# Electricity and Energy Sector Plan – Discussion Paper

Australian Hydrogen Council
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## Introduction

The Australian Hydrogen Council (AHC) is the peak body for the hydrogen industry, with over 100 members from across the hydrogen value chain. Our members are at the forefront of Australia's hydrogen industry, developing the technology, skills and partnerships necessary to ensure that hydrogen and its derivatives play a meaningful role in decarbonising Australian industry.

AHC welcomes the opportunity to engage on the sectoral decarbonisation plan for electricity and energy and congratulates the Australian Government on its commitment to decarbonising Australia's electricity and energy sectors.

Hydrogen will be critical to decarbonise the hard to electrify and difficult to abate sectors of the economy, whether in its ability to decarbonise steelmaking (at least the iron ore reduction phase), provide heat for high temperature processes (such as processing bauxite into alumina to make aluminium), for heavy transport (including as a feedstock for future marine and aviation fuels), or to support food security via clean and green ammonia fertilisers. There is an enormous amount of work required to scale the production of clean and green hydrogen and derivatives to meet these future needs, none of which are currently commercially viable for decarbonisation purposes.[1]

It has been said that creating this new hydrogen industry is like the birth of the global LNG market, or the early solar industry. These were large and took years of focus, and this was *even though* each produced energy we could use and value; that is, natural gas and electricity. In contrast, we need to create an entirely new market for clean and green hydrogen, with new forms of production, new ways to use hydrogen and a new end-to-end supply chain that is supported with an appropriately resourced ecosystem.

In his recent announcement of the *Future Made in Australia Act*, the Prime Minister noted that there are enormous challenges in achieving decarbonisation of existing industry and in simultaneously building out the sovereign capabilities Australia will need to remain globally competitive in the coming decades. He also noted that Australia will require a new era of interventionalist policy in areas of national interest.[2]

We welcome this policy direction and hope that enough can be done, and soon enough, for Australia to take advantage of our natural advantages. Australia is already behind in delivering clear national policy on how it will deliver the energy transition domestically, and how will support decarbonisation in our region.

Australia's ability to produce hydrogen and its derivatives should be considered by the Australian Government as a key matter of national interest, supported by significant policy and investment incentives to increase the production, utilisation and potentially export of clean and green fuel alternatives. Cost competitiveness and parity with fossil fuels will not happen without preparedness for extensive, long term government support and provision of subsidies. Governments must be market creators at this stage of the energy transition, to enable the extensive reallocation of private

[1] The limited existing manufacture of hydrogen usually relies on fossil fuels for onsite needs.
[2] Albanese, A. (2024) *A future made in Australia*, Australian Government, speech, 11 April, https://www.pm.gov.au/media/future-made-australia.

funds alongside significant public expenditure required to support construction and operation of infrastructure in the public interest.

In 2023, AHC produced a position paper[3] in response to the draft National Hydrogen Strategy that considered the broad requirements for developing the hydrogen industry. This paper provides a comprehensive overview of the possible policy levers, enablers of investment, and inputs required by industry as it scales. The position paper is submitted for your consideration as an attachment to this response and its 53 recommendations are presented in the Appendix.

The rest of this submission provides additional information and context since our position paper was published, exploring:

- the role of molecules in facilitating domestic and regional industrial decarbonisation;
- useful improvements to the current policy settings;
- the problem of the high standards imposed on the nascent hydrogen industry;
- the necessity for whole of system net zero modelling; and
- the requirements for our clean energy workforce.

## The importance of molecules

We talk about molecules in this submission, so it is worth explaining what we mean. At a simple level, society uses electrons as electricity, and through storage such as batteries. Society also uses molecules, where energy is in a more stable and long-lived form, such as oil and its derivatives, and natural gas.

Electrification is an integral element of Australia's decarbonisation, and we support the logic of electrifying wherever this is possible and economic. However, this is already not an easy task, with almost 80 per cent of Australia's domestic energy consumption in FY2021-2022 in the form of molecules rather than electrons.[4]

While many applications for molecules will shift to electrons as electrification emerges as the most efficient option for continued operations, there is still a significant portion of industrial activity that will not be covered. And hydrogen is the only large-scale option for decarbonising energy that requires molecules.

Further, Australia is a trusted energy partner across Asia and the export of molecules is critical to Australia's prosperity. It is integral that export of energy vectors remains an option that is actively supported by government policy and incentives. Our trade partners are confronting their own decarbonisation challenges within their national context, and Australia has an important role in remaining a source of clean energy, in whatever form is required.

