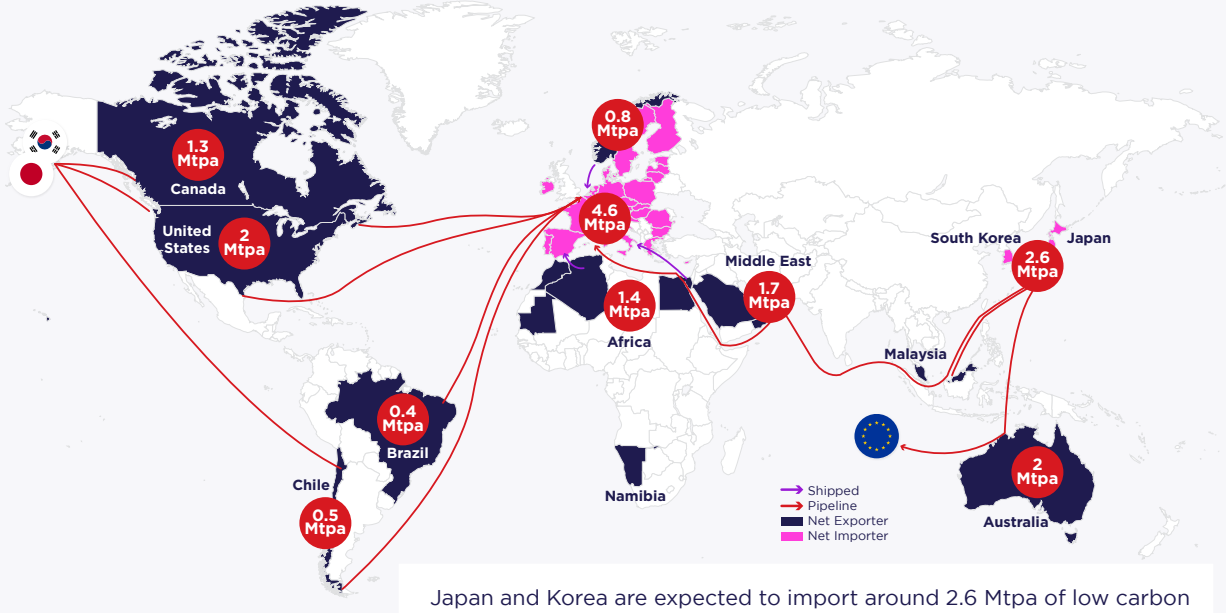
Australia, which is a trusted trading partner of these countries as well as being geographically close, can meet much of this demand according to Flor Lucia de la Cruz, principal research analyst, hydrogen and derivatives at energy consultancy Wood Mackenzie.

Mr Hutchinson agrees and says that "Japan, Korea and Singapore will be important customers of green hydrogen for Australia, and we are well-placed to meet a sizeable proportion of their likely future demand." But Ms Lucia de la Cruz warns that Asia-Pacific countries are likely to build diversified supply chains and negotiate offtake agreements with multiple suppliers, putting many of Australia's projects at risk.

Balancing supply and demand will be tricky, as Korea's experience illustrates. Although technically more advanced than many other nations, its hydrogen industry has already failed to meet its initial consumption targets, along with many other hydrogen targets it set five years ago.[9]

This may have a knock-on effect for Australia's projected export volumes, which critics warn won't be as big as expected, especially while shipping hydrogen as a liquid or carrier remains prohibitively expensive. Australia must broaden its customer base to destinations that are further afield such as the European Union, says Ms Lucia de la Cruz. However, even if demand in markets such as Germany is strong and increasing, the extra cost of converting hydrogen to a carrier and shipping risks making Australian green hydrogen commercially uncompetitive.

Fig 3: Australia is projected to have the capacity to meet almost all of Japan and Korea's hydrogen needs. Will they buy it?



Japan and Korea are expected to import around 2.6 Mtpa of low carbon hydrogen by 2035. But over that period Australia is forecast to produce up to 2Mtpa. Not all of this will be taken by Japan and Korea, who intend to source their supply from a diversified global market.

