MISSION INNOVATION

August 2022

National Innovation Pathway Round-up

AUSTRALIA

National Innovation Pathway Round up - Australia

Introduction

Mission Innovation members agreed to develop **National Innovation Pathways (NIPs)** to describe and build collective understanding on how each member plans to pioneer clean energy technologies to meet their climate and energy goals.

Each member has their own approach to developing and identifying innovation needs and priorities, with some already having undertaken extensive strategy development. The Roundup provides a **single location of summary information on countries' innovation priorities** utilizing existing sources of information so members and interested stakeholders can easily find key information of interest.

All MI members were asked to provide answers to a survey (Annex A) providing as much information as possible, with some questions being optional. The survey asked questions relevant to each element of the National Innovation Pathway described in the Joint Launch Statement:

1. Energy transition scenarios and priority national-level energy innovation needs / priorities until at least 2030;
2. Strategies or national-level plans to address these energy innovation needs / priorities, including institutional design and working internationally
3. Information on how Members will measure innovation outcomes and innovation ecosystem developments;
4. Members' preferred modes and methods of collaboration; and
5. Any further supporting evidence that was used to identify the energy innovation needs / priorities, such as analysis of domestic competitiveness, economic opportunities or national level climate and clean energy plans.

Members will be asked to refresh this document annually if significant changes to national policy have taken place.

1. Clean Energy Innovation Strategy

1.1 Summary

Australia's NDC sets out a target to achieve net zero emissions by 2050, and to reduce greenhouse gas emissions by 43% below 2005 levels by 2030. Australia plans to drive emissions reduction through rapid deployment of existing technologies, and investing in the technologies and industries of the future. The Australian Government's Powering Australia plan is the key strategy to create jobs, cut power bills and reduce emissions by boosting the accessibility and deployment of clean energy technologies across the economy. Powering Australia aims to drive the uptake of technology and innovation in existing industries, while investing in the technology and industries of the future to help meet the goals of the Paris agreement. Among other goals, it aims to increase the share of renewables in Australia's National Electricity Market to 82% by 2030.

Technology is integral to Australia's clean energy innovation strategy. Australia has focused on technologies predicted to have a significant impact on emissions reduction to direct and prioritise funding and investment. The technologies in focus include hydrogen, energy storage, and ultra low-cost solar. Australia is investing in key technologies through multiple competitive, merit-based mechanisms, including the Australian Renewable Energy Agency (ARENA), Clean Energy Finance Corporation (CEFC), and the Cooperative Research Centres (CRC) Program.

The Australian Government will establish a Powering the Regions Fund to support innovation by existing industries, and the creation of new industries in regional areas. The fund will support: industry with its decarbonisation priorities, such as energy efficiency improvements and fuel switching (e.g. hydrogen); new clean energy industries like green hydrogen and

bioenergy; existing workers to upskill into new technologies; and the continued purchase of Australian Carbon Credit Units (ACCUs). Programs to support these priorities are currently under development.

To expedite deployment of renewables, the Australian government is investing in clean energy infrastructure, including an AUD $20 billion investment to modernise the electricity grid through the Rewiring the Nation plan. Australia is committed to making the clean energy technology the world needs for the energy transition, with the support of initiatives such as the AUD $15 billion National Reconstruction Fund. This Fund will support innovation in new and revitalised clean industries. As part of this, Australia is investing in renewables and low emission technologies. Commercial opportunities being targeted include: components for wind turbines; production of batteries and solar panels; modernising steel and aluminium; and hydrogen electrolysers. Australia will also invest AUD $100 million to deliver an initial 85 solar banks, giving households that are unable to install rooftop solar access to cheaper energy.

1.2 Methodology

Australia's policies for clean energy innovation are extensively informed through modelling, analysis, and stakeholder engagement. Australia's energy innovation covers whole of economy energy innovation, and is also directing funding towards key priority technologies. The Rewiring the Nation plan will invest $20 billion dollar to rebuild and modernise the Australian electricity grid, ensuring it can handle an increasing proportion of renewable energy. The plan will increase the reliability of the grid while driving down prices by allowing renewable energy projects to access the grid and by storing electricity within community batteries. This plan will also invest in hydrogen electrolysers and fuel switching, as well as clean energy component manufacturing.

Australia's emission reduction plan, Powering Australia, was modelled independently by RepuTex, and will reduce emissions by 43% by 2030. The role of the Climate Change Authority in providing independent, expert advice to Government will be emphasised. The Authority will assess and publish progress against the Government's emissions reduction targets, and advise Government on future targets, including the 2035 target, contributing to an Annual Statement to Parliament on climate change.