[3] AHC (2023) *A fit-for-purpose refreshed National Hydrogen Strategy: next steps for building Australia's hydrogen industry*, August, https://h2council.com.au/ahc-publications/.
[4] Calculated based on data found in Table H and Table R of Department of Climate Change, Energy, the Environment and Water (2023) *Australian Energy Statistics,* Australian Government, September, https://www.energy.gov.au/publications/australian-energy-update-2023.

## There needs to be stronger policy commitment

While we support the policy architecture proposed by the Australian Government to date (and welcome future clarification through this consultation and the other sectoral plan work to support an overall Net Zero Plan), there remain gaps to support clean and green molecules for the energy transition:

- **Safeguard Mechanism**: The amended Safeguard Mechanism is the key government policy to ensure industry decarbonisation aligns with legislated net zero targets and is Australia's core replacement for a carbon price. Beyond the obvious problem that the legislation covers the emissions of only the nation's highest emitters, it also doesn't go far enough to incentivise covered organisations to commit stronger or faster action. This is a particular problem when parties need to invest in hydrogen, because of the nascent status of the industry. While there have been promising trials announced, the Safeguard Mechanism – in its role as a pseudo carbon price – will need to be bolstered to accelerate uptake of decarbonisation solutions and increase investment in production facilities for clean and green hydrogen and derivatives.[5]

- **Carbon Leakage**: Many Australian industries produce products (including metals) for export. In an increasingly carbon constrained world, many nations are exploring carbon border leakage mechanisms in order to prevent unfair dumping of products produced in countries without significant decarbonisation policies and intentions, the most prominent of these being the CBAM in the European Union.[6] We support the Carbon Leakage Review,[7] and its purpose in assessing the impact of carbon mitigation policies on the viability of existing industries, as well as on investment attraction. We have previously argued that it makes sense that we need to protect emerging, domestic production, and so hydrogen, ammonia and urea should be included on the carbon leakage list.[8]

- **Sustainable Finance Strategy**: We reiterate our comments to the Treasury consultation paper [9] that it is paramount that the strategy mandates the use of the finalised taxonomies and explicitly accounts for clean molecules within them. It is important that the developers of the taxonomies (CCA, ASFI as well as Commonwealth departments developing the sector decarbonisation strategies) ensure that the supply and value chains associated with clean molecules are a focus for the modelling, guiding taxonomy development. Australia has

[5] AHC (2023) *A fit-for-purpose refreshed National Hydrogen Strategy: next steps for building Australia's hydrogen industry*, August, https://h2council.com.au/ahc-publications/.
[6] European Commission (2024) *Carbon Border Adjustment Mechanism*, https://taxation-customs.ec.europa.eu/carbon-border-adjustment-mechanism_en.
[7] DCCEEW (2023) *Public consultation on the proposed approach to assess and address carbon leakage risk, as part of the Carbon Leakage Review*, https://consult.dcceew.gov.au/consultation-proposed-approach-carbon-leakagerisk-as-part-of-the-carbon-leakage-review.
[8] AHC (2023) *Re: Public consultation on the proposed approach to assess and address carbon leakage risk, as part of the Carbon Leakage Review*, 15 December, https://h2council.com.au/wp-content/uploads/2023/12/231215- Carbon-Leakage-Review-AHC-SUB_for-submission.pdf.
[9] AHC (2023) *Re: Sustainable Finance Strategy*, 1 December, https://h2council.com.au/wp-content/uploads/2023/12/231201-Sustainable-Finance-Strategy_AHC-submission.pdf.

existing and emerging capabilities in producing, moving, storing, and using hydrogen and its derivatives. For these capacities to increase, the requirements for the supply chains need to be explicitly considered and modelled, rather than emerge as implied within the taxonomies.

Overall, whilst significant export of hydrogen and its derivatives is not anticipated until the early 2030s, planning and environmental approvals for the development and construction of supply chains and supporting infrastructure need to begin now – and the significant investment decisions required for these supply chains will not be taken by private sector actors until there is policy certainty and stability, alongside dedicated and long-term financial incentive or subsidy announced by the Australian Government.

