



Australian Government



COAG  
Energy Council

# NATIONAL HYDROGEN STRATEGY

## Issues paper series

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This issues paper explores the opportunities for developing an export market for Australian hydrogen with partner countries.

The COAG Energy Council Hydrogen Working Group seeks feedback on the potential role of national policies and actions in realising these opportunities.

A list of questions is presented at the end seeking further input from interested stakeholders.

## Developing a hydrogen export industry

This paper has been informed by submissions to the *Request for Information* released in March this year, as well as:

- targeted visits to countries that have already started to develop hydrogen technologies and markets
- the stakeholder roundtables that were held throughout May and June

The COAG Energy Council Hydrogen Working Group would like to thank industry and community members for their engagement in the strategy development process.

In this paper, unless otherwise indicated, 'hydrogen' refers to 'clean hydrogen,' defined as being produced using renewable energy or using fossil fuels with carbon capture and storage (CCS). This definition reflects the principle of technology neutrality set by COAG Energy and Resources Ministers when they commissioned a comprehensive and ambitious strategy for the development of an Australian hydrogen industry.

### The value proposition

Global demand for hydrogen is increasing, and Australia is well-positioned to take advantage of the economic opportunity, particularly as export partner of choice for importing nations such as Japan and Korea. These nations are highly dependent on imported energy, and are focused on clean hydrogen-based fuels as part of transitioning from fossil fuels while ensuring energy security and diversity. Australia is already a valued energy provider and partner. Coupled with our relative geographical proximity, an abundance of renewable energy assets and experience developing resources and energy projects, we are well-placed to be a major hydrogen supplier to these nations.

As outlined in *Hydrogen for Australia's Future*,<sup>1</sup> East Asia is the likely key destination for our hydrogen exports, most notably Japan and South Korea, with Singapore and Taiwan also emerging as potential markets.<sup>2</sup> The Economic Research Institute for ASEAN and East Asia (ERIA) forecasts that Australia is poised to become the East Asia region's largest hydrogen exporting source, exporting 42% of regional supply by 2040.<sup>3</sup>

Hydrogen is an emerging market, which will grow organically in response to demand for clean energy. The value of the emerging large scale hydrogen market is unknown, but we know it could be immense. The International Renewable Energy Agency (IRENA) forecasts that around 8% of final energy consumption could be attributed to renewable hydrogen by 2050.<sup>4</sup> And the Hydrogen Council has a 2050 vision of creating a US\$2.5 trillion market for hydrogen and fuel cell equipment, which would provide sustainable employment for more than 30 million people.<sup>5</sup>

Meanwhile, ACIL Allen estimates in a medium hydrogen demand scenario that Australia's share of global trade in hydrogen could be worth up to \$5.7 billion in 2040, while the total economic contribution to the Australian economy could be up to \$473 million in 2025 and up to \$4.3 billion in 2040.<sup>6</sup>

## Australian benefits

ACIL Allen forecasts that, in Australia by 2040, up to 7,000 jobs could be created in the hydrogen supply chain for exports in a medium hydrogen demand scenario,<sup>7</sup> including for the provision of products and services to the hydrogen export industry. There are also likely to be spin-off opportunities across the energy, resources, manufacturing, services, transport and education sectors. A hydrogen export industry will also enable greater domestic adoption of hydrogen. This may improve the competitiveness of a number of export industries, particularly where there is increasing global and domestic demand for lower emissions products.

