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Australia's hydrogen tipping point: The urgent case to support renewable hydrogen production

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Executive summary

The transition to net zero is ushering in a new economics of comparative advantage and clean manufacturing – the energy-industrial complex reigns supreme.

For much of Australia's post-war industrial history, tyranny of distance, the cost of labour and our small domestic market have worked against our ability to compete as a global industrial powerhouse. But in the transition to a low carbon world, access to renewable energy will become an increasingly important cost driver. Markets and firms that decarbonise their supply chains swiftly and at low cost will rise to the top. This promises new opportunities for Australia, if we act swiftly enough to seize the moment.

Our future is not just ours to make, but it is for others to take. As economies around the world embark on the greatest transformation since the industrial revolution, our destiny is one for us to forge, for the things that we can do, with one eye on our global competitors. In the current transformation, the competitive landscape has been radically altered by the comprehensiveness and aggressiveness of the Inflation Reduction Act of 2022 – on a scale and magnitude which cannot be ignored.

The economic race is a transformation of the entire production system of our economy – to generate economic growth and jobs and income, decoupled from high emissions intensity. The transformation begins with the energy which powers our economy – namely a shift towards clean, renewable energy as a reliable, efficient, and effective input into our production systems. It will trigger development of a **new energy-industrial complex**, which will become a driver of innovation and productivity growth, a determinant of price levels, and a barometer for economic resilience. The acceleration of investment into renewable power is the first enabler of the new energy-industrial complex.

Hydrogen has the potential to be a tipping point for Australian manufacturing

As the energy fuel mix shifts, particularly towards clean electrification, hydrogen emerges as a significant new component of Australia's energy needs. This is because hydrogen has the potential to decarbonise 'hard-to-abate' industries, such as heavy transport, metals refining and fertiliser production. Australia's competitive position in renewable hydrogen could tip the playing field back in Australia's favour as a manufacturing economy by lowering input costs and accelerating agglomeration effects in industrial clusters.

Today, Australia stands at a crossroads. We could be on the edge of the precipice of a virtuous cycle where accelerating deployments of renewable electricity and renewable hydrogen unlock clean manufacturing at scale in regional Australia, accelerating our transition, distributing the benefits, and increasing national economic complexity.

Yet crossing this tipping point is proving challenging and the clock is ticking because emerging global competitors are moving quickly.

This decade matters – hydrogen producers are likely to develop significant and persistent first mover advantages and the USA, Europe and Gulf State producers are entering into a bidding war for market share and dominance

The global hydrogen market is expected to deliver significant first mover advantages and positive economic spillover effects driven by long-term contracts. This dynamic is expected to trigger a **race to scaled production** where innovation drives production down the cost curve. But the economic and commercial benefits of innovation extend beyond technology development and maybe sticky and persistent supply contracts are likely to accrue to the early movers.

A delayed start due to low competitiveness could leave Australia with limited opportunities for the hydrogen value chain, a smaller clean energy manufacturing base, forgone labour productivity gains, and a mountain to climb to break into scaled hydrogen production in later years.

In turn, this would slow the decarbonisation of Australia's industrial base, inhibit momentum for regional economic diversification, and delay development of a new tax base. More than this, delay risks forgoing opportunities for low cost renewables and hydrogen to cornerstone the revival of Australian clean manufacturing.

Aggressive industrial policies from global competitors will reduce Australia's renewable hydrogen production – we must respond

Despite Australia's clean energy ambitions, the reality is our global competitiveness is declining. In part this is driven by higher domestic renewable electricity prices than in competitor markets, but it is also driven by decisive policy action in these markets too. The Inflation Reduction Act is the most visible example of this, but the EU, Canada, and a number of Gulf States have also embraced market intervention.

We estimate that if Australia does not respond to the Inflation Reduction Act, we could **export 65% less hydrogen** p.a. by 2050 than before the IRA's introduction, **with scaled production delayed until after 2030**. This could mean that renewable hydrogen never reaches a comparable scale with our current fossil fuel exports, with implications for our balance of trade and clean manufacturing aspirations.

Industry policy is changing, and Australia must respond. This does not require Australia to blindly follow policy settings in other countries. But it does require careful consideration of what it would take to compete where we have existing advantages, and how we can achieve this at least cost to our economy.

We suggest six design principles that should shape a renewed Australian industrial policy including for renewable hydrogen:

1. Time bound; surgical intervention focused on critical elements of the value chain
2. Leverage the benefits of competition and shape markets that unambiguously benefit domestic and export objectives
3. Prioritise long-term and sustainable value to drive economic development and provide an economic and social dividend from interventions
4. Government intervention needs to be simple and efficient to implement
5. Reinforce dynamic industrial and service ecosystems
6. Enable place-based just transitions.

Swift policy action could ensure Australia's global competitiveness

Our analysis suggests there are substantial differences between policy the levers that Australia could choose to incentivise hydrogen production. Production credits emerge as more efficient at incentivising additional hydrogen production than capital grants or investment tax credits.

Our analysis also suggests there is a **Goldilocks zone for policy intervention – around a A$2/kg** hydrogen production credit. This is around half the level of the maximum credit in the IRA for renewable hydrogen, reflecting Australia's underlying comparative advantages and keeping an eye on fiscal objectives.

This would require **public investment of A$15.5 billion in today's terms over a decade**. If we get it right, Australia would be on track to produce almost 16 million tonnes of renewable hydrogen a year by 2050, with exports worth **A$17.4 billion** a year in today's terms. Crucially, we would match the decline of our fossil fuel industries with the growth of new clean industries.

New industrial policy settings must demonstrate long-term public value

Policy settings for hydrogen will need to strike a balance between competitiveness, community expectations, and geostrategic power shifts. We cannot develop a hydrogen and clean manufacturing economy in the way of previous resource booms. This means acknowledging the trade-offs up front and taking an approach which builds out place-based industrial ecosystems and offers support across value chains to maximise value-added economic activity within Australia.

The window to act is closing fast

Much like carbon, there is a time value of industrial policy. There is a short window for Australia to act and ensure its competitiveness and lay the foundations for a significant new industry. The competition will continue to increase, but without intervention, Australia risks a smaller industry that does not live up to public promises, fails to deliver for regions in transition, and fails to offset declining fossil fuels.

1. Hydrogen's role in Australia's future

The economics of clean manufacturing

For much of Australia's post-war industrial history, our tyranny of distance, labour costs and economies of scale have worked against our ability to compete as a global manufacturing powerhouse.[1] In more recent times, Australian manufacturing has been tied to energy prices, which have remained higher than competitors.[2] As a consequence, our economy has grown less complex, less resilient, and the case for rebuilding a manufacturing base has remained an aspiration.

The transition to net zero is altering the structure of national economies. In a transitioning world, manufacturing will remain driven by economies of scale, but access to renewable energy and clean feedstocks will become an increasingly important cost driver and enabler of market access.

With significant renewable energy potential, Australia has clear comparative advantages in a low carbon future. This is the logic that underpins aspirations for Australia to become a renewable energy superpower building our capabilities in green metals, fertilisers and renewable energy component value chains.

As **Exhibit 1** shows, hydrogen will be a key part of Australia's competitiveness in this new economic order – making up 10-15% of our energy mix.[3]

In this new world, clean energy and manufacturing value chains are a fundamental of economic growth.

The **energy-industrial complex** (see **Exhibit 2**) becomes a driver of innovation and productivity growth, a determinant of price levels, and a barometer for economic resilience. In this future, **speed and scale** of renewable energy and clean manufacturing deployment matter, as fast-moving technology frontiers make markets sensitive to compounding innovation and advantages are likely to be sticky.

[1] McLean, Ian, (2012) 'Why Australia Prospered: The Shifting Sources of Economic Growth'

[2] Deloitte (2022) 'Bringing Manufacturing Home: How companies can succeed on the global stage with Australian manufacturing' < https://www2.deloitte.com/au/en/blog/consulting-blog/2022/bringing-manufacturing-home.html>

[3] Deloitte (2022) 'The Electrification of Everything' < https://www2.deloitte.com/au/en/pages/energy-and-resources/articles/energy-system-deep-dive.html>

[4] Ibid

Exhibit 1: Australia's energy mix to 2070[4]

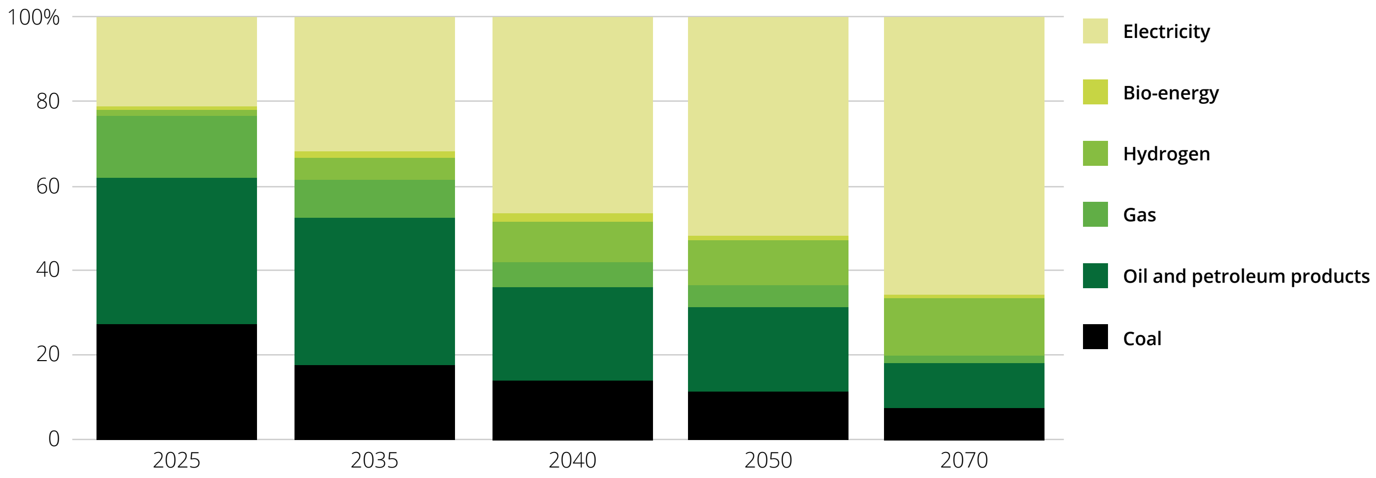
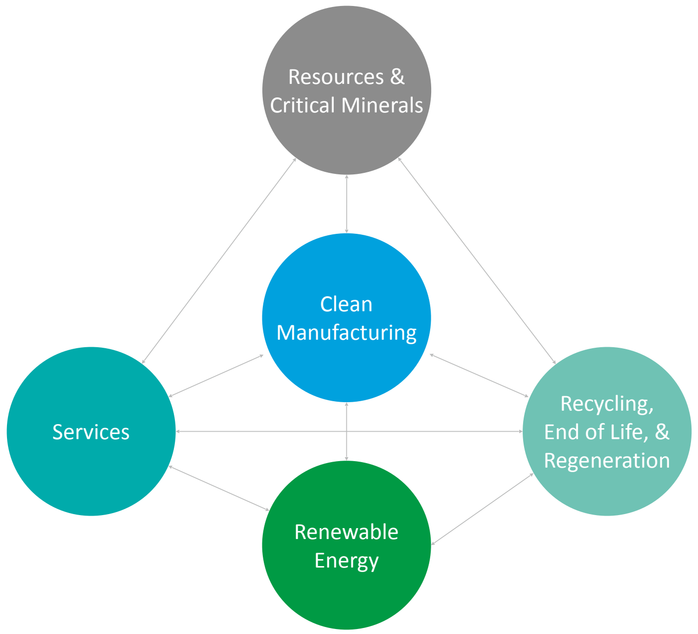


Exhibit 2: The energy-industrial complex



1. Hydrogen's role in Australia's future

If Australia's energy-industrial complex is aligned, accelerating deployment of renewables and renewable hydrogen will put downward pressure on input prices and increase Australia's manufacturing competitiveness and attractiveness. In turn, this supports investment and job creation in Australia's industrial regions.