Australian policy and decision makers are creating the economic conditions for the emergence of entire new industries in Australia. The products that could be manufactured, produced, and traded are central to the energy and economic security of our trading and security partners across the region. If we are to be successful in the efforts to decarbonise not only Australia but the region, Australian governments must be willing to increase their risk appetite – to expand the suite of investment options to include equity stakes, large debt financing and expanded contracts for difference to incentivise the uptake of clean molecules in place of those derived from fossil fuels. Again, we commend the Australian Government for its investment in the National Reconstruction Fund (Australia's manufacturing bank) to supplement the important work of the CEFC (Australia's green bank). But funding provided to these two agencies should be an order of magnitude higher if Australia's industrial and decarbonisation aims are to be met.

Our regional partners – in Japan, in Korea, Taiwan, and Singapore as well as across ASEAN – are ready to co-invest and co-design the early mover Australia projects, but not at any price and not without Australia demonstrating willingness to carry some of the cost burden and investment risk. The AHC contends that in the absence of very significant and rapid reallocation of Australian private capital, the scale of the investments required for hydrogen production (power, transmission, storage of electrons, electrolysers, storage of hydrogen as well as downstream uses of the hydrogen such as production of ammonia or reduction of iron ore) necessitate international investment. The AHC is hopeful that the regional and national investment priorities arising from the sector decarbonisation strategies currently under development will also consider the role of hydrogen investment.

## The transition to clean molecules needs a runway

The hydrogen industry in Australia is not being given the time and opportunity to decarbonise in a cost-competitive manner.

As Australia continues to phase out fossil fuel power generation, the grid (and therefore all industrial users of grid power) is transitioning to cleaner power and energy. Other industries have the option to connect to the grid and decarbonise alongside Australia's broader electricity transition.

However, hydrogen production using grid electricity is not encouraged. Instead, to be considered green (and often, to make the project economically viable), project proponents are increasingly expected to fund and build their own renewable source of power as input into hydrogen production, alongside the other downstream elements of their hydrogen supply chain, effectively doubling the

investment needed. This requirement for a purpose-built source of electrons is specific to production of molecules.

We understand and appreciate that hydrogen can be framed as an impediment to decarbonising the electricity grid, but this approach holds hydrogen to an unrealistic standard for an emerging industry that is not yet commercially viable. It will do irreparable harm to the sequencing of this transition.

Australia is known to have the largest pipeline of hydrogen projects in the world, but these are not reaching final investment decision and there is concern that, if Australian hurdles are not amended, the proponents may start to look elsewhere to progress projects. In some cases, we have seen Australian projects (even just for the renewables that will ultimately feed the hydrogen) doing the right thing by investing in decarbonising Australian industry, and yet being repeatedly delayed and downsized over prolonged periods to adhere to formal or unspoken standards imposed by governments, which can lead the projects to lose stakeholder confidence, fall over or have proponents pull out.[10]

We have seen other jurisdictions grappling with how to incentivise the hydrogen industry without placing broader energy system decarbonisation in jeopardy. For example, in the EU the requirement for additionality was increasing costs and halting hydrogen progress. This has instead been staged so that facilities constructed prior to 2028 are exempt from additionality until 2038.[11] This scaling up continues in terms of time-matching on a monthly basis before transitioning to hourly from 2030. In the Republic of Korea, the desire and intention to transition to low carbon hydrogen has been balanced in the design of the hydrogen auctions to allow (in the first instance) the use of grey (unabated) hydrogen to be used, to incentivise investment in the build out of the enabling infrastructure for storage, transportation, and use of hydrogen across the country.

These examples are provided not to argue for a lack of regulation or to leave it to the market; we must recalibrate and find the path of least harm. The overlapping priorities of the energy sector should not enable the disproportionate stifling of an industry before it can establish. This will need to be managed in a considered way and may require sensible trade-offs or bespoke solutions for each difficult priority that ultimately enables Australia's decarbonisation. This could manifest, for example, as time limited regulations on hydrogen, providing the relief to set up supply chains, build the infrastructure, develop scale, and begin to address the green premium.

## We need whole-of-system modelling

AHC is supportive of the approach throughout the Discussion Paper to electrify where this makes sense and follow the research and data when it comes to the hard to abate areas. Comprehensive and published planning information – defined here as projections and assessments of future energy

[10] For example: Parkinson, G. (2024) 'Major wind farm withdrawn after more planning delays, downsizing, name changes and fierce opposition', *Renew Economy*, 21 April, https://reneweconomy.com.au/major-wind-farm-withdrawn-after-more-planning-delays-downsizing-name-changes-and-fierce-opposition/#google_vignette.