Source: Wood Mackenzie

All this suggests that while Australia's prospects as a green hydrogen superpower are strong, success is not guaranteed. The nation risks squandering its competitive advantage without the right economic environment—including a significant uptick in investment.

"All the decisions that need to be made to enable hydrogen availability in the future mean understanding the investment cycles, taking some risks, investing in research and development, and being prepared for the costs to hit within this political cycle," explains Fiona Simon, chief executive officer of the Australian Hydrogen Council. "The benefits won't be realised for some time to come, but we'll be kicking ourselves if we haven't done any of the work now to prepare for that future."

This may be the nation's hydrogen weak spot. The Australian Government's State of Hydrogen 2022 report found that progress is slowing, with an emerging gap between "policy aspirations and commercial realities".[10]

Fig 4: Time to pick up the pace? Australia's progress is slowing.

	2021 Assesment		2022 Assesment	
Industry Development Signal	**2025 Pace**	**2030 Pace**	**2025 Pace**	**2030 Pace**
Investment	Advancing quickly	Advancing	Advancing	Advancing
Project scale	Advancing quickly	Advancing quickly	Advancing	Advancing
Cost-competitiveness	Advancing quickly	Advancing quickly	Advancing	Advancing
Australia's exports	Advancing	Advancing	Advancing	Advancing
Chemical feedstock	Advancing quickly	Advancing quickly	Advancing quickly	Advancing
Electricity grid support	Advancing slowly	Advancing slowly	Advancing	Advancing slowly
Mining and off-grid	Advancing	Advancing slowly	Advancing	Advancing slowly
Heavy transport	Advancing quickly	Advancing slowly	Advancing slowly	Advancing slowly
Light transport	Advancing slowly	Advancing slowly	Advancing slowly	Advancing slowly
Gas networks	Advancing	Advancing	Advancing	Advancing slowly
Electricity generation	Advancing quickly	Advancing	Advancing quickly	Advancing quickly
Steel and iron making	Advancing slowly	Advancing slowly	Advancing slowly	Advancing slowly
Industry heat	Advancing	Advancing	Advancing slowly	Advancing slowly

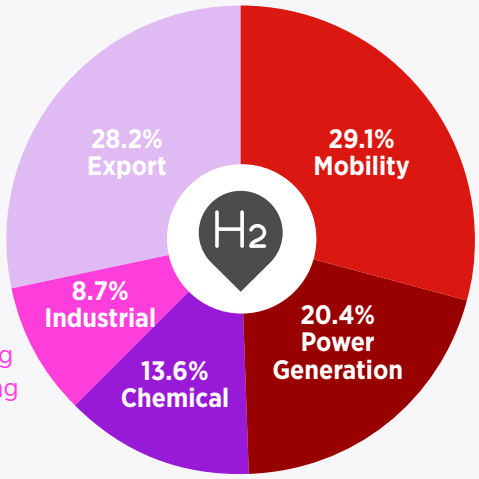
Source: DCCEEW[11]

The reality of Australia's lagging hydrogen performance has led some to curtail their ambitions. Between 2021 and 2023, the Australian Energy Market Operator lowered its 2050 hydrogen export forecast by roughly 35%.[12] [13] Dr Simon believes Australia must pick up the pace to be a global hydrogen superpower. "Australia isn't walking its talk on hydrogen," she says.

> Australia isn't walking its talk on hydrogen.
>
> **Dr Fiona Simon, CEO, Australian Hydrogen Council**

Fig 5: How hydrogen will be used in Australia
Australian hydrogen projects, by use case

- Ammonia, metal hydrides, etc. for chemical use
- Liquid and Compressed H2 for energy



- Passenger vehicles
- Heavy transport
- Bus, rail, and industrial transport

- Gas networks
- Electricity

- Heating
- Refining

- Ammonia for fertiliser
- Methanol for plastics

Percentages calculated by proportion of projects announced for each use case. By number of projects, domestic uses far exceed exports. However, the 28.2% of projects intended for export make up over 90% announced electrolyser capacity.