However, this virtuous cycle is not preordained. Complacency and overreliance on our comparative advantages could see Australia fail to trigger this virtuous cycle. This could leave the economy with higher input prices than would otherwise be the case and narrow our pathway to develop significant and globally competitive clean manufacturing capabilities.

Renewable hydrogen has a key role to play in Australia's decarbonisation journey

Hydrogen has received considerable interest in recent years, as its role in decarbonisation has become clearer. Forecasts of hydrogen's role vary widely, with different use cases considered commercially viable. Some studies suggest hydrogen is likely to be a 500-600 Mt p.a. market by 2050.[5] Others are more pessimistic, seeing demand around half these levels but may not reflect a Paris-aligned pathway.[6] In either scenario, hydrogen production will grow substantially from the 95 million tonnes produced today. Crucially, virtually all hydrogen today is produced from fossil fuels.

The question is how fast will the existing supply of hydrogen itself decarbonise, how quickly will industrial sectors of the economy turn to renewable hydrogen to speed their emissions reduction; and how quickly can new renewable hydrogen supply be brought online at scale? Demand, and timing of demand for renewable hydrogen, will vary by specific end use (**Exhibit 3**).[7]

[5] See for example Bloomberg 'New Energy Outlook 2022' (2022) <https://about.bnef.com/new-energy-outlook/>.

[6] See for example DNV 'Hydrogen Forecast to 2050' (2022) <https://www.dnv.com/focus-areas/hydrogen/forecast-to-2050.html>

[7] Deloitte "Hydrogen: Making it Happen" (2023) <https://www2.deloitte.com/nl/nl/pages/energy-resources-industrials/articles/hydrogen-report.html>

Exhibit 3: Uses of renewable hydrogen

Sectors		Role of Clean Hydrogen		Timing		
				2030+	2040+	Comments
Industry	**Steel**	H	**Reduction agent** for DRI or BF-BOF and for high temperatures	✔	✔	**Voluntary demand**, but long asset replacement times
Industry	**Ammonia**	H	Feedstock to **produce ammonia**	✔	✔	**Ease of asset replacement**, as H2 is already used
Industry	**Methanol**	H	Feedstock to **produce methanol**	✔	✔	
Industry	**Refining**	H	Feedstock for **hydro-cracking and –treating**	✔	✔	
Industry	**Other chemicals**	M	Feedstock and / or fuel for **steam cracking**	—	—	Depending on **economics** (vs e-cracking)
Industry	**Cement**	M	**Booster fuel** to increase calorific value	✘	—	**Unfavourable short-term economics** (vs biomass used)
Industry	**Other industry**	L	Most can be **directly electrified / niche applications**	✘	—	Depending on **economics**
Mobility	**Road freight**	H	Fuel in **heavy-duty long-haul** transport	✔	✔	**Voluntary demand** and **favourable economics**
Mobility	**Shipping**	H	Fuel in international shipping in the form of **H2, ammonia** or **methanol**	—	✔	Lack of **technology alignment and maturity**
Mobility	**Aviation**	H	**Direct use** or as **feedstock** to produce **Sustainable Aviation Fuel**	✔	✔	**Regulatory pressure** (EU) and **no asset changes** needed
Mobility	**Cars**	L	**Electrification possible** and more economic	✘	✘	
Mobility	**Trains**	M	Fuel to **replace diesel engine trains** in long-haul transport	✘	—	
Build	**Residential**	L	Heating alternative in case of **economic limitations of electrification** (e.g. high cost to electrify buildings with poor insulation)	✘	—	Expected to **first start in areas where electrification is not economic**
Build	**Commercial**	L		✘	—	
Power		M	Balance intermittency from renewables through **storage**	✘	—	Required **when renewables reach high share in energy mix**

1. Hydrogen's role in Australia's future

For Australia, hydrogen will play an essential role in decarbonising hard-to-abate sectors such as chemical and fertiliser production, alumina refining, steel, cement and heavy transport.

Australia's hard-to-abate sectors are those where our emissions are where our emissions are high, and where carbon-linked import policies such as Europe's carbon border adjustment mechanism (CBAM) will begin to bite, either directly or through intermediaries, such as South Korean manufacturers selling into Europe.

Again, it is shaping up to be a question of timing. While many Australian industrial operators have made decarbonisation commitments, how they will deliver emissions reduction is still being determined. Recent market developments suggest that in the short term, industrial players are likely to purchase carbon offsets and credits rather than choosing to switch to renewable hydrogen.[8]

This is principally driven by the relatively high costs of renewable hydrogen at today's prices – as prices decline, hydrogen will break even with carbon credits and absolute emissions reductions will be realised.

The economics of renewable hydrogen will get stronger as regulators begin to focus on Paris-aligned decarbonisation and as instruments such as CBAMs are contemplated and implemented in more markets.

Early deployment of cost-competitive renewable hydrogen would accelerate decarbonisation in Australia. For example:

- Switching to green ammonia in Australia's fertiliser production industry would save 4.25 $MtCO_{2e}$ each year.[9]
- Switching to renewable hydrogen calcination in alumina refining would save 3.5 $MtCO_{2e}$ p.a.[10]
- Together, this would account for 23.7% of Australia's emissions from industrial processes and product use[11] or the equivalent of taking 1.6 million cars off Australia's roads each year.[12]

[8] Department of Climate Change, Energy, Environment, and Water 'Safeguard Mechanism Reforms' (2023)

[9] Assumes 8.5kg CO2e per kg hydrogen; 5.4 Mt of fertiliser produced in Australia each year based on data from the Fertilizer Australia

[10] ARENA, 'A Roadmap for Decarbonising Australian Alumina Refining' (2022) < https://arena.gov.au/knowledge-bank/a-roadmap-for-decarbonising-australian-alumina-refining/ >

[11] Department of Industry, Science, Energy and Resources (2022) 'National Inventory Report' < https://www.dcceew.gov.au/sites/default/files/documents/national-inventory-report-2020-volume-1.pdf>

[12] Calculated using the United States Environmental Protection Agency Greenhouse Gas Equivalencies Calculator < https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator>

1. Hydrogen's role in Australia's future

Renewable hydrogen could become an enabler of Australia's clean manufacturing aspirations

Australia has publicly stated ambitions to 'be a country that makes things again'[13] and to invest in 'green metals, steel, alumina, aluminium; clean energy component manufacturing; hydrogen electrolysers and fuel switching'.[14]

Each of these ambitions is grounded in established industries and comparative advantages – our existing footprint in mining and refining, our rapidly growing demand for renewables and renewable hydrogen. But delivering against these ambitions is non-trivial and requires deliberate efforts across value chains to secure and link inputs and outputs across stages of production.

Seen from this perspective, renewable hydrogen offers more potential than just decarbonisation. It is a key ingredient for Australia's clean manufacturing aspirations.[15]

Renewable hydrogen produced via electrolysis requires significant volumes of renewable energy to produce. For example, a million tonnes of renewable hydrogen could require as much as 27GW of combined solar and wind generation capacity to produce each year.[16] This demand for low carbon technologies will be materials intensive – a recent study from the World Bank and the Hydrogen Council suggests that a number of minerals that Australia currently produces will be in significant demand, including: aluminium, zinc, copper, nickel, manganese, titanium and platinum group metals.[17] An integrated approach to developing domestic clean manufacturing capabilities would therefore consider how to leverage this demand which Australia is uniquely suited to meet.

Deployment of the scale of renewables required to build out a globally significant hydrogen industry offers four related opportunities for Australia to build economic complexity and move down value chains from our currently resource intensive model to:

1. Localise and circulate the value of essential and critical minerals necessary to build and deploy renewables and electrolysers for hydrogen
2. Deploy the renewables necessary to enable large-scale and low-carbon metals processing in Australia, such as green iron and steel
3. Leverage large and growing domestic demand and potential supply chain constraints to move into subcomponent manufacturing in key renewable supply chains
4. Combine scaled renewables and hydrogen to produce value-added green metals such as iron, steel, alumina, and aluminium.

[13] Hon Ed Husic MP, Minister for Industry and Science, 29 November 2022, 'National Press Club Address' <https://www.minister.industry.gov.au/ministers/husic/speeches/national-press-club-address-building-economy-future>

[14] Hon Ed Husic MP, Minister for Industry and Science, 10 October 2022, 'Address to the Australian Steel Convention' < https://www.minister.industry.gov.au/ministers/husic/speeches/address-australian-steel-convention >

[15] Ross Garnaut 'The Superpower Transformation: Making Australia's Zero Carbon Future' (2022), La Trobe University Press

[16] Based on Deloitte modelling; note that this assumes no battery utilisation in renewable hydrogen production

[17] World Bank 'Sufficiency, sustainability and circularity of critical materials for renewable hydrogen' (2022) <https://www.worldbank.org/en/topic/energy/publication/sufficiency-sustainability-and-circularity-of-critical-materials-for-clean-hydrogen>

1. Hydrogen's role in Australia's future

Capturing these opportunities is far from easy. It will require policymakers and industry alike to shift away from consideration of linear supply chains to integrated value chains and production ecosystems.[18] Together, these efforts will build out Australia's energy-industrial complex.

The timing of Australia's development of renewable hydrogen matters

The shift to net zero has material implications for regional Australia where fossil fuel dependent jobs are heavily concentrated.[19] To date, transition plans and announcements for these regions have relied upon forecasts of job creation from clean manufacturing sectors.[20] Renewable hydrogen production is central to these transition plans – both as an enabler of industrial decarbonisation and a foundation for clean manufacturing development.

However, this implies that Australia can scale renewable hydrogen development to coincide with the decline of existing industries such as thermal coal.