A substantial opportunity exists for the hydrogen industry to achieve growth across Australia. For renewable hydrogen, the greatest access to land, renewable resources and proximity to coastal shipping routes for at-scale production, will be in regional locations both on and off electricity grids. Hydrogen production for export could particularly benefit regional communities and traditional land owners. The hydrogen industry will need new skilled personnel as well as skilling up the existing workforce, and it will need to access to associated infrastructure – all of which will spur investment in local communities. This trend was observed in Australia’s development of the LNG industry – with which hydrogen shares a number of similarities.<sup>8</sup>

Developing Australian expertise in hydrogen could also become an important export. Just as we have experienced in the LNG industry, Australian industry could look to export more than the molecule; for example, technical skills, new or expanded supporting industries, equipment, intellectual property, education and training. Siemens’ submission noted government financial support for the deployment of multi-megawatt scale hydrogen production “... is a valuable investment to position Australia with the necessary skills, capabilities and capacity to address the demands of an export market, while already delivering the domestic benefits...”<sup>9</sup>

## Towards making Australia a hydrogen partner of choice

From our consultations with a range of industries and interested stakeholders across Australia, the Working Group has identified key actions and milestones needed for developing a hydrogen export industry in the period 2020-2030. **Table 1** outlines these actions including a number that are covered in more detail in the *Attracting hydrogen investment* paper and *Hydrogen at scale* paper. Actions shown in bold font are discussed in more detail in the following section *Pathways for capturing the opportunity*.

Table 1 – Potential actions required to develop Australia’s hydrogen export industry

2020-2023	2023-2025	2025-2030
<ul style="list-style-type: none"> <li>• <b>Secure high level country-to-country strategic agreements and define frameworks</b></li> <li>• <b>Secure Australia’s role as a leader nation in international engagement, including multilateral, bilateral forums, and collaboration in conferences, trade fairs, international events</b></li> <li>• <b>Collaborate and work with competitor nations, and global industry, to grow the market while maintaining a competitive advantage</b></li> <li>• Continue to support export supply chain pilot projects and associated RD&amp;D to reduce the costs of production and transportation</li> <li>• Continue to pursue investment opportunities for their early commercialisation</li> <li>• Develop guarantee of origin requirements to assist in substantiating clean hydrogen production and best position Australian clean hydrogen</li> <li>• Carry out quantitative analysis to determine cost competitiveness of Australian hydrogen production for export</li> <li>• Identify possible joint venture consortiums for future hydrogen supply chain development</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Secure offtake agreements</b></li> <li>• <b>Achieve Final Investment Decision on at least one large-scale hydrogen supply chain project</b></li> <li>• Finalise an infrastructure plan for hydrogen export supply chains</li> <li>• Establish Australia as a global base for hydrogen trade (export trading platform)</li> <li>• Continue to drive down the hydrogen supply chain cost curve – channel RD&amp;D towards technologies and approaches to bring down the cost of production and at-scale supply</li> <li>• Determine the best transport methods for Australia’s export supply chains</li> </ul>	<ul style="list-style-type: none"> <li>• Construct large-scale hydrogen supply chains to capture the benefits for Australia</li> <li>• <b>Achieve a target of fulfilling 50% of Japan and Korea’s hydrogen imports by 2030</b></li> </ul>

## Pathways to capturing the opportunity

For Australia to be ahead of the global race and ensure it becomes the partner of choice, we need to pursue a number of short, medium and longer-term actions. As one industry member noted at an export industry roundtable “it is a sprint if we want to be the first, but a marathon if we want to be a big player in the long run.”

### Production at scale

To provide certainty to both investors and the emerging market, we need to fully understand and quantify Australia’s potential to produce hydrogen at scale to meet the anticipated international demand. As outlined in the accompanying *Hydrogen at Scale* paper, estimates undertaken by a number of organisations quantify this potential. The Working Group has commissioned work to better quantify and locate these opportunities, to inform the overarching National Hydrogen Strategy. What we already know is that Australia has the natural resources, skills and knowledge, access to infrastructure and large scale LNG expertise that can enable large scale hydrogen supply chains to be developed.