Source: CSIRO HyResource, 2023[14]

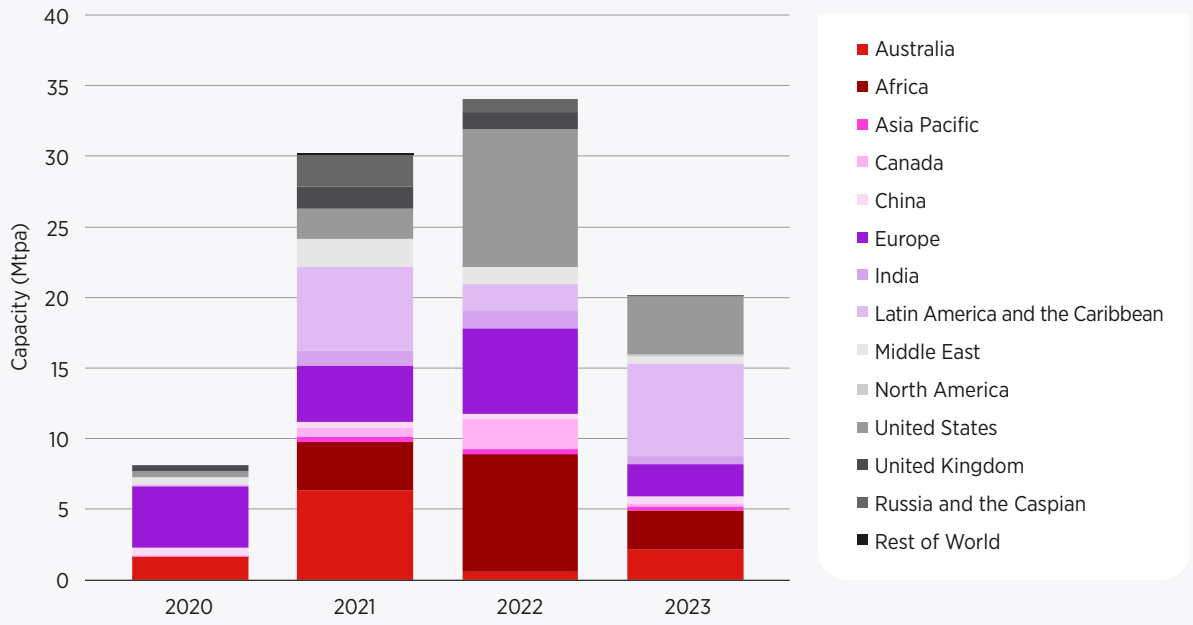
HYDROGEN IN AUSTRALIA AND THE WORLD

Australia has the natural resources required to produce hydrogen at scale, but in this it is not unique. Despite an early lead, the nation has dropped in the global hydrogen production league tables. Australia trails in public and private investment, regulation, project scale and, crucially, the number of projects funded and approved for commencement with a Final Investment Decision (FID).[15]

Ms Lucia de la Cruz warns that Australia is playing catch up with hydrogen competitors who have moved faster and harder.[16] "The landscape has become a lot more competitive. Other countries in Latin America, the Middle East and North Africa that have ample available renewables and land have all announced projects," she says.

Fig 6: Australia was a world leader in announced capacity in 2020, but the US and Africa have caught up.