The same challenges will be borne by State and Federal Governments who respectively collect fossil fuel royalties and company tax revenues. This suggests that Australia's medium- to long-term term fiscal outlook is also linked to this sequencing challenge.

For example, previous modelling suggests that Australia's economy will suffer over the long run because of the physical damages of climate change if no meaningful action is taken, thus reducing economic activity by A$3.4 trillion by 2070.[21]

The Reserve Bank of Australia has modelled the impact of a net zero by 2050 scenario on Australian exports of coal and LNG, finding significant declines by 2030.[22] This suggests that the decline of fossil fuel intensive exports will begin to erode a share of the tax base while market pressures on producers expedite their transition plans or consign them to stranded asset status.

Meaningful action on climate change will result in a growing not slowing economy. An export-scale hydrogen sector provides an opportunity to provide a new tax base and replace the fossil fuel revenues that will erode as part of the global energy transition.

However, three questions remain unanswered:

1. What is the appropriate form of taxation for the hydrogen economy?
2. What magnitude of contribution could hydrogen, directly and indirectly, make to government revenues?
3. When is hydrogen revenue likely to begin to enter government coffers?

Announced projects are yet to translate into scaled production

Three years on from the publication of Australia's National Hydrogen Strategy, much has changed. CSIRO's hydrogen project tracker lists 111 prospective projects, 26 of which are export scale.[23] Yet despite public funding rounds from ARENA and several state governments, only two projects – both 10 MW facilities in Western Australia[24] – have reached financial close. Many projects are trapped in a bankability gap between offtake negotiations, persistently high electricity prices, and constrained supply chains.

Over the same period, the rest of the world has quickly caught up – particularly regions with high renewable potential. Significant projects are progressing in the US[25] and the Gulf States.[26] These regions are seeing larger projects reaching financial close, significant public investments, and they are drawing attention and effort from project developers.

This paper seeks to reenergise the debate in Australia about renewable hydrogen. It does so by outlining the contours of an inevitable public debate about the size of the future industry, appropriate policy support measures, and how the industry could deliver public value for Australians.

[18] See for example the four fundamentals for developing innovative production ecosystems – Breznitz, D. (2021) 'Innovation in Real Places: Strategies for Prosperity in an Unforgiving World'

[19] Smith, W. Philips, T 'Who's buying? The impact of global decarbonisation on Australia's regions' (2022) < https://cpd.org.au/wp-content/uploads/2022/01/Whos-Buying-Report.pdf>

[20] See for example Australian Energy Transitions Initiative 'Setting up industrial regions for net zero' (2022) < https://energytransitionsinitiative.org/wp-content/uploads/2022/06/Setting-up-industrial-regions-for-net zero-Australian-Industry-ETI-report-JUNE-2022.pdf>

[21] Business Council of Australia (2021) 'Achieving a net zero economy' <https://www.bca.com.au/achieving_net_zero_with_more_jobs_and_stronger_regions>

[22] Reserve Bank of Australia, 'Towards Net Zero: Implications for Australia of Energy Policies in East Asia (September 2021) <https://www.rba.gov.au/publications/bulletin/2021/sep/towards-net zero-implications-for-australia-of-energy-policies-in-east-asia.html>

[23] CSIRO, 'Hydrogen Map', November 2022.

[24] ARENA 'Australia's first large scale hydrogen plant to be built in Pilbara', 16 September 2022 and Reneweconomy 'First solar hydrogen project strikes offtake deal, to nearly double solar farm' 2 February 2023.

[25] See for example Trammo "Trammo and ReMo Energy sign MoU – Development of a low-carbon NH3 & exclusive offtake of green NH3' (17 October 2022) < https://www.trammo.com/post/trammo-and-remo-energy-sign-mou-development-of-a-low-carbon-nh3-exclusive-offtake-of-green-nh3>

[26] See for example Hydrogen Insight, 3 October 2022, 'Green hydrogen's new hotspot?' < https://www.hydrogeninsight.com/production/green-hydrogens-new-hotspot-developers-pledge-42bn-spend-on-flood-of-egyptian-projects/2-1-1325823>

2. Australia's role in the global hydrogen market

Renewable hydrogen will be a global market and more competitive than Australia may expect.

Renewable hydrogen will be a global market from day one. Climate change is a global concern that requires every country to decarbonise, entailing a global need for renewable hydrogen. While demand will start in industrialised economies, the hydrogen economy is also a major sustainable growth opportunity for developing countries. The latter can take advantage of their natural resources to develop their own ecosystems, address a growing local demand driven by the net zero transition, and integrate into the global value chain by exporting part of their hydrogen production to other regions.

It is well understood that regions like Australia, with high quality renewable energy endowments will be well placed to be globally significant renewable hydrogen suppliers. This means that supply will be especially large in the Middle East, Africa, Latin America, USA, China and Australia.

But we must also recognise that unlike previous commodity booms, renewable hydrogen can be produced virtually anywhere. This suggests competition will be stronger in the renewable hydrogen market than in the existing oil and gas or mineral markets. Put simply, scarcity is no longer enough to guarantee a sizeable industry.

A further consideration is that only a subset of hydrogen will be traded across international borders. It is widely expected that in many cases, renewable hydrogen will be produced and consumed in situ in industrial hubs.[27] Across intermediate distances – such as across Europe, or from North Africa to Europe – pipelines may be feasible and lower cost than shipping. Finally, there will be regions where seaborne renewable hydrogen is the only viable pathway – such as between Australia and Asia.

Feasibility of seaborne hydrogen is still being undertaken and transport via ammonia is a key component of many proponent plans today.

[27] IRENA 'Global hydrogen trade to meet the 1.5C climate goal: Part 1 – Trade outlook to 2050 and way forward' (2022)

Overcoming the commercialisation gap is the threshold issue

At present, renewable hydrogen faces cost disadvantages compared to more emissions-intensive alternatives – a commercialisation gap. For instance, if the relative costs of moving to a cleaner manufacturing process are high and there remains uncertainty about the benefits of cleaner products – such as a green premium or no imminent threat of lost markets – an Australian fertiliser company may delay its switch to renewable hydrogen.

The **commercialisation gap** is not unique to renewable hydrogen – it is a feature of early-stage industries and nascent markets. The presence of unpriced carbon externalities can exacerbate the commercialisation gap, but this is increasingly being rectified by the introduction of carbon pricing globally.

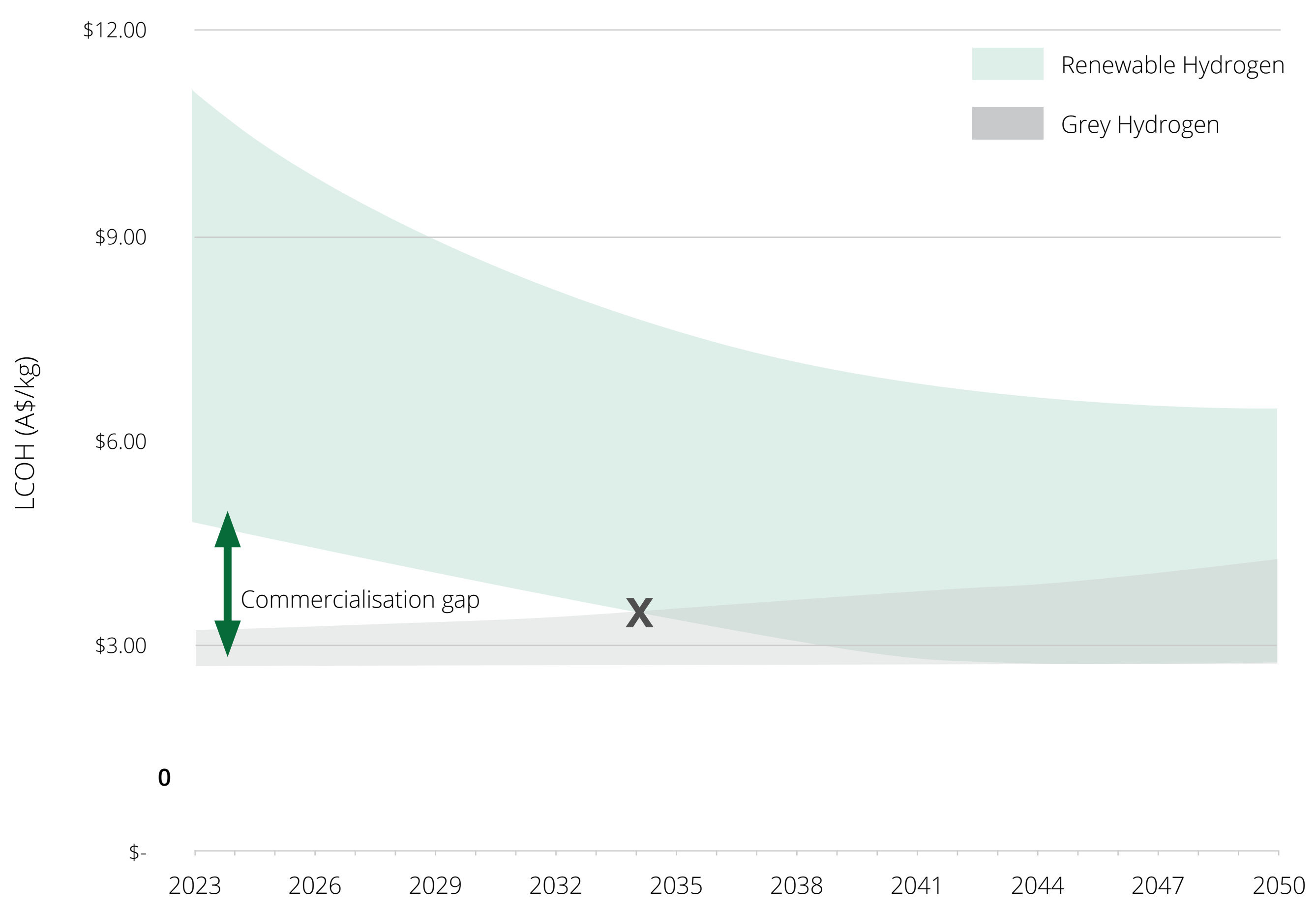
Based on today's prices and the reforms to Australia's Safeguard Mechanism, renewable hydrogen in Australia is likely to close its commercialisation gap in the early 2030s (**Exhibit 4**). This could be brought forward by scaled production which drives technology costs lower, earlier.

There are several enablers of cost-competitive renewable hydrogen including economies of scale achieved by large-scale production, reductions in electrolyser costs as technologies improve, reductions in renewable power prices, and a range of efficiency gains. While the innovation literature and experience suggest that these gains will diffuse across all producers, it is likely that there will be medium-term discontinuities where some producers[28] and regions gain competitive advantages over others. It seems reasonable to assume these advantages would correlate with the length of offtake agreements.