[11] Hydrogen Europe (2024) 'A changing political landscape', *The Hydrogen Europe Quarterly*, Issue Q1 2024, https://hydrogeneurope.eu/wp-content/uploads/2024/03/The-Hydrogen-Europe-Quarterly_6_24DIGITAL_FINAL.pdf.

supply and demand pathways – would assist governments, the private sector and the public to make informed decisions about their options and actions for broader net zero planning.

No planning and reporting information of this type is currently being produced. AEMO's ISP is the nearest example of a comparable product, but it does not cover oil, energy exports, the consumption of electricity and gas off main grids, or the achievement of policy and programmatic goals. So, while the ISP is an important input to a national energy planning document, it serves a different, more specific, and limited purpose. We are pleased with the recent review and plans to increase the scope of the ISP,[12] however, this needs to go much further if we are to capture comprehensive net zero modelling.

The energy and industry transition will connect complex systems and require fundamental change. We need additional, interconnected data that interrogates the intricacies of the complete system, from addressing off grid energy supply to workforce needs in remote locations to modelling future potential policy steps. This level of planning is a significant task but would provide the required confidence to invest, navigate risk and identify opportunities.

The natural parameters of the ISP means that some important analysis is currently out of scope. For example, in the Green Energy Exports scenario, 50% of electrolysers are assumed to be grid-connected, compared to 100% under the 2022 ISP Hydrogen Superpower model. If only the NEM-connected workforce and infrastructure requirements are modelled, then the forecast for these resources will understate the holistic requirements and potentially undermine the urgency for necessary policy support. Especially when decentralisation is necessary to support this transition, the Australian Government should ensure that the impact and requirements be incorporated into detailed decarbonisation modelling that considers Australia's entire energy ecosystem.

This modelling could also identify efficiencies and opportunities such as for developing common user infrastructure. It could also clarify understanding and assist policy development on the role for hydrogen in supporting the electricity grid, whether as a means of storage to be then fed back into the grid when needed, or where electrolysers act as a flexible load.

For Australia to appropriately sequence the complex energy transition, we need this form of advanced planning and regular reassessment across the wider net zero undertaking. We would encourage the Australian Government to consider the scale of modelling and forecasting required to decarbonise effectively and sequence efficiently, and fund publicly available and granular modelling across the entire net zero system.

## There are limited low carbon fuels without cheaper electricity

The challenge for Australia is that we still need to build the renewables capacity that we are relying on to power our future renewable superpower ambition. This is on top of what is required to decarbonise the grid and provide system reliability.

[12] Energy and Climate Change Ministerial Council (2024) *Response to the Review of the Integrated System Plan*, Australian Government, https://www.energy.gov.au/sites/default/files/2024-04/ecmc-response-to-isp-review.pdf.

The need to build renewables to produce hydrogen is one of the most significant matters for consideration, where governments will be confronted with – and will need to explicitly manage, if not accommodate – competing priorities.

This also relates to electricity prices, where electricity pricing is a key driver of hydrogen costs. Australia is not on track so far, with ARENA stating the need for the cost of renewable electricity to be below $20/MWh (compared to the current levelised cost of electrons from solar PV at $60/MWh) in order to facilitate viable green hydrogen production.[13] Given that Australia's potential renewable superpower status is founded on anticipated future cheap electricity prices, this is also a matter of importance for the Net Zero by 2050 Plan. Policy initiatives that support hydrogen projects include concessions or exemptions on Transmission Use of System (TUoS) charges, as previously suggested by AHC in various fora.

As noted in the Discussion Paper, there is strong overlap between the sectoral plans when discussing energy and fuels. We are pleased to see the Australian Government is tackling the complexity of alternative fuels and how multiple streams (including hydrogen) will need to be progressed to meet the competing demands.

We agree that there is an opportunity for Australia to establish a low carbon fuels industry. This supports fuel security, recognises the lower energy density of green fuels, and incentivises decarbonisation through supply. Separate modes of transport and industries are working to unpack the research, trajectory, and timelines of different low carbon fuel options, but there is significant overlap, especially regarding biofuels and hydrogen. While hydrogen is often considered the long-term solution (given the natural limitations of biofuels) multiple avenues should be progressed in tandem to ensure that there is sufficient hydrogen available when the demand requires it. Regardless of the specific green fuel, there is a significant cost gap between traditional and alternative fuels, which must be considered and addressed by the Australian Government through policy.