Annual announced capacity by major market



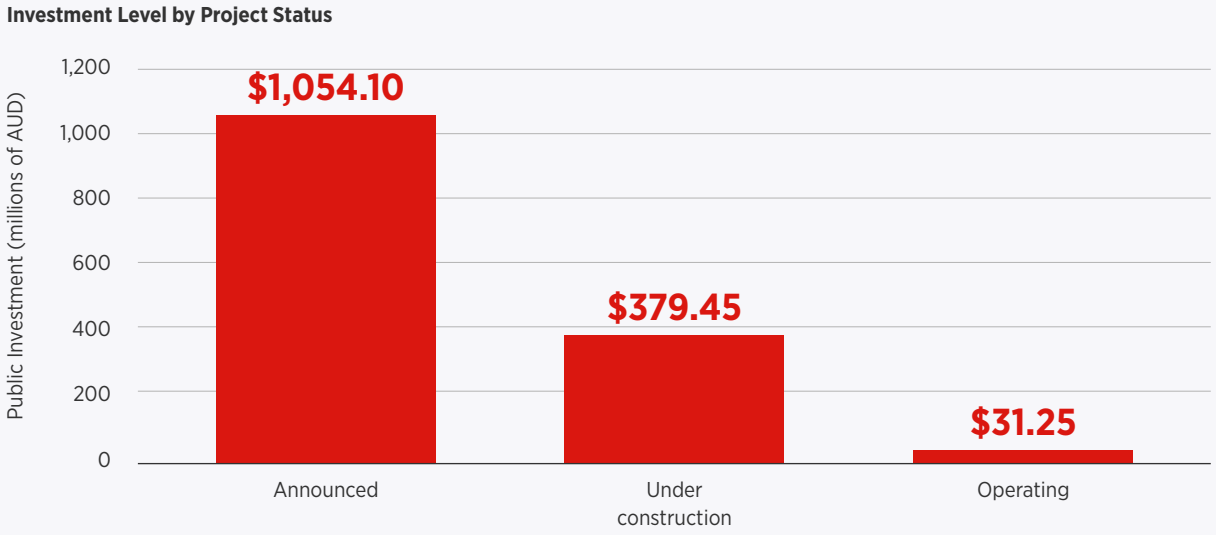
Source: Wood Mackenzie

> We're asking governments to do a pretty difficult thing—to pick some winners and put real dollars into it before we have all the data. There's a capital reallocation piece where we will have winners and losers. It's going to be difficult.
>
> **Dr Fiona Simon, CEO, Australian Hydrogen Council**

Policy documents and press releases laud Australia's A$300 bn of potential hydrogen investments,[17] which are expected to produce 12 million tonnes of green hydrogen.

However, few of the projects that have been announced have proceeded to the crucial FID stage, and fewer still to construction.

Fig 7: Australia's announced hydrogen projects far outweigh those that have begun operating.



Data includes all announced hydrogen projects with costs projected as of 19 Aug 2023. Projects completed but not yet operational are considered 'Under Construction'. Public investment figures exclude funds committed by foreign governments or private entities.

Source: CSIRO HyResource, 2023[18]

At the time of writing, only two Australian projects with 10-megawatt capacity had reached FID. The working group that developed Australia's National Hydrogen Strategy is worried, noting "Australia lags behind other nations in converting announcements into final investment decisions."[19]

Australia's policy and regulatory frameworks also lag behind other nations. According to Wood Mackenzie, Australia has the second least comprehensive hydrogen policy framework of the world's 16 largest hydrogen jurisdictions. Unlike the EU and USA, Australia has not set production or demand targets, or identified the key sectors that it believes will drive the development of a domestic hydrogen industry. These types of targets, says Ms Lucia de la Cruz, are a crucial way to give the private sector confidence to invest and to kick-start demand.

Fig 8: Australia's hydrogen policy environment lags global competitors.

	Australia	EU	USA	South Korea	Japan	India	China	Germany
2030 Production Target	✗	40 GWe / 10 Mtpa	10 Mtpa	✓	3 Mtpa	5 Mtpa	0.2 Mtpa by 2025	10GWe
2030 Demand Target	✗	20 Mtpa	10 Mtpa	5.3 Mtpa by 2040	0.42 Mtpa (2)	–	✓	✗
Primary demand sectors	Export Industry Mobility	Industry Ammonia Refining	Other Refining Ammonia	Power Mobility	Power Mobility Industry	Refining Fertiliser City Gas	Refining Chemicals Mobility	Refining Ammonia Steel
Incentives (Tax or CfD)	1.2	Subsidy: up to €4/kgH_2	Tax: up to $3/kg$H_2$	✗	CfD	Tax: up to $0.4/kg$H_2$	✗	✗
H2 project funding (US$ billions)	0.4	~167	~54.2	~3	~53(3)	~2.5	✗	~9.7
Net-zero target legislated	✓	✓	✓	✓	✓	–	–	✓
Emissions (Scope / kgCO_2/kgH_2)	✗	Full life-cycle 3.4	Production only 2.0	well-to-gate 4	well-to-gate 3.4	well-to-gate 2	well-to-gate 14.5 / 4.9(4)	