[28] See for example Systemiq, University of Exeter, Simon Sharpe, and Bezos Earth Fund 'The Breakthrough Effect' (2023)

[29] Deloitte analysis based on Australia's production potential. Grey hydrogen prices are developed using Advisian 'Australian Hydrogen Market Study' (2021). The upper bound of grey hydrogen prices includes an equivalent A$/kg carbon price aligned to the reformed Safeguard Mechanism price cap.

Exhibit 4: Renewable hydrogen cost competitiveness over time[29]



Speed and scale may outweigh comparative advantage before 2030

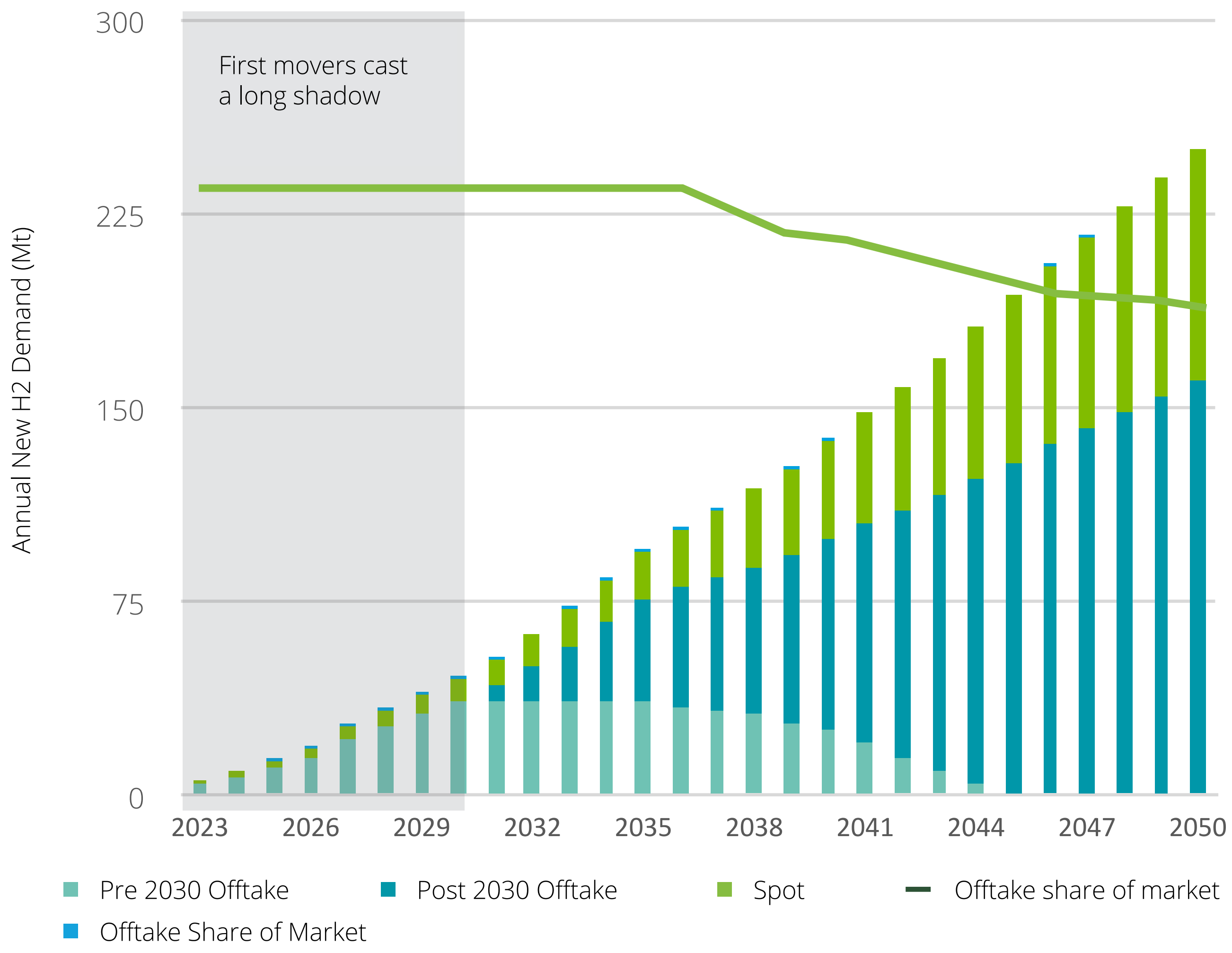
The next decade is likely to become a **race to secure contracts** (offtake) for renewable hydrogen producers.

A key characteristic of the emerging hydrogen market is the long-term nature of contracts. This means that locking in contracts can lock others out of the market for considerable periods of time. In an economic sense, it means that the demand curve is lumpy and non-continuous.

The hydrogen market is expected to follow the trajectory of similar industries and be dominated by long-term offtake agreements (see **Exhibit 5**) which will be required to underwrite the finance required for renewable production.

Supply contracts will lock in market share for first movers and provide capital, track record, and intellectual property for follow-on production. By the time the market matures, it may be dominated by large, vertically integrated players with productivity and scale advantages until further technology breakthroughs disrupt the market equilibrium.

Exhibit 5: Potential development trajectory for renewable hydrogen market structure[30]



[30] Deloitte analysis based on historic development of the LNG industry. This conservatively assumes 80% of hydrogen demand is captured in 15-year offtake contracts each year. From 2035 it assumes 60% of demand is recaptured by long-term offtake. Demand is adapted from DNV 'Hydrogen Forecast to 2050' (2022) <https://www.dnv.com/focus-areas/hydrogen/forecast-to-2050.html>

2. Australia's role in the global hydrogen market

There are six reasons first movers are likely to lock in significant advantages with elements of persistence:

1. **Trajectory of similar industries** such as Australian LNG (Northwest Shelf),[31] China's dominance of the solar PV and lithium-ion value chains,[32] Europe's outsized role in offshore wind manufacturing,[33] and the UK's shipbuilding industry in the early 20th century[34] all show the persistence of production advantages even as favourable policy settings are withdrawn and competitive forces intensify.

2. **Intellectual property development** early movers are likely to develop intellectual property around optimisation of at-scale renewable hydrogen production (e.g. control processes, optimisation of variable renewable energy inputs). Research shows catching up in intellectual property remains the most difficult for later market entrants.[35] Early innovation is also likely to facilitate currently undiscovered upsides, uncovered through entrepreneurship and commercialisation.

3. **Transaction cost advantages** could be realised by producers who reach scale early. This would see these players strengthen their client relationships, build a brand and track record of delivery, and credibility with investors.

4. **Regional agglomeration effects** are most likely where scale is achieved early, as this will lower the costs of co-locating other parts of the hydrogen value chain. In turn, this could drive further innovation and intellectual property gains.

5. **Regional labour productivity gains** appear common in early stage industries and can spill over to geographically proximate industries, delivering a regional dividend.[36]

6. **Workforce constraints** driven by a demand for a specialised hydrogen workforce has the potential for projects to outstrip supply in the short run. Early movers will be best positioned to acquire, train, and retain the requisite workforce.

[31] Gardner, R (1989), The North West Shelf Natural Gas Project: An Analysis of Critical Events

[32] Binz, C, Tang, T, Huenteler, J. 'Spatial lifecycles of cleantech industries – the global development history of solar photovoltaics' (2017) Energy Policy.

[33] Afeweki, S. and Steen, M 'Gaining lead firm position in an emerging industry: A global production networks analysis of two Scandinavian energy firms in offshore wind power'(2022) Competition & Change

[34] Hanlon, W, 'The persistent effect of temporary input cost advantages in shipbuilding, 1850-1911', NBER Working Paper (2019)

[35] Binz, C, Tang, T, Huenteler, J. 'Spatial lifecycles of cleantech industries – The global development history of solar photovoltaics' (2017) Energy Policy.

[36] See for example Pillai, S, 'Learning to Scale or Scaling to Learn? An Empirical Exploration of Production Scaling in the Early American Automotive Industry.' Bocconi University (25 June 2019) and Greenstone, M et al, 'Identifying agglomeration spillovers: evidence from million dollar plants' (2008) NBER Working Paper 13833

Taken together, these factors suggest that first movers could unlock a virtuous cycle of supply agreements enabling them to build competitive advantages, and then using these competitive advantages to retain market share as the industry matures.

A number of these factors are likely to be persistent and some are likely to be region-specific. When combined with the lack of comparative advantage in the short run, it appears that the renewable hydrogen market could be dominated in the medium term by early players who reach significant scale.

This is not to say that other producers could not emerge and compete. Global investment in renewable hydrogen will certainly drive down technology costs and enable cheaper production in future years and comparative advantages will remain relevant. It simply suggests that later entrants will have a steep hill to climb to develop differentiated capability and reach scale.

3. Australia's competitiveness is at risk

Five key elements of renewable hydrogen competitiveness

Australia's National Hydrogen Strategy and many other policy documents reference Australia's comparative advantages which will give us an edge as a hydrogen producer.

We have world-class renewable energy potential, ranking in the top two globally for onshore wind capacity and utility-scale solar PV capacity.[37]

Proximity to Asia provides a natural advantage for exporting seaborne renewable hydrogen to Asia relative to other prospective exporters – effectively, lower shipping costs. Seaborne hydrogen still has to overcome some challenges with carriers - ammonia is currently assumed to be a viable shipping approach.

Australia is not alone in possessing comparative advantages in renewable hydrogen production. The United States, Gulf States including Saudi Arabia and Egypt, and African countries including Morocco and Namibia all have significant renewables endowments. These countries have also announced significant hydrogen production and clean manufacturing ambitions and multiple export-scale projects.

This suggests Australia's success is not preordained, and the costs of complacency are high. In fact, our analysis suggests that the economics of the IRA could have the unintended consequence of undermining Australia's export market share – namely in Japan and South Korea.

In the near term, no producing region is likely to have material comparative advantage in renewable hydrogen production – power prices are the key driver of cost variability. This is because original equipment manufacturers (OEMs) sell electrolysers on a global market, and capacity factors are in equivalence as developers will each select the best sites in each country for their first projects and each aspirational exporting market has some sites with high capacity factors.

Instead, regions will compete on cost in the short run in a race to scale and contracts.

We have identified five key elements of renewable hydrogen competitiveness, set out at **Exhibit 6**. These elements cover project economics (power prices, carbon prices, and policy support) and deployment constraints (enabling environment, workforce).