Meeting Japan’s long-term targeted price of hydrogen will require significant cost reductions in both hydrogen’s production and its transportation. Japan has provided clear targets through its 2017 Basic Hydrogen Strategy for a delivered cost of hydrogen to be US\$3/kg by 2030 and US\$1.3/kg (or ¥13/Nm<sup>3</sup>) by 2050.<sup>10</sup> These are up to 10-fold reductions in current production cost, which will be assisted through continued fall in renewable energy input costs, along with scale-up cost efficiencies.

### Country-to-country agreements

Many submissions and comments throughout the consultations focused on the importance of government-to-government agreements to underpin joint commitments as partners of choice. In the short term, the Australian Government can pursue this avenue with important trading partners such as Japan, Korea and Singapore. Bilateral memorandums of understanding and trade agreements will signal confidence to the industry and help encourage negotiation of specific commercial offtake and financing agreements for at-scale projects. Australia already engages in regular energy and resources dialogues with Japan, Korea and Taiwan. Underpinning these activities and their success in developing investment in large scale projects is the assumption that specified cost targets can be met and can compete with other energy prices such as LNG.

While there is direct competition on the horizon – including Qatar, Norway, Saudi Arabia and Russia – estimates made by the Hydrogen Council and others of the size of the future global hydrogen market means all sources of hydrogen will be important to meet demand. Collaboration will be essential in order to develop a global hydrogen market and to compete. As outlined in the Chair’s *Tokyo Statement* from the first Hydrogen Energy Ministers’ Meetings in September 2019 in Tokyo, ‘*The Ministers and Delegates confirmed the value of collaborating to accelerate progress to ensure hydrogen technologies contribute to a Hydrogen Society...*’<sup>11</sup>

It is also worth considering what would happen if partner countries fail to achieve the hydrogen vision. As raised in the *Hydrogen at Scale*

Paper, Australia's largest opportunity is as a supplier to other countries, where the speed at which our industry scales up will be highly dependent on demand stimulus in other countries. Recent data compiled by Bloomberg New Energy Finance projects that Japan's short-term hydrogen targets (2020) for a number of applications may not be met and, in the case of domestic fuel cells, significantly so. It also notes Japan's draft 2019 Fifth Basic Energy Plan includes objectives of reducing nuclear and coal reliance, however does not lower overall targets for nuclear and coal.<sup>12</sup> Aurecon's submission notes

*"...on the demand side, a critical success factor is ensuring that our long term trading partners for energy commodities such as thermal coal and liquefied natural gas – principally Japan, China, South Korea – are engaged and progressing with their domestic energy market transformation in favour of hydrogen."<sup>13</sup>*

Establishing our domestic industry is a means of managing this risk, ensuring markets are available in the event that international markets do not emerge as quickly or as extensively as expected. This option also has domestic benefits, including decarbonising our own industries, introducing a new energy carrier in the mix, and developing new skills and technologies.

In the light of the above, Australia needs to regularly assess progress in major market nations and their likely future scale of hydrogen demand. Governments can advance conversations with these nations at the national level, and private industry will also continue to assess the industry's scale and opportunities.

### **International engagement on hydrogen**

Setting export targets would signal our export ambition to the international market and to investors. The Working Group suggests a possible aspirational target of aiming to secure 50% of Japan and Korea's supply by 2030.

The IEA report *The Future of Hydrogen – Seizing today's opportunities* identifies launching the hydrogen trade's first international shipping routes as a key near term opportunity to boost hydrogen on its path towards widespread use.<sup>14</sup> As part of its Basic Hydrogen Strategy,<sup>15</sup> Japan has identified Australia as a key partner to secure a commercial at scale project by 2030. This opportunity will be leveraged by the learnings from the Hydrogen Energy Supply Chain pilot project that is currently being piloted in Victoria until 2021.<sup>16</sup>

A hydrogen export industry will require the Australian Government to advocate and lead on a range of hydrogen industry matters through multilateral engagement across a variety of international organisations. These organisations range from forums for international negotiation, to those focused on the development of hydrogen as a fuel source, and technical level issues. These might include the G20, Hydrogen Energy Ministerial Meeting, the International Energy Agency, Mission Innovation, the Clean Energy Ministerial, the OECD, the United Nations Framework Convention on Climate Change, the International Partnership for Hydrogen and Fuel Cells in the Economy, the Asia-Pacific Economic Cooperation and the International Maritime Organisation.