Targets | Legislated | Drafted/in progress/partially in place | Not in place

(1) The exact amount of funding offered in the UK is unclear. This figure is based on announced funding and an assumption that 20% of funding for wider net zero initiatives will go to supporting the hydrogen value chain.
(2) Wood Mackenzie estimate equivalent to 1% of power generation in Japan in 2030.
(3) Japan plans to invest US$107 billion from both the private and public sector to develop hydrogen supply chains over 15 years. We've assumes a 50-50 split.
(4) China CI definition for Low Carbon Hydrogen is 14.51 kgCO_2e/kgH_2; and for Clean/Renewable hydrogen is 4.9 kgCO_2e/kgH_2
*The exact amount of funding offered in many countries is unclear. Figures shown here are estimates based on funding announcements, and Wood Mackenzie internal conversion factors and assumptions.

Source: Wood Mackenzie

> Australia has the potential to supply a sizeable proportion of global demand for green hydrogen. Where Australia can compete is on scale: it can develop much bigger projects than other countries and has the capacity to get to profitability faster. But the right settings need to be in place if Australia is to realise its ambition.
>
> **Mark Hutchinson, CEO, Fortescue Energy**

THE US IRA: CAN AUSTRALIA COMPETE?

The United States is now leading the hydrogen production race, buoyed by the 2022 US Inflation Reduction Act[20] (IRA) and the previous year's Bipartisan Infrastructure Law.[21] IRA tax credits for hydrogen producers are worth up to US$3 (A$4.50) per kilo,[22] a subsidy that can reduce the production costs of green hydrogen by almost half[23].

Unsurprisingly, the country now has a large pipeline of hydrogen projects—although not all of these are necessarily green—and the US's total announced production capacity has grown 1.5 times faster than the rest of the world[24] since 2021.[25]

Subsidies also give US producers—along with those in the EU, Canada, and some Gulf States who are also set to receive public largesse—a first-mover advantage. They can lock customers into long-term supply contracts and access in-demand equipment like electrolysers and solar technology. "The effect of IRA support pushes Australian-produced hydrogen out of Asian export markets,"[26] warns Deloitte.

Australia's trading partners have already directed substantial investment into the US since the IRA was introduced.[27] Dr Fiona Simon, CEO of the Australia Hydrogen Council, says although it is too difficult to provide exact figures for how this has impacted Australia, she has seen a distinct financial shift to the US.

"We've observed major players saying, 'we were going to invest in Australia, and now we're not,' or deciding to reorient themselves toward looking to the US," she explains, adding that the IRA has also increased the export of domestic equipment and talent to the US. "We do appear to be falling further and further behind."

> There's a gap between what's happening on the ground and the model estimates, which underestimates the real production costs of hydrogen. That price gap is hindering market development today and we need to understand how to close that.
>
> **Deger Saygin, industry programme lead, Clean Energy Finance and Investment Mobilisation Programme, Organization for Economic Cooperation and Development (OECD)**

GREEN HYDROGEN HURDLES

Beneath the urgency,[28] most hydrogen projects globally are hampered by many of the same issues. Supply chain and labour constraints, an inflationary macroeconomic environment, regulatory blockers, and a lack of public support hinder progress globally, according to the Hydrogen Council.[29] Even in the US, where the industry is underpinned by enormous subsidies, only 11 of the 115 hydrogen projects announced since President Biden's inauguration have secured capital commitments, according to S&P.[30] Australia may no longer be leading the hydrogen race, but we aren't facing the wooden spoon either.