[37] Chu, Cheng-Ta and Hawkes, Adam 'A geographic information system-based global variable renewable potential assessment using spatially resolved simulation' (2019) Energy: 193

Exhibit 6: Elements of renewable hydrogen production competitiveness[38]

	Renewable Power Price (A$/MW)	Effective Carbon Price (A$/t CO2e)	Enabling Environment	Workforce	Policy Support for clean hydrogen
AU	$70-80	$37-75	28	0.37%	Capital grants
US	$30-40	$43	22	0.59%	Inflation Reduction Act
EU	$100-110	$123	6	0.78%	Green Deal Industrial Plan
Gulf States	$30-40	-	41		Sovereign Wealth Funds & Public Investment
Chile	$40-45	$7	9	0.41%	Capital grants
Sources	Based on Deloitte interviews regarding PPA pricing	Based on World Bank Carbon Pricing Dashboard	Based on ranking in Bloomberg Climate Scope 2022	Based on IRENA clean energy workforce estimates as share of total employed persons	Qualitative based on announced policy settings

[38] Renewable power prices from Deloitte interviews and Pexapark; carbon price data from World Bank 'Carbon Pricing Dashboard' (2023) <https://carbonpricingdashboard.worldbank.org/> for Australia the range reflects ACCU prices and the Safeguard Mechanism credit cap; enabling environment ranking based on Bloomberg 'ClimateScope Results 2022' <https://global-climatescope.org/results/>; workforce data are based on data from IRENA 'Renewable energy employment by technology' (2022) <https://www.irena.org/Data/View-data-by-topic/Benefits/Renewable-Energy-Employment-by-Country>; Policy settings are based on Deloitte's assessment of the quantum of funding available and market reactions

3. Australia's competitiveness is at risk

As Exhibit 6 suggests, competitiveness as a scaled hydrogen producer demands differentiation and advantage relative to prospective competitors. And Australia risks being off the pace, particularly with respect to our renewable power prices, enabling environment, and policy support. For example, renewable power contracts can currently be struck in the US or Gulf States at less than half the price as those on Australia's east coast. This poses a significant challenge for Australia – improving our competitiveness is essential to unlocking first mover advantages.

Aggressive industrial policies are undercutting Australia's advantages

In response to the twin imperatives of decarbonisation and economic development from the net zero transition, several countries have announced or implemented significant green industrial policies with implications for Australia.

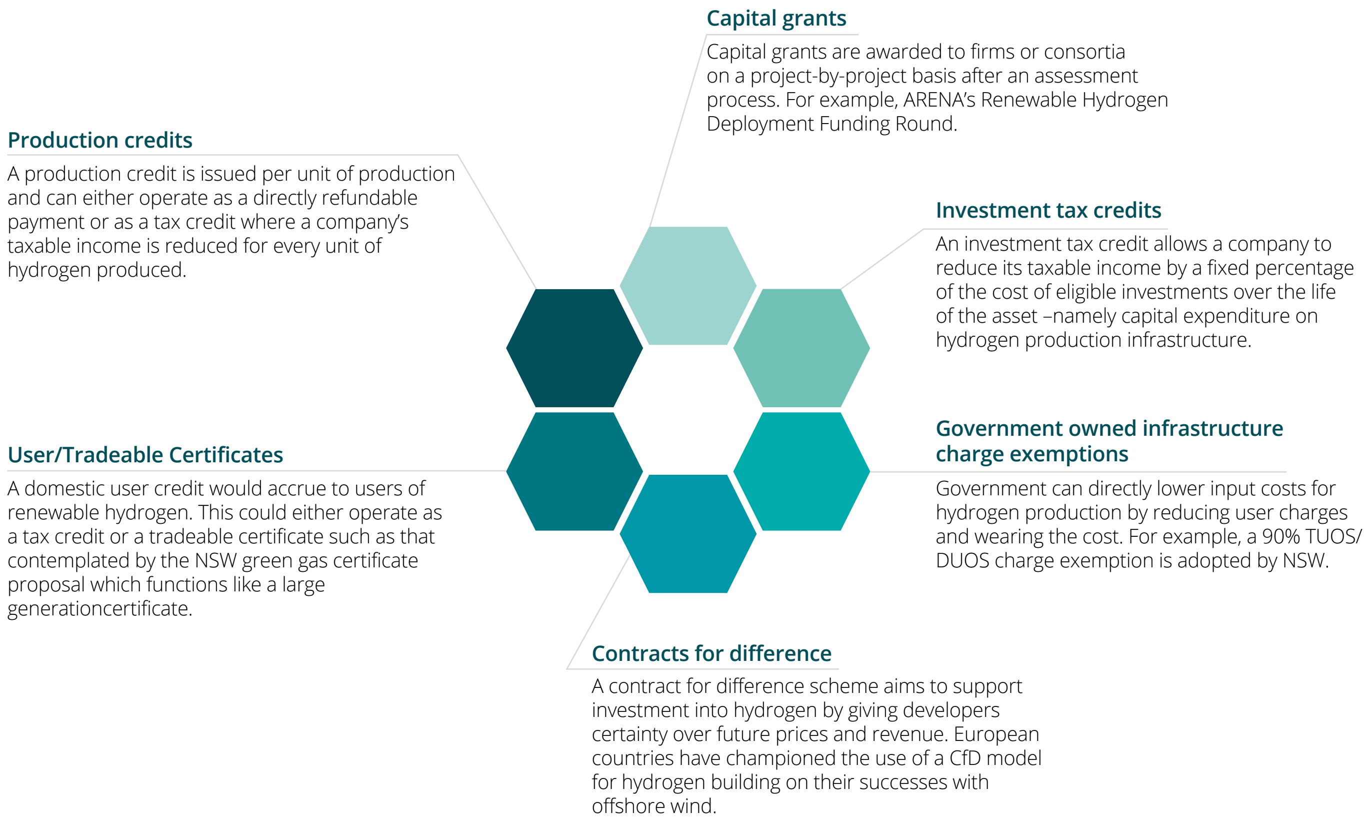
Exhibit 7 sets out the different types of policy levers aimed at incentivising additional hydrogen production in different markets. A number of these levers are actively being used in Australia, including up front capital grants from ARENA and infrastructure charge exemptions such as the TUOS/DUOS reduction for NSW hydrogen producers.

While Australia was an early mover in deploying these hydrogen support policies, **other markets have moved faster and harder**. Three recent policy interventions warrant Australia's attention:

The **Inflation Reduction Act** (IRA) makes US$369 billion (A$520 billion) in clean manufacturing support available for US-based low carbon activity. In many cases this support is uncapped, suggesting the total cost may be higher. Credits can also be stacked. For example, a hydrogen producer could benefit from a US$3/kg hydrogen production credit,[39] a US$15/MWh clean energy production credit, and lower renewable capex costs through clean manufacturing investment tax credit.[40] Stacked together these credits can reduce the cost of hydrogen production by more than A$4.50 per kg produced and now make US-produced renewable hydrogen the cheapest in the world.

The **EU Green Deal Industrial Plan** offers new investment incentives, including a production-linked credit for renewable hydrogen via an auction process. The first auction will be held later in 2023 and offers more than €800 million (A$1.2 billion) in support for hydrogen producers. It also aims to simplify the regulatory environment and project approvals and speed development of a clean manufacturing workforce.[41]

Exhibit 7: Taxonomy of hydrogen production policy levers



[39] Note, this is for hydrogen produced with <0.45 kg lifecycle carbon emissions per kg of hydrogen produced. Projects with higher lifecycle emissions would receive a lesser credit, down to a level of US$0.60/kg for hydrogen produced using 2.5-4kg of emissions per kg of hydrogen.

[40] Whitehouse 'Inflation Reduction Act Guidebook' (2022)

[41] European Commission 'A Green Deal Industrial Plan for the Net Zero Age' (2023)

3. Australia's competitiveness is at risk

Prospective producers in Gulf States look set to benefit from significant investments from sovereign wealth funds with very long-term return horizons and concessional access to government-owned infrastructure such as ports, pipelines, and transmission lines. For example, Saudi Arabia has recently announced a 1 trillion-SAR package (approx. US$266 billion)[42] to become a vertically integrated hydrogen and metals manufacturer. Targeted sectors include renewable hydrogen-derived green steel, green aluminium, and green fertilisers.[43]

These policy changes represent a new paradigm of industrial policy. Countries have shifted from market-enabling to market-shaping.[44] This interventionist approach has seen a shift away from more complicated but lower risk tools such as capital grants and contracts for difference towards direct production-linked incentives and greater government participation in enabling and common-user infrastructure projects.

Exhibit 8 illustrates Australia's challenge arising from policy intervention in other markets. Based on our analysis, the Inflation Reduction Act closes America's **renewable hydrogen commercialisation gap** – the price difference between renewable hydrogen and existing, higher carbon alternatives.

This enables supply agreements to be struck on today's terms, in turn supporting projects to reach final investment decision (FID) and construction. In contrast, if Australia does not close its commercialisation gap until the 2030s, it will be challenging to get significant projects deployed and we will be delayed entering the global market.

There is already evidence that the Inflation Reduction Act is having an effect with projects signing offtake agreements and reaching financial close.[45]

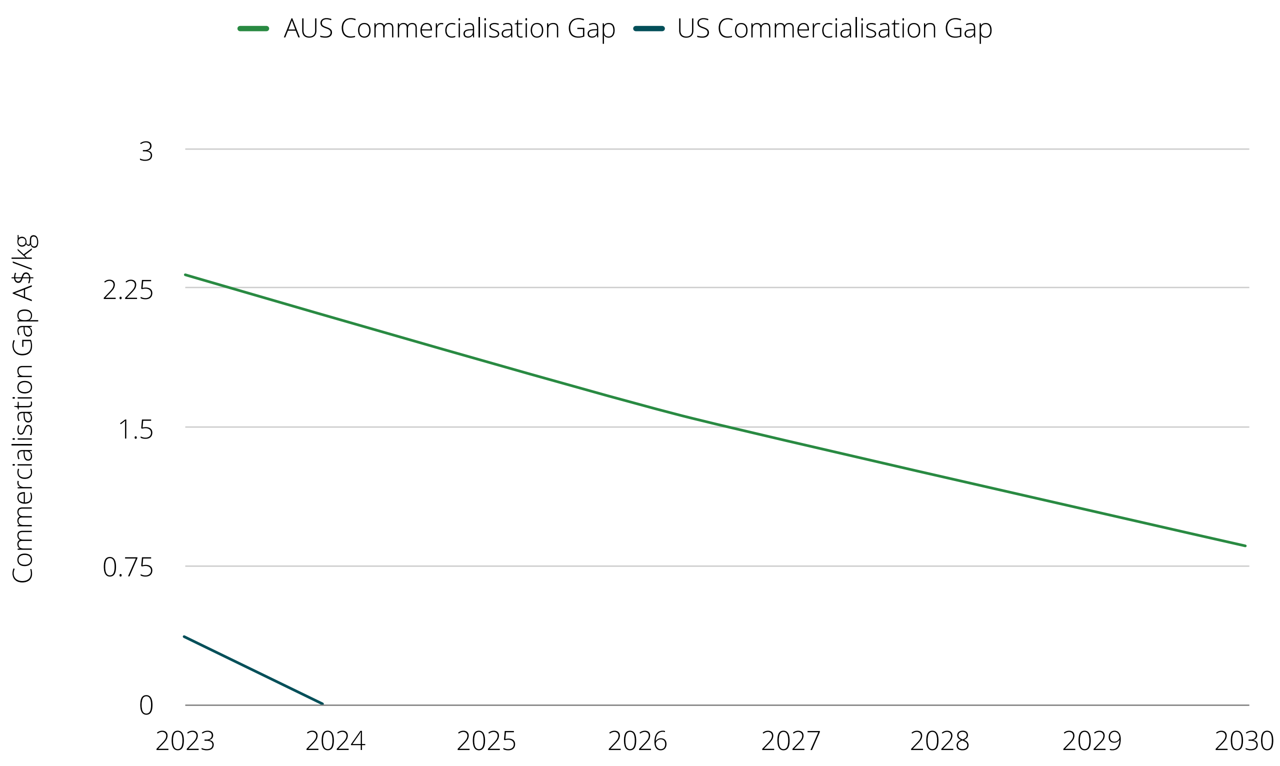
In contrast, Australia now faces a growing competitiveness gap with the US and other renewable hydrogen producers.