Participants at consultations noted that international markets do not always differentiate between Australian jurisdictions and companies, rather viewing Australia as one entity. Australian jurisdictions and companies should adopt a 'Team Hydrogen Australia' approach to engagement, while allowing individual jurisdictions and companies to position their products and attract investment.

### **Securing offtake agreements**

Production at scale will be required for export, and it is difficult to finance infrastructure requirements without a guarantee or strong signal from customers that demand is there to provide a return on investment. This underpinning certainty can take many forms, such as foreign investment, offtake agreements from export markets, or domestic offtake agreements.

Governments could demonstrate leadership by providing initial financial support to encourage investment. Many submissions to the Working Group pointed to the West Australian Government's underwriting in 1979 of the first LNG project as an off-taker, providing the bridge for investors to undertake the project. The project's development cost was estimated at \$12 billion, an amount unprecedented in Australia's resource development at the time.<sup>17</sup> The WA Government signed take-or-pay contracts and the State Energy Commission of WA (SECWA) built a gas pipeline between Burrup and southwest Western Australia. The arrangement was legalised through the *North West Gas Development (Woodside) Agreement Act 1979 (WA)*.

### **Proactively solving technical barriers to trade**

Australia has the opportunity, capacity and potential to influence – or even lead – the development of global hydrogen regulations, standards and trade rules and access. Within Australia, regulations need to be harmonised between jurisdictions and between international standards to ensure consistent practice. This could become part of Australia's hydrogen value proposition and be a selling point to potential customers. At present, there are no agreed international rules on trading hydrogen, nor is there any global body or institution leading on the development of international hydrogen trade. In roundtables, participants told the Working Group that Australia, in conjunction with Japan and Korea, could take a leading role in developing these global standards and trade platforms.

### **Ensuring benefits are delivered to all Australians**

It is important to ensure that, in pursuing opportunities for industry resulting from Australia's role in an international hydrogen market, the benefits are also shared with Australians. Lessons can be learned from previous industry developments, and considering these lessons early and building them into the strategy will be essential. This is covered in more detail in the *Hydrogen at Scale* and *Understanding community concerns for safety and the environment* papers.

Developing a hydrogen export industry will be a marathon exercise. This means it is important to act on these issues now, so that we are ready to accelerate later. Japan's 2017 *Basic Hydrogen Strategy*<sup>18</sup> and its recently revised *Strategic Roadmap for Hydrogen and*



*Fuel Cells*,<sup>19</sup> aims to demonstrate liquefied hydrogen supply chain by the mid-2020s with large-scale imports from 2030 onwards, and sets targets up to and beyond 2050.

Australia must be prepared for sustained effort, beginning now and extending to the long term. We need to collaborate to compete – between both companies and governments in Australia and with international partners – to develop the scientific, technical and regulatory expertise to create an industry. Japan, in particular, is focused on securing multiple international supply chains for national energy security reasons, and we should look to collaborate to assist the organic growth of the market over the period 2020 to 2030, while maintaining our competitive advantages.