When considering next steps, as we have previously advocated,[14] the REZ and industry hubs model of funding and coordination should be extended to cover so-called Hydrogen Economic Zones (or Low Carbon Precincts) to facilitate planning across industries and with some degree of central (that is, government led) funding and coordination. We believe that the focused parameters of industrial decarbonisation within key regions will assist in identifying and addressing the challenges that arise within the net zero transition. Crucially, this concentrated precinct would supply the data required to inform and sequence wider Australian decarbonisation decisions, as well as provide central locations to develop R&D, explore international partnerships (such as through green shipping corridors) and address barriers (such as common user infrastructure investment).

[13] Australian Renewable Energy Agency (2024) 'The role of green hydrogen and ultra-low cost solar in Australia's superpower vision', *ARENAWIRE*, 13 March, https://arena.gov.au/blog/the-role-of-green-hydrogen-and-ultra-low-cost-solar-in-australias-superpower-vision/.

[14] AHC (2023) *A fit-for-purpose refreshed National Hydrogen Strategy: next steps for building Australia's hydrogen industry*, August, https://h2council.com.au/ahc-publications/.

## We must build Australia's clean energy workforce

Clean energy projects are experiencing current skill shortages in critical occupations including electricians and construction workers. For example, the 2023 Skills Priority List (SPL) found that 73% of Electrotechnology and Telecommunications Trades and 100% of Construction and Trades Worker occupations are in shortage nationally.[15]

Skill shortages will be exacerbated in the coming years as renewable projects of growing scale are deployed at a more rapid rate. Jobs and Skills Australia (JSA) found that Australia needs an additional 32,000 electricians and 450,000 construction jobs to 2030 to meet legislated 2030 decarbonisation targets.[16] It concluded that current policy settings will not deliver the workforce needed to meet existing targets. It also found that while clean energy will provide a pathway for some transitioning workers, this workforce is too small to supply the rapidly growing needs of industry.

To address this gap, JSA's report made 50 recommendations for substantial reform across sectors including government, industry, education, and training. These recommendations outline a comprehensive reform agenda that should be the cornerstone of any clean energy workforce planning. However, they are responding to the challenge of achieving net zero by mid-century, rather than attaining renewable energy superpower status.

The report notes that higher ambition would require unprecedented planning, coordination and cooperation between governments, education and training providers, industry, unions, communities, and workers. This is needed to address the following challenges:

- **A lack of national coordination and strategic sequencing of projects.** Greater coordination of project delivery would:
    - Enable project prioritisation based on end-use (and, AHC suggests, key public interest criteria), whether for domestic or export decarbonisation.
    - Minimise boom-bust construction cycles that exacerbate workforce competition between states and regions, reducing costs for developers and consumers.
    - Increase the utilisation of apprentices by enabling a group training organisation-type approach to managing placements between clean energy projects.
    - Aggregate regional skill and training needs across projects, mitigating the problem of thin markets for education and training providers in regional Australia where most jobs are located.
    - Provide local businesses with a continuous pipeline of work across the duration of the transition. Pipeline surety enables investment in equipment and workers.

[15] Jobs and Skills Australia (2023) *2023 Skills Priority List: Key Findings Report,* Canberra, Australia, https://www.jobsandskills.gov.au/sites/default/files/2023-10/2023%20SPL%20Key%20Findings%20Report.pdf.
[16] Jobs and Skills Australia (2023) *The Clean Energy Generation*, Canberra, Australia, https://www.jobsandskills.gov.au/sites/default/files/2023-10/The%20Clean%20Energy%20Generation_0.pdf.

- **Intensifying domestic competition for skilled workers.** This is due to historic low unemployment, and a record pipeline of large-scale public infrastructure investment. In a superpower scenario, competition will further increase as the clean energy sector competes with emerging industries such as clean manufacturing for workers and skills from the same pool. This will intensify as states compete for the skills needed to achieve decarbonisation targets and develop a renewable energy export industry.
- **Intensifying global competition for skilled workers.** This results from escalating global decarbonisation ambitions and the previously discussed large-scale clean energy investment policies and incentives.
- **Uncertainty regarding future demand for renewable energy projects across solar, wind, storage, and green hydrogen.** Any expansion of clean industry will create additional demand for renewable energy generation, with further workforce impacts. The ISP's Step Change and Hydrogen Superpower scenarios project NEM capacity will need to increase by factors of four and ten, respectively, to 2050. The Net Zero Australia project found that national generating capacity needs to increase 40-fold to 2050.