Speed to market is critical. The longer investment decisions are delayed, the more challenging it will be for Australian producers to enter the market.

In the meantime, we need to be mindful that American producers are actively investing, building and innovating to enhance their competitive position in the hydrogen market.

In turn, this will slow the decarbonisation of Australia's industrial base, inhibit momentum for regional economic diversification and postpone the development of a new tax base.

Exhibit 8: Renewable hydrogen Commercialisation Gap in Australia and USA[46]



[42] Assuming an exchange rate of USD1 to SAR3.75

[43] Hydrogen Insight 'Saudi Arabia aims to be world's leading hydrogen exporter as it announces US$266bn clean energy plan' (31 January 2023) < https://www.hydrogeninsight.com/policy/saudi-arabia-aims-to-be-worlds-leading-hydrogen-exporter-as-it-announces-266bn-clean-energy-plan/2-1-1396134

[44] See for example Oxford Smith School & Swedish Energy Agency 'The role of Ministries of Finance in driving and shaping the low-carbon energy transition' (2023)

[45] See for example Financial Times 'How Biden's climate law is charging US green spending and provoking Europe' (26 January 2023) < https://www.ft.com/content/6d43e8be-9b93-4430-b4d7-fe74fafe2835> and Trammo 'Trammo and ReMo Energy sign MoU – Development of a low-carbon NH3 & exclusive offtake of green NH3' (17 October 2022) < https://www.trammo.com/post/trammo-and-remo-energy-sign-mou-development-of-a-low-carbon-nh3-exclusive-offtake-of-green-nh3>

[46] Deloitte analysis based on bottom-up cost curves for hydrogen production. The commercialisation gap is calculated as the gap between the levelised cost of renewable hydrogen and the production cost of grey hydrogen including a carbon price.

3. Australia's competitiveness is at risk

Without action, Australia's hydrogen industry may never replace declining fossil fuels

It is one thing to speculate on the potential impact of competitor policy settings on Australia's renewable hydrogen production aspirations. Modelling is required to unpack impacts in greater depth.

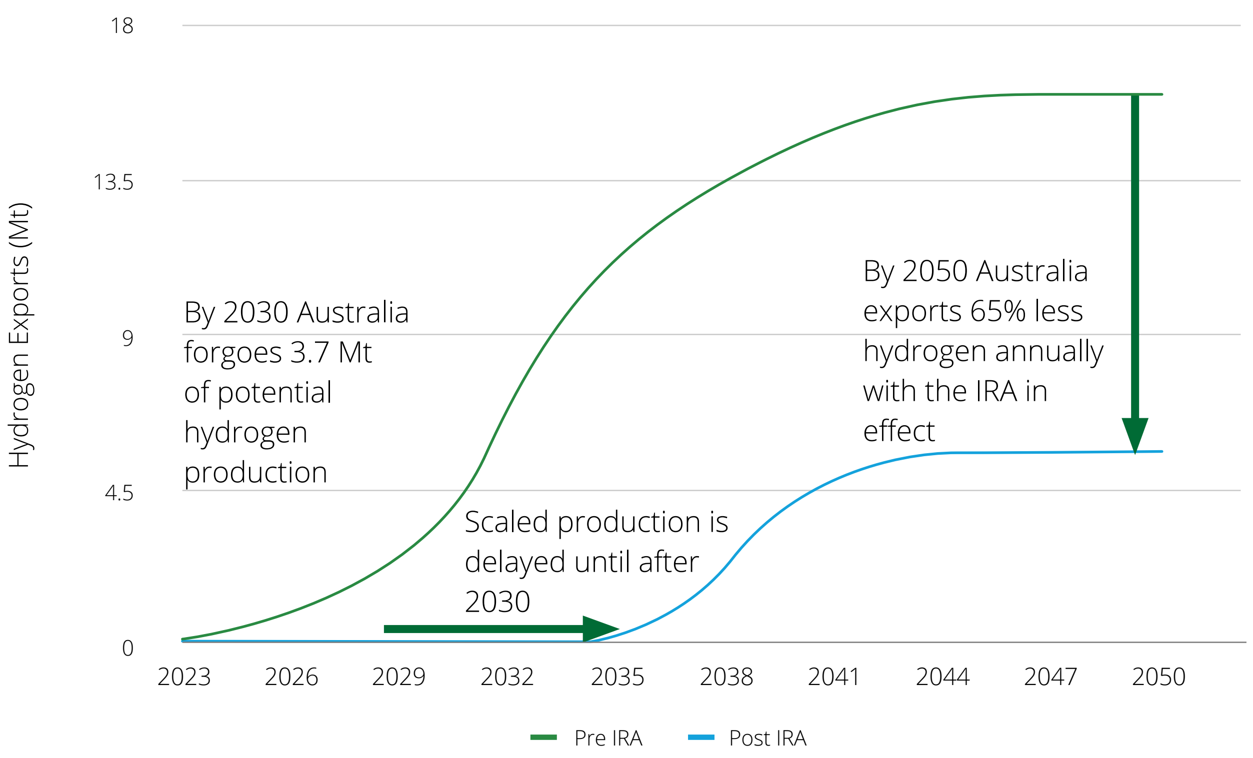
To shed light on this matter, we have undertaken stylised modelling of global renewable hydrogen trade under different policy settings to answer three core questions:

1. What are the impacts of the Inflation Reduction Act on Australia's hydrogen production potential?
2. What are the economic implications for Australia?
3. Is a policy response required?

Exhibit 9 shows that introduction of the Inflation Reduction Act's hydrogen incentives could have significant consequences for Australia's hydrogen export aspirations. Modelling shows that regardless of the IRA, Australia will supply its own hydrogen needs for industrial decarbonisation. However, the effect of IRA support pushes Australian-produced hydrogen out of Asian export markets. Our modelling assumes that any hydrogen destined for export is shipped in the form of ammonia.

The effect is swift and material. **By 2050, Australia produces 65% less hydrogen for export.** Crucially, **scaled production is delayed a decade** until the mid-2030s. This would likely result in Australia forgoing first mover advantages and being locked out of early offtake contracts.

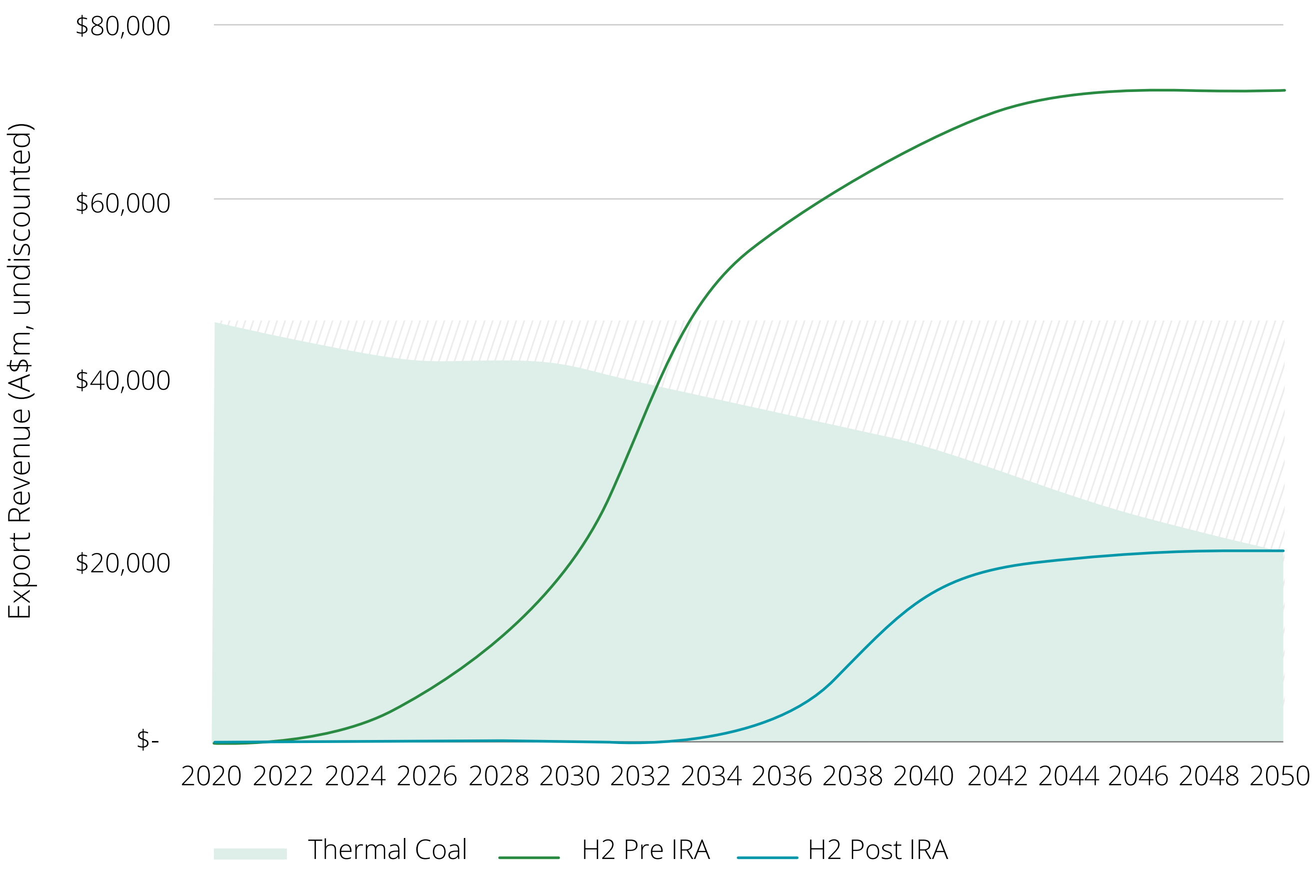
Exhibit 9: Australian hydrogen production before and after the Inflation Reduction Act[47]



[47] Deloitte analysis based on a market clearing model for hydrogen trade.