## Questions

The National Hydrogen Taskforce is seeking responses to the questions below. You can submit your comments via the Department of Industry, Innovation and Science's consultation Hub: <https://consult.industry.gov.au/national-hydrogen-strategy-taskforce/national-hydrogen-strategy-issues-papers>

- 1. How do we best position and sell the benefits to international partners of investing in Australia's emerging hydrogen industry?*
- 2. How could governments support the cost competitiveness of Australia's hydrogen exports?*
- 3. What could governments do to encourage commercial offtake agreements for export?*
- 4. How do we balance our global competitiveness with ensuring all Australians benefit when considering the collection of government revenues from hydrogen exports?*
- 5. What can (or should) be done to ensure an appropriate balance between export and domestic demand?*
- 6. How ambitious is the target of fulfilling 50% of Japan and Korea's hydrogen imports by 2030?*

## References

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- <sup>1</sup> <http://www.coagenergycouncil.gov.au/publications/hydrogen-australias-future>
- <sup>2</sup> *The Future of Hydrogen – Seizing today’s opportunities*, IEA report prepared for the G20, Japan June 2019
- <sup>3</sup> *Demand and Supply Potential of Hydrogen Energy in East Asia* ERIA Research Project Report 2018, No 01
- <sup>4</sup> *Global Energy Transformation*: International Renewable Energy Agency: A roadmap to 2050, p. 28
- <sup>5</sup> *Hydrogen scaling up: A sustainable pathway for the global energy transition*, Hydrogen Council, November 2017
- <sup>6</sup> ACIL Allen Consulting for ARENA, *Opportunities for Australia from Hydrogen Exports*, August 2018
- <sup>7</sup> *ibid.*
- <sup>8</sup> *Sustaining impact from Australian LNG operations*, McKinsey Australia, April 2016
- <sup>9</sup> [https://consult.industry.gov.au/national-hydrogen-strategy-taskforce/national-hydrogen-strategy-request-for-input/consultation/download\\_public\\_attachment?sqliD=question-2019-02-05-6971102952-publishablefilesquestion-1&uuld=512683188](https://consult.industry.gov.au/national-hydrogen-strategy-taskforce/national-hydrogen-strategy-request-for-input/consultation/download_public_attachment?sqliD=question-2019-02-05-6971102952-publishablefilesquestion-1&uuld=512683188)
- <sup>10</sup> <https://www.meti.go.jp/press/2018/03/20190312001/20190312001-3.pdf> accessed 6 June 2019
- <sup>11</sup> <https://www.meti.go.jp/press/2018/10/20181023011/20181023011-5.pdf>
- <sup>12</sup> *Japan’s new energy plan a medley of contradictions*, Bloomberg New Energy Finance, 17 May 2018
- <sup>13</sup> [https://consult.industry.gov.au/national-hydrogen-strategy-taskforce/national-hydrogen-strategy-request-for-input/consultation/download\\_public\\_attachment?sqliD=question-2019-02-05-6971102952-publishablefilesquestion-1&uuld=603918116](https://consult.industry.gov.au/national-hydrogen-strategy-taskforce/national-hydrogen-strategy-request-for-input/consultation/download_public_attachment?sqliD=question-2019-02-05-6971102952-publishablefilesquestion-1&uuld=603918116)
- <sup>14</sup> *The Future of Hydrogen – Seizing today’s opportunities*, IEA report prepared for the G20, Japan June 2019
- <sup>15</sup> [https://www.meti.go.jp/english/press/2017/pdf/1226\\_003b.pdf](https://www.meti.go.jp/english/press/2017/pdf/1226_003b.pdf) (*Basic Hydrogen Strategy*, December 2017 - English Translation)
- <sup>16</sup> <https://www.industry.gov.au/funding-and-incentives/mining/mining/low-emissions-technologies-for-fossil-fuels/hydrogen-energy-supply-chain-pilot-project>
- <sup>17</sup> House of Representatives Committees, Standing Committee on Industry, Science and Resources, *A sea of indifference – Australian industry participation in the North West Shelf Project*, 30 March 1998, Chapter 1, p 3
- <sup>18</sup> [https://www.meti.go.jp/english/press/2017/1226\\_003.html](https://www.meti.go.jp/english/press/2017/1226_003.html)
- <sup>19</sup> [https://www.meti.go.jp/english/press/2019/0312\\_002.html](https://www.meti.go.jp/english/press/2019/0312_002.html)