The Electricity and Energy Sector Plan must be clear on the level of aspiration of any superpower scenario, detailing production targets for industries like green hydrogen, ammonia, green metals etc. Understanding future demand is essential for workforce planning across the supply chain.

Clean energy exports have the potential to create a substantial number of jobs. Modelling of the workforce needed to deliver ISP scenarios found the peak electricity sector workforce under the Hydrogen Superpower scenario to be over double the peak workforce under Step Change.

Net Zero Australia has also found that the domestic workforce required to achieve net zero is around half the workforce needed to replace our fossil fuel exports with renewable energy. Without meaningful direction on the timing, size, scale and potential locations of export industry infrastructure, effective workforce planning and policymaking is impossible.

## APPENDIX A: Recommendations from AHC's response to the National Hydrogen Strategy Refresh

### Government role

| Topic | Recommendation | Section of paper |
|---|---|---|
| **Overall** | **Recommendation 1**: Commit to significant market making and ecosystem building in the public interest | 2.1 |
| | **Recommendation 2**: Task the Net Zero Economy Agency with overseeing the implementation of the refreshed NHS. | 2.1 |
| | **Recommendation 10**: Support the refreshed NHS with public implementation plans and stakeholder engagement. | 2.3 |

### Priorities

| Topic | Recommendation | Section of paper |
|---|---|---|
| **Domestic** | **Recommendation 6**: Prioritise hard to abate and scalable domestic demand sources. | 2.2 |
| **Export** | **Recommendation 7**: Support hydrogen for export as an energy vector and for value added products such as green iron. | 2.2 |
| **Emissions** | **Recommendation 21**: Remain open to blue hydrogen for regions that can support it without unnecessarily delaying renewable hydrogen developments. | 4.2 |

### Targets

| Topic | Recommendation | Section of paper |
|---|---|---|
| **Targets** | **Recommendation 9**: Set hydrogen targets for 2030 and 2040, with a range for 2050. | 2.3 |

### Analysis

| Topic | Recommendation | Section of paper |
|---|---|---|
| **Overall** | **Recommendation 3**: Task the Net Zero Economy Agency to oversee a rolling programme of industry analysis to support ecosystem planning. | 2.1 |
| **Costs** | **Recommendation 4**: Task the Net Zero Economy Agency to oversee an assessment of cost and clarify investment needs from the public and private sectors. | 2.1 |
| **NHIA** | **Recommendation 5**: Extend and re-run the NHIA analysis to support decision-making for the refreshed NHS. | 2.1 |
| | **Recommendation 29**: Ensure a refreshed NHIA addresses refuelling infrastructure. | 4.2 |

| Topic | Recommendation | Section of paper |
|---|---|---|
| **Supply chain** | **Recommendation 8**: Assess Australia's hydrogen supply chain risks and opportunities. | 2.2 |
| **Energy** | **Recommendation 20**: Develop consistent energy planning scenarios and cost recovery mechanisms by connecting AEMO, AEMC and energy regulators with the Net Zero Economy Agency and the refreshed NHS. | 4.2 |
| | **Recommendation 52:** Undertake a full energy market and grid impact analysis for wide scale adoption of electrolysers as flexible load in the electricity grid. | 5.4 |
| **Water** | **Recommendation 22**: Develop a national assessment of hydrogen industry water needs and required planning to meet the revised NHS objectives and support long-term water security. | 4.2 |
| **Pipelines** | **Recommendation 23**: Develop a national assessment of hydrogen pipeline corridors, easements, and route alignment. | 4.2 |
| **Ports** | **Recommendation 24**: Develop a national assessment of port capability to meet the revised NHS objectives and targets. | 4.2 |
| **Storage** | **Recommendation 27**: Develop a national assessment of hydrogen storage needs for different purposes, timeframes, and locations. | 4.2 |
| **Workforce** | **Recommendation 34**: Undertake capacity gap analyses to support regional development. | 4.3 |
| **RD&D** | **Recommendation 39**: Develop and articulate RD&D priorities for hydrogen. | 4.3 |
| **Regulation** | **Recommendation 42**: Undertake and publish a regulatory gap analysis and programme of reform. | 4.3 |
| **Shipping** | **Recommendation 51**: Develop a national assessment of shipping routes and refuelling requirements. | 5.3 |
| **Aviation** | **Recommendation 53:** Work with the Department of Infrastructure, Transport, Regional Development, Communications and the Arts and its Jet Zero Council to consider the next steps for hydrogen for SAF production, using the CSIRO Futures report. | 5.5 |