3. Australia's competitiveness is at risk

Exhibit 10: Hydrogen export revenues compared to thermal coal[48]



[48] Deloitte analysis based on a market clearing model for hydrogen trade. The projection for thermal coal revenues are from Deloitte Decarbonisation Solutions™ using the Below 2°C scenario from NGFS GCAM 5.3+

There are further implications for an orderly transition away from fossil-fuel intensive exports. Before the introduction of the Inflation Reduction Act, Australia's hydrogen industry would have been well placed and well timed to offset declining fossil fuel exports such as thermal coal, However, as can be seen in **Exhibit 10**, the IRA reduces Australia's production volume and delays development of scaled hydrogen production. This leaves a growing wedge of unreplaced export revenues, increasing the likelihood of a disorderly transition in regional communities.

With scaled production delayed until after 2030, Australia is unlikely to be a first mover. There are five implications for policymakers:

1. Smaller scale production will make the economics of co-location of the hydrogen value chain less attractive than in other regions. This could reduce agglomeration effects and therefore regional innovation potential
2. Significantly smaller and delayed production removes a material demand driver of renewable energy superabundance. This could therefore limit Australia's ability to move downstream into clean manufacturing opportunities such as green steel, particularly as other markets improve their competitiveness and individual companies commit projects and capital
3. Without globally competitive, scaled regional hydrogen hubs, Australia risks leaving potential productivity gains for industrial facilities on the table. Missing out on the learning-by-doing opportunities that are gained by other industrial regions at a point when industrial processes are being redeveloped could leave a lasting impact
4. An IRA-induced delay to scaled Australian hydrogen production will require development of differentiated capabilities to gain future market share
5. The consequences of a lack of scale for a non-trivial part of Australia's future energy mix suggests that Australia's production costs may well be higher than they otherwise need be.

4. Elements of the necessary policy response

Australia is at a crossroads

There is no doubt that Australia has the natural, economic, institutional and community endowments to become a globally competitive, clean manufacturing powerhouse.

The Australian governments are already doing many of the right things. The Federal Government's reform of the Safeguard Mechanism, formation of the National Energy Transformation Partnership, and funds such as Rewiring the Nation and the National Reconstruction Fund are ambitious and consequential. State Government policies such as Queensland's Energy and Jobs Plan, the New South Wales hydrogen hubs initiative, South Australia's hydrogen power station, and Western Australia's Renewable Hydrogen Roadmap are providing investors with clarity and opportunity.

But we must accept that there is a growing gap between policy aspirations and commercial realities today.

Australia faces a choice. A choice about our role in the global economy; a choice between an orderly and disorderly transition; a choice between acting early and acting late.

The choices are these:

- The pace of domestic decarbonisation and greening of our trade profile
- The speed of renewable energy deployment
- The pace at which we develop new industries to take advantage of demand for low carbon products
- The degree to which regional Australia faces economic disruption associated with transition
- The extent to which declining fossil fuel revenues impact the budget bottom line before new revenue lines materialise.

Should we choose not to respond to aggressive green industrial policies adopted by other countries then we are making a clear choice. Inaction risks a negative feedback loop where delayed decarbonisation and a slower pace of renewables deployment rule out economic diversification. In turn, this risks Australia's ability to attract capital and workers, to secure the technologies and components needed to transition, and to maintain stable and sustainable fiscal footings. Put simply, it makes the transition harder, more costly, and more contingent.

4. Elements of the necessary policy response

Design principles grounded in Australian context should shape a policy response

Given our comparative advantages, Australia does not need to replicate the policy solutions advanced by our competitors. But equally we cannot ignore the effects they are having on our market development and competitiveness. We need to develop our own guiding principles for how to respond, which reflect our unique comparative advantages, economic structure, and policy objectives.

We also need to acknowledge areas where our competitiveness is being eroded. As **Exhibit 6** demonstrated, areas of weakness include:

- A lack of competitive policy settings
- High input costs such as renewable energy costs
- Decarbonisation constraints such as low-cost offset-based alternatives for potential hydrogen off-takers
- Deployment constraints stemming from approvals pathways and supply chain disruption.

Six principles should shape a policy response:

1. **Time bound; surgical intervention focused on critical elements of the value chain.** This suggests that intervention must be time-limited to support industry establishment while carbon externalities and thin markets distort competition. Market segments must have potential to realise productivity gains necessary for cost-competitive global production by the end of the intervention period
2. **Leverage the benefits of competition to shape markets that unambiguously benefit domestic and export objectives.** Intervention should drive market-based competition and innovation to develop comparative advantages into competitive advantages with strong local to global flows of knowledge, demand and inputs. Competition will also ensure that that resources (including energy) are allocated to their most productive use, ensuring maximum value is added. But competition should operate with guardrails to avoid unintended consequences for domestic hydrogen users
3. **Prioritise long-term and sustainable value to drive economic development and deliver an economic and social dividend for intervention.** Intervention should deliver value for taxpayers and the Australian community. This should include seeking to make intervention cost-neutral where possible and identifying potential budget savings associated with new industry development. But it should also include a wider recognition of value created by the industry, including the value of expedited decarbonisation and management of transition risk in regional communities
4. **Government intervention needs to be simple and efficient to implement.** Intervention should be delivered at the least possible cost to economic efficiency, should only incentivise productive behaviour, should have the lowest administrative and compliance costs, and prioritise ease and speed of implementation
5. **Reinforce dynamic industrial and service ecosystems.** Intervention should seek to enhance Australia's innovation and production ecosystems consistent with what works. This suggests a focus on economic complexity and co-location of value chain elements in place-based hubs. Leveraging Australia's endowment of critical minerals to maximise value chain development appears a clear priority
6. **Enable place-based just transitions.** Intervention should support jobs and private investment in regional areas as well as the contributions of these regions to Australia's emission reduction targets. But it must also integrate with existing place-based policy settings and avoid creating costs for other place-based delivery systems.

Applied across the dimensions of competitiveness, Australia could trigger a tangible shift in market relevance and cross a tipping point to unlock a virtuous feedback loop of clean energy manufacturing, enabled by widely available renewable energy and hydrogen, where regional communities will be the primary beneficiaries of value-added economic activity, jobs, and emissions reduction.

But should government choose to respond to rapidly manifesting risks to our hydrogen and clean manufacturing potential, a different question manifests: what is the most efficient policy intervention?

Australia needs to select the right policy instruments to incentivise hydrogen production.

As can be seen in **Exhibit 7**, governments around the world have used a range of different policy instruments to incentivise renewable hydrogen production. But given the early stages of the market, there is limited real world data to evaluate these different policies to inform policymakers.

This paper addresses this challenge and provides policymakers with insights into the relative efficiency of different hydrogen support mechanisms. Policy efficiency is a measure of how government expenditure contributes to additional hydrogen produced in Australia, measured in (A$/tonne).

Exhibit 11: Policy efficiency compared across policy levers and magnitude

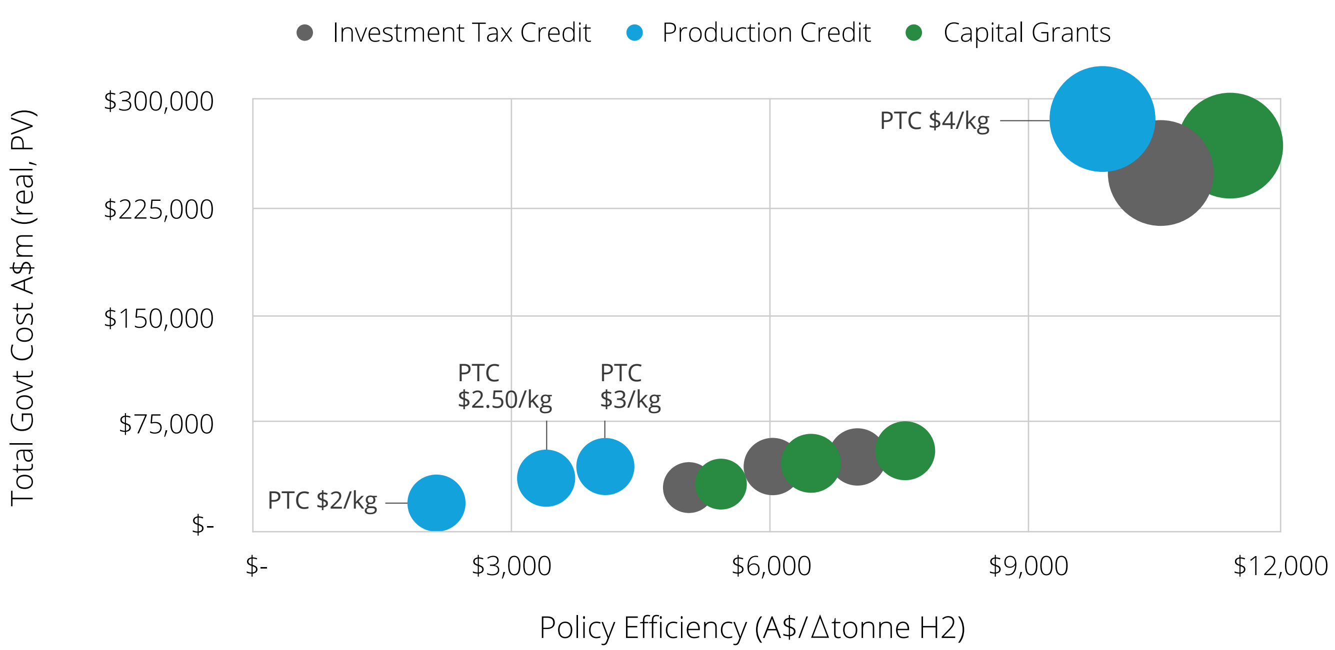


Exhibit 11 shows three classes of policy intervention: capital grants, investment tax credits, and production credits at different magnitudes.

The key insight for policymakers is that production credits are materially more efficient than other modelled interventions, costing less and incentivising more production. This is likely because future production credit payments are amortised into near term production costs, providing a reduction in levelised cost of hydrogen prior to the policy taking effect. By comparison, a capital grant or investment tax credit only impacts levelised cost of hydrogen in the initial years of cashflows when capital expenditure is assumed to take place.

Having identified that a production credit is a relatively efficient form of intervention to incentivise renewable hydrogen production, a question remains about the optimal magnitude of such a credit.

Exhibit 12 shows the additional hydrogen produced and cost to government in present value terms of adopting hydrogen production credits at different levels.

This exhibit clearly shows that a production credit does not have a linear impact on production; and there is a likely Goldilocks zone of policy intervention.

If the intervention is too small, marginal government support does not incentivise additional hydrogen production – in effect Australian producers remain uncompetitive with the US.