Fig 9: Green hydrogen production hurdles

Costly capital and components

Increased interest rates and electricity and equipment prices have made hydrogen plans more expensive than ever. The capital costs of all technologies are estimated to have increased by a fifth since 2021-22.[31]

Renewables remain expensive

Australian renewable energy prices are more expensive than its US or Middle Eastern competitors.[32] Many renewables projects are hindered by approvals and community opposition.[33]

Global electrolyser shortage

The World Hydrogen Council warns that a global shortage of electrolysers, and the skilled labour to run them, is likely as international competition for projects accelerates.[34]

Water scarcity

Every kilogram of green hydrogen produced uses between 9kg to 14 kg of water.[35] Access to water supplies of this size will see the hydrogen industry compete with agriculture and local communities.

> A lot of hydrogen projects are going to fail, but the projects that have been having the right conversations throughout the value chain will inevitably be the ones getting to FID.
>
> **Flor Lucia de la Cruz, principal research analyst, hydrogen and derivatives, Wood Mackenzie**

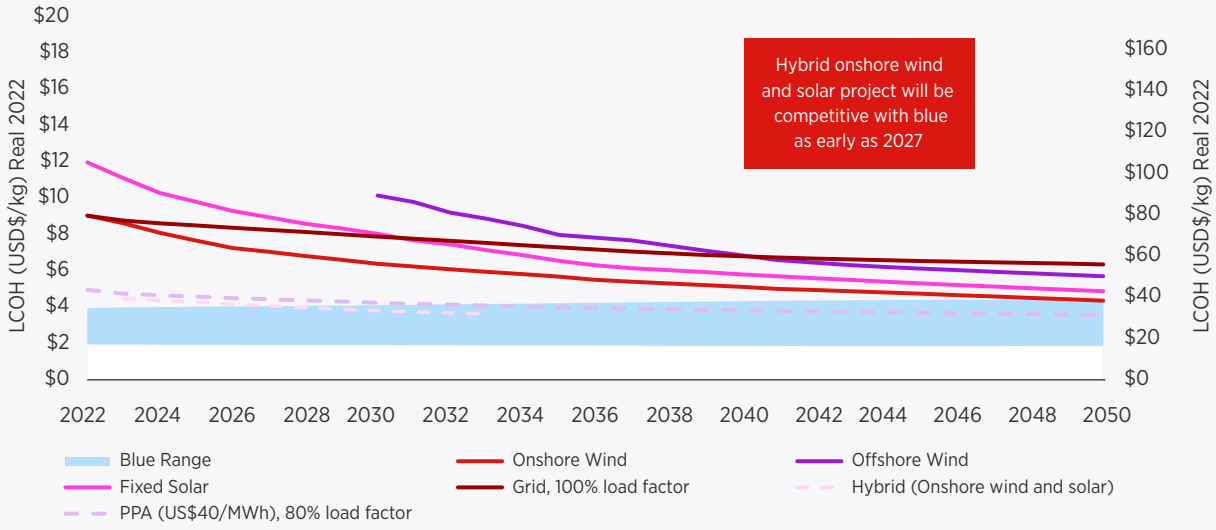
COST: THE DECIDING FACTOR

Arguably, the biggest challenge for Australia's green hydrogen sector is to reduce the costs of production to a price where it will be competitive in comparison to global buyers, or that markets willing to pay a 'green premium' will bear.

If the cost of producing green hydrogen reaches $2 per kilogram, outside of storage and shipping, it becomes competitive with existing technologies like natural gas for use in ammonia production, transport fuel, and firming electricity.[36] Yet with capital costs still high, the A$2 target remains a "stretch goal"[37] that Deloitte suggests would require an additional A$15.5 billion in publicly funded hydrogen production credits to meet.[38]

Fig 10: Green hydrogen will soon be cheaper than blue - but only if powered by onshore wind and solar.