## Ecosystem, engagement and implementation

### *Tier 1: Short term implementation priorities*

| Topic | Recommendation | Section of paper |
|---|---|---|
| **Overall** | **Recommendation 15**: Create Hydrogen Economic Zones to support regional hydrogen initiatives and connect the relevant supply, demand, infrastructure and workforce. | 4.1 |
| | **Recommendation 31**: Boost Australian Government ability to attract and deploy private capital. | 4.3 |
| **Emissions** | **Recommendation 46**: Clarify the next steps and fast-track the process to implement the GO scheme. | 4.3 |
| **Export** | **Recommendation 11**: Support the refreshed NHS through a clear investment proposition. | 3.1 |
| | **Recommendation 12**: Develop joint support packages between Australia and its trading partners to support trade in hydrogen and hydrogen derivatives. | 3.1 |
| | **Recommendation 13**: Explicitly locate hydrogen production and use within the current international agreements on critical minerals. | 3.3 |
| | **Recommendation 14**: Actively seek risk and information sharing opportunities with like-minded international partners. | 3.3 |
| **Industry capability** | **Recommendation 38**: Create a 'one stop shop' and case management to assist with funding and permissions. | 4.3 |
| **Ports** | **Recommendation 26**: Commit to a funding envelope for ports. | 4.2 |
| **Storage** | **Recommendation 28**: Commit to a funding envelope for common user storage. | 4.2 |
| **Heavy transport** | **Recommendation 30**: Commit to a funding envelope for refuelling infrastructure. | 4.2 |
| | **Recommendation 48**: Support hydrogen in heavy road transport with a national ZLEV strategy, fleet trials, transition funds, and either a heavy vehicle fuel efficiency standard or sales target. | 5.1 |
| **Industrial sectors** | **Recommendation 49**: Attract private investment for hard-to-abate industrial processes. | 5.2 |

### *Tier 2: Medium term implementation priorities*

| Topic | Recommendation | Section of paper |
|---|---|---|
| **Community** | **Recommendation 32**: Support a new programme of work on community water values and hydrogen awareness. | 4.3 |
| | **Recommendation 33:** Develop messages and communications support for the refreshed NHS to roll out to all governments and industry. | 4.3 |
| | **Recommendation 45**: Work with AEMC and AER on cost and price models to ensure affordable energy bills. | 4.3 |
| **Industry capability** | **Recommendation 36**: Support a lessons learned repository through CSIRO's Knowledge Hub. | 4.3 |
| | **Recommendation 37**: Support the Australian Hydrogen Council to expand the scope of HyCapability. | 4.3 |
| | **Recommendation 16**: Support a nationally connected and coordinated regional network facilitated by the Australian Hydrogen Council. | 4.1 |
| | **Recommendation 17**: Support Business Renewables Centre Australia to expand its remit and create hydrogen specific modules. | 4.1 |
| **Supply chain** | **Recommendation 18**: Support the development of domestic electrolyser production and assembly through a domestic manufacturing package. | 4.2 |
| | **Recommendation 19**: Secure supplies of raw materials (e.g., nickel and platinum group metals) and other key components. | 4.2 |
| **Workforce** | **Recommendation 35**: Drive coordination of competency standards and training packages for hydrogen. | 4.3 |
| **RD&D** | **Recommendation 40**: Work with CSIRO and the Chief Scientist, and other RD&D leaders to deliver hydrogen RD&D priorities and knowledge sharing. | 4.3 |
| | **Recommendation 41**: Establish common testing and prototyping infrastructure. | 4.3 |
| **Ports** | **Recommendation 25**: Select and support ports with existing industry connections to be demonstration ports. | 4.2 |
| **Heavy transport** | **Recommendation 43**: Harmonise Australian heavy vehicle regulation with international standards. | 4.3 |
| **Industrial sectors** | **Recommendation 44**: Develop harm prevention regulations to support industrial sectors. | 4.3 |
| | **Recommendation 47**: Support Australian-made clean products in hard-to-abate industries, supported by government procurement. | 4.3 |
| | **Recommendation 50**: Develop bespoke packages for other early adopters in high temperature process heating. | 5.2 |