But intervention can also be too high – where incentivised Australian producers are competitive, but not competitive enough to reach additional markets. This is because displacement of competing production comes at an increasing marginal cost as each additional unit of Australian production is higher up the cost curve replacing a unit of competing production lower down the competitor's cost curve.

The impact of policy duration on policy efficiency is also considered. This analysis identified that production credits are highly sensitive to duration, and a shorter credit duration would materially reduce efficiency. This is because the Inflation Reduction Act support lasts for 10 years.

Getting policy intervention right offers transition upside

The analysis suggests that a **A$2/kg hydrogen production credit for 10 years** would be the most efficient way for Australia to reverse the negative spillovers of the IRA and chart a pathway to clean manufacturing for regional communities.

This is around half the level of the IRA's hydrogen production credit, reflecting Australia's pre-existing comparative advantages.

As **Exhibit 13** shows, this scale of intervention would restore Australian production.

This would require a **public investment of A$15.5 billion** in today's terms (net present value), over the decade.[50]

But a production credit alone is only part of the story. Australia must also ensure that we tackle challenges of renewable energy prices, barriers to deploying renewables at pace and scale, and support Safeguard Facilities to accelerate emissions reduction efforts while maintaining trade competitiveness.

Our analysis shows that if Australia gets it right, Australia could produce **15.94 Mt** of renewable hydrogen each year, with exports worth **A$17.4 billion** a year in today's terms (A$47.3bn p.a. undiscounted). Crucially, the decline of our fossil fuel industries would be matched by the growth of new clean industries, minimising transition challenges for regional Australia.

A scaled hydrogen industry could **bring forward 436 GW of solar and wind capacity** by 2050. This demand could underwrite manufacturing capabilities for the 48,500 wind turbines and 523 million solar panels needed for this alone.

[50] A standard discount rate of 7% is applied.

Exhibit 12: Production credit impact is highly sensitive to the magnitude of support in A$/kg terms

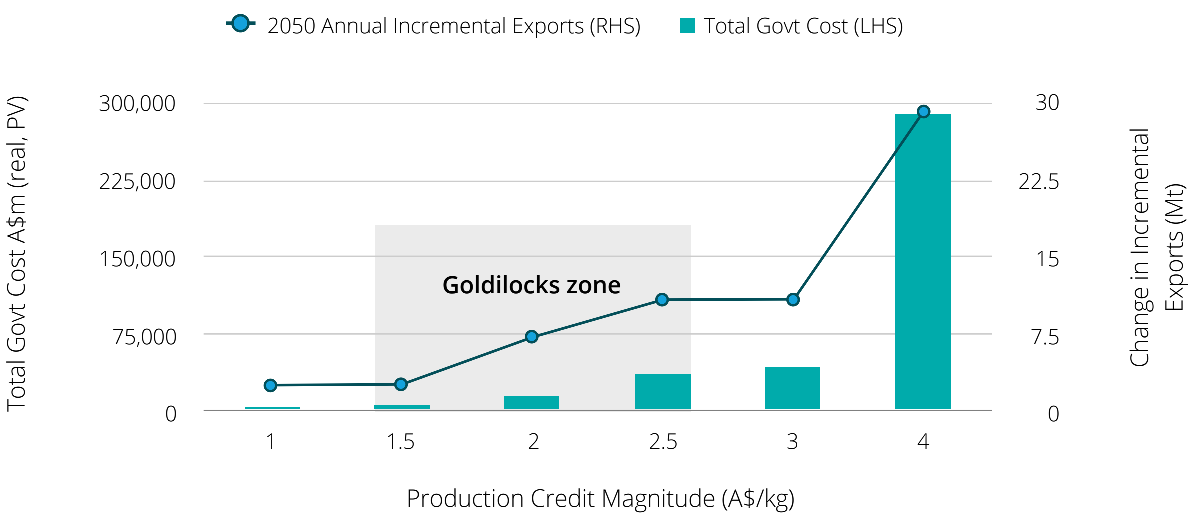
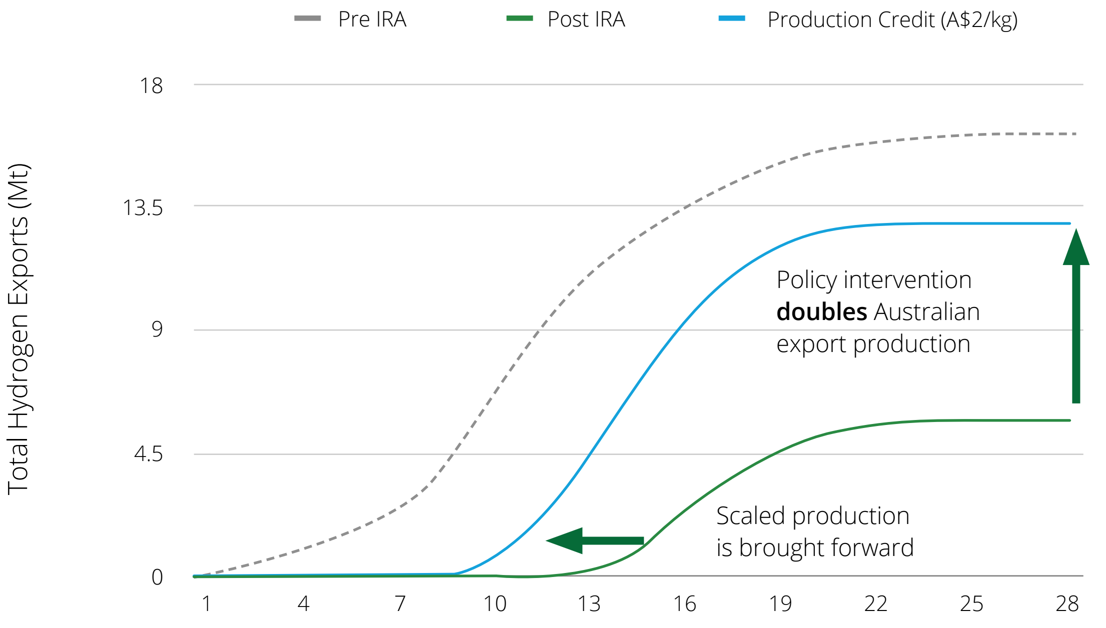


Exhibit 13: Australian hydrogen production after policy intervention



4. Elements of the necessary policy response

Hydrogen policy intervention must demonstrate long-term public value

Policy settings for hydrogen will need to strike a balance between competitiveness and community expectations. We cannot develop a hydrogen and clean manufacturing economy in the way of previous resource booms. This means acknowledging the trade-offs up front and taking a place-based and system-wide approach to industry development.[51] Crucially, it means placing public value at the core of a response to declining competitiveness in renewable hydrogen and clean manufacturing.

In parallel with minimising the direct cost of intervention to taxpayers, public value would be served by placing conditions on access to government support. Industrial policy settings in competitor markets are increasingly coming with additional conditionalities.[52] For example the Inflation Reduction Act has conditionalities attached to local content requirements, emissions intensity, wages, and place. Australia should consider linking hydrogen production support to lifecycle emissions, as per the IRA. This would ensure alignment with decarbonisation and the design principles for creating long-term sustainable value.

In addition to lessons from IRA conditionalities, development of Australia-specific policy support would be well placed to consider conditionalities that:

- limit government exposure to faster-than expected market development (e.g. clawback provisions)
- limit negative externalities and perverse incentives (e.g. limits on production when the energy grid reaches capacity)
- incentivise proactive, confidential data sharing (e.g. procurement information, capital planning, recruitment, environmental impacts) to support place-based transition coordination
- incentivise reinvestment into local innovation, value chain development and other productivity enhancing activities.

These conditionalities could also prioritise trade corridors or partnerships for specific value chains with specific markets – Australia-Korea and Australia-Japan. For example, this could entail linking development of a green steel value chain with South Korean hydrogen consumers and manufacturers. This could allow key markets to actively participate in the development of Australia's hydrogen industry and reduce their geostrategic risks of dependence on suppliers. The implications for agendas such as the Quad are significant and real. Further trade and security considerations are laid out in additional analysis by Deloitte.[53]

The window to act is closing fast

There has been considerable commentary following the introduction of the Inflation Reduction Act of a 'subsidy arms race' or a 'race to the bottom'. Other countries are raising objections in international forums.[54] Yet countries are also explicitly referencing the Inflation Reduction Act when they impose their own, green-linked industrial policies.

How Australia responds will be fundamental to our economic future. And we cannot risk delay.

The passage of time represents bandwidth, capital, and talent looking elsewhere to fulfil their clean manufacturing needs. Three emerging trends risk becoming the market norm:

1. Australian-grown clean manufacturing innovators are increasingly looking to the US and elsewhere to scale up their production[55]
2. Australian companies are being outbid for international talent, forgoing expertise and time[56]
3. Anecdotal evidence suggests that shortlists are already being drawn up for optimal sites for clean manufacturing of green steel, aluminium, and other metals, with Australia relegated as a potential development destination.[57]

There is a short window for Australia to act and ensure its competitiveness and lay the foundations for a significant new industry. The competition will continue to increase, but without intervention, Australia risks a smaller renewable hydrogen industry that does not live up to public promises, fails to deliver for regions in transition, and fails to offset declining fossil fuels.

[51] Deloitte (2021) 'Australia Remade: A country fit for the age of disruption' < https://www2.deloitte.com/au/en/pages/building-lucky-country/articles/australia-remade.html>

[52] See for example OECD (2022) 'Assessing environmental impact of measures in the OECD Green Recovery Database' <https://www.oecd.org/coronavirus/policy-responses/assessing-environmental-impact-of-measures-in-the-oecd-green-recovery-database-3f7e2670/> and Mazzucato, M. 'Rethinking the social contract between the state and business: a new approach to industrial strategy with conditionalities' Working paper 18/22 < https://www.ucl.ac.uk/bartlett/public-purpose/sites/bartlett_public_purpose/files/mazzucato_m._2022._rethinking_the_social_contract_between_the_state_and_business_a_new_approach_to_industrial_strategy_with_conditionalities.pdf>

[53] Deloitte (2023) 'A security policy for the global hydrogen economy' <https://www2.deloitte.com/de/de/pages/sustainability-climate-dsc/studies/a-security-policy-for-the-global-hydrogen-economy.html>

[54] Rob Harris 'Europe's EV feud with US must stop, says Australia's trade minister' (13 December 2022) < https://www.smh.com.au/world/europe/europe-s-ev-feud-with-us-must-stop-says-australia-s-trade-minister-20221213-p5c5y5.html>

[55] For example 5B, a NSW-based solar technology manufacturer is opening a new US-based production facility < https://5b.co/news/2022/5b-closes-aud55-million-series-b-funding-round-with-aud20-million-bp-ventures-investment>

[56] Thornton, K. 'The US has started a clean energy arms race' The Australian (6 February 2023)

[57] Deloitte analysis

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