Green hydrogen projects from hybrid onshore wind and solar will compete with blue hydrogen as early as 2027



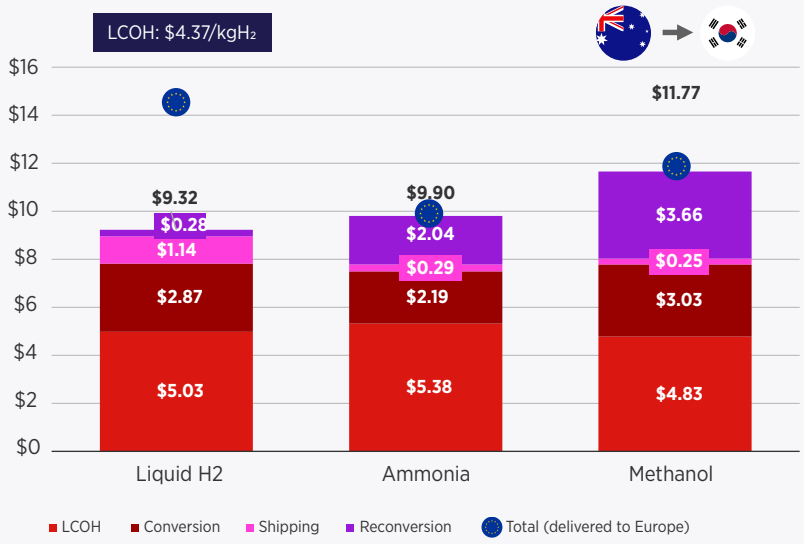
Source: Wood Mackenzie

Even under the best circumstances, the global price for green hydrogen is forecast to be at least double the price of grey hydrogen, which is around US$1.50 (A$2.25) per kilogram.[39] Australian green hydrogen is yet to even come close: At the ActewAGL Hydrogen Refuelling Station, green hydrogen currently costs between A$10-$15 per kilogram.[40]

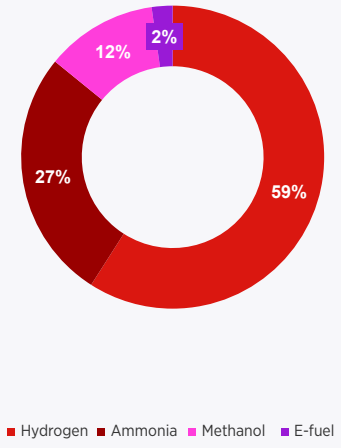
But proponents say this price will quickly fall with the right settings. Frontier Energy Limited says its Bristol Springs project, one of only three hydrogen projects in Australia to receive zero carbon pre-certification,[41] could achieve a theoretical total cost inclusive of capital of $2.77 per kilogram.[42]

Fig 11: Transport will add significantly to the cost of green hydrogen.

Australian green hydrogen delivered to South Korea in 2027



Hydrogen demand by derivative, 2033



Source: Wood Mackenzie

HYDROGEN AT HOME: WHERE IS THE REAL COMPETITIVE ADVANTAGE?

Once economically viable, green hydrogen has multiple potential uses and could be critical to help Australia reach its 2050 net-zero goal.[43] With a limited number of investment cycles, and with profitability closely linked to scale, industry and government must agree on which infrastructure projects and policies to prioritise.

Fig 12: Australia's competing hydrogen objectives

10-30%

Green hydrogen is predicted to reduce Australia's CO_2 emissions by between 10% and 30%.

To meet this goal, an estimated 364,000 tonnes of green hydrogen will be needed by 2030, with an additional 2,230,000 tonnes needed by 2050.

Source: National Hydrogen Strategy Review[44]

12 MILLION

The Australian Energy Market Operator's 'Hydrogen Superpower' scenario sets the goal for exporting hydrogen at 12 million tonnes each year by 2050.

Source: Australian Energy Market Operator[45]

CSIRO's expectation is that green hydrogen will initially be used in "smaller scale and less glamorous" domestic projects that will serve as the building blocks for a bigger, more lucrative export industry to come later.[46]

Yet Mr Hutchinson takes a different view. He is bullish on hydrogen's export potential both as a fuel and as green ammonia, arguing that Australia's comparative advantage is that it can develop projects at scale.

Not everyone is convinced that exporting hydrogen as a fuel should be Australia's top priority. Dr Finkel says as science and technology evolves, one of hydrogen's most viable uses will be its role as a chemical to produce green steel.

"Steel making accounts for 8% of global carbon dioxide emissions, and almost all of this comes from the first step of this process, which is to make pure iron from iron ore. If we replace the carbon presently used in this process with green hydrogen made on-site, the emissions from steel making will be water vapour," he says.

As the price premium for green steel increases, the economic case for domestic manufacturing is also building. Australia's opportunity may lie in the first half of the steel production process, says Dr Finkel, where iron ore is transformed into green iron and exported as briquettes.

The Grattan Institute and Accenture put Australia's green iron and steel opportunity at A$35.3 bn in exports by 2040.[47]

Regardless of priorities, the Australian hydrogen industry is united in its call to accelerate progress if Australia wants to stay in the race.

Frederic Baudry, President of BP Australia, described it as "a Sliding Doors moment" in June 2023.

"It's urgent because policies implemented today will take time to filter through, and major energy projects will take time to come online. But they need to be funded now," he said.[48]

Mr Hutchinson agrees and says infrastructure is the most immediate critical need. "This is something that can't be borne by the private sector alone: we need government to get on board."

> Australia has a huge opportunity in hydrogen. Everything we need is in the existing strategies, but there will need to be a shifting emphasis as the technology and market signals develop.
>
> **Dr Alan Finkel, Australia's chief scientist from 2016 to 2020 and author of the National Hydrogen Strategy**

WHO'S BUYING IT?

To advocates' chagrin, the hydrogen industry is frequently described as a chicken and egg scenario. Producers remain hesitant to break soil on production facilities without commitments from customers to buy their future green hydrogen, known as 'offtake agreements'. In turn, customers say they can't commit without certainty of supply.[49] Shoring up demand with offtake agreements is considered the best way to de-risk the sector,[50] and global, hydrogen projects that have successfully reached FID have typically targeted existing value chains. Yet, in Australia, most policy efforts have concentrated on facilitating production via tax credits rather than identifying areas of existing or unmet demand.

Whether there will be demand for green hydrogen domestically in Australia remains a subject of intense debate. For most sectors, switching from existing fuel sources to hydrogen will be a technologically complex process that will require an enormous capital investment. Switching to hydrogen in the steel sector alone will likely cost trillions of dollars. Saul Griffith, a prominent scientist and hydrogen detractor, insists that the cost of adopting green hydrogen will in many cases be too high, needlessly costing taxpayers and absorbing capital that could be spent on technologies that can reduce emissions more efficiently, such as electrification and batteries.[51] The broad—but not universal—consensus among researchers[52] and government[53] is that hydrogen is a less attractive source of base load electricity than renewables, but that the fuel could play a part in storing excess renewable energy to meet later demand.

Nevertheless, of Australia's 16 green hydrogen projects at FID stage (at the time of writing) only two intend to export the fuel. The remainder are intended for domestic mobility, industrial, residential, and agricultural applications. Announced projects that haven't yet secured FID tell a different story: nearly half intend to export.[54] The money seems to be following projects that are domestically focused, while the risk of an oversupplied domestic hydrogen industry remains unresolved.

> We're presenting ourselves as the hydrogen maker of the future but, at the same time, we haven't built any of the infrastructure that we need. We could still be undone by not planning ahead for the workforce, or renewables, or by not understanding the social licence requirements sufficiently.
>
> **Dr Fiona Simon, CEO, Australian Hydrogen Council**

CONCLUSION

Australia finds itself at a crossroads in this critical moment for the global hydrogen opportunity. Although early out of the gate to establish a green hydrogen capability, the nation has since lost its lead to international competitors. As Australia's progress has slowed, pressure has grown on the scale and economic viability of the nation's hydrogen hopes.

To remain competitive, Australia must establish a clear hydrogen direction with meaningful targets for supply and domestic and international demand. Re-focusing efforts to lock-in offtake agreements will help secure final investment decisions and move the country's green hydrogen projects from announcements to viable businesses. If Australia is to decarbonise its industries and be a formidable global hydrogen market contender, the urgency of the task is clear.

END NOTES

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