Our energy and innovation strategies are informed through consultation with stakeholder groups across key priority technologies or industries, as well as through public consultation processes, including with State and Territory Governments. Early and ongoing community engagement, including with Traditional Owners, will be key to understanding community values, concerns and aspirations as clean energy sectors grow. Australia is committed to supporting research, development, demonstration and early-stage commercialisation through investment and co-investment, and using consultation to inform our investment strategy.

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Table 1: RELEVANT DOCUMENTS AND POLICIES

Document or policy name	Description of the document or policy	Specific outcomes, goals or targets identified in the document or policy	Year	Web Link(s)
Powering Australia	Australia's plan to create jobs, cut power bills and reduce emissions by boosting renewable energy	To reach an economy-wide net GHG emissions target of 43% reduction from 2005 levels in 2030. Increase the share of renewables in the National Electricity Market to 82% by 2030	2021	https://keystone-alp.s3-ap-southeast-2.amazonaws.com/prod/61a9693a3f3c53001f975017-PoweringAustralia.pdf
Powering Australia (modelling data)	The economic impact of the Powering Australia plan	Analysis of economic and emissions impact of Powering Australia	2021	https://keystone-alp.s3-ap-southeast-2.amazonaws.com/prod/61a966013f3c53001f975016-REPUTEX_The%20economic%20impact%20of%20the%20ALP's%20Powering%20Australia%20Plan_Summary%20Report.pdf
Australia's NDC	Australian nationally determined contribution (NDC) under UNFCCC Paris Agreement	Sets an economy-wide target of 43% below 2005 levels by 2030.	2022	https://unfccc.int/sites/default/files/NDC/2022-06/Australias%20NDC%20June%202022%20Update%20%283%29.pdf

2. Clean Energy Innovation Priorities

2.1 Overview of Clean Energy Innovation Priorities

Table 2: CLEAN ENERGY INNOVATION PRIORITIES

Innovation priority	Focus of innovation activity (tick all that apply)	Targets/Goals (if applicable)	Technologies or topics of interest	Total RD&D funding allocated, (include budget years where applicable)	Planned demonstration Investments (include budget years and indicate if domestic or international spending where possible)	Links to relevant reports or plans
Clean Hydrogen	☐ Early-stage research ☐ Applied research ☐ product development ☑ Demonstration ☑ Commercialisation Other:	Clean hydrogen production under $2 per kilogram (kg)	Renewable electrolysis Hydrogen storage and transportation	AUD $464 million Clean Hydrogen Industrial Hubs program (FY21-26)	ARENA has given conditional approval for a $32 million grant to build a commercial scale 10 megawatt electrolyser to produce clean hydrogen in Wodonga, Victoria. This will be amongst the largest in the world. Under this project, 10% hydrogen will be	https://www.industry.gov.au/news/funding-available-for-clean-hydrogen-industrial-hubs

					blended into existing gas pipelines supplying 40,000 homes and businesses, a key step towards decarbonising Australia's gas networks. This is one of three projects conditionally approved for $103.3 million in total under ARENA's Renewable Hydrogen Deployment Funding Round	
Ultra low-cost solar	☑ Early-stage research ☑ Applied research ☑ product development ☑ Demonstration ☑ Commercialisation Other:	Solar electricity generation at $15 per MWh. ARENA Solar 30 30 30 initiative's goal to achieve 30% module efficiency and 30 cents per installed watt by 2030	Enhancing module efficiency through solar cell design Reducing balance of system costs	AUD $40 million Ultra Low Cost Solar PV Research and Development Round (FY22-27)		https://arena.gov.au/funding/ultra-low-cost-solar-pv-research-and-development-round/
Energy Storage	☐ Early-stage research ☑ Applied research ☑ product development ☑ Demonstration ☑ Commercialisation Other:	Electricity from storage for firming under $100 per MWh	Lithium-ion batteries Pumped hydro Hydrogen	AUD $100 million Battery Manufacturing Precinct; AUD $100 million Large Scale Battery Storage Funding Round ARENA	AUD $1.38 billion Snowy 2.0 pumped hydro; $AUD 657 million Kidston Pumped Hydro Energy Storage	https://www.snowyhydro.com.au/ https://www.alp.org.au/policies/australian-made-batteries

						https://arena.gov.au/projects/kidston-pumped-hydro-energy-storage/ https://arena.gov.au/funding/large-scale-battery-storage-funding-round/#step-1-read-the-program-guidelines
Low emissions materials (steel and aluminium)	☐ Early-stage research ☐ Applied research ☑ product development ☑ Demonstration ☑ Commercialisation Other:	Low emissions steel production under $700 per tonne; Low emissions aluminium under $2,200 per tonne (based on the marginal cost)	Clean hydrogen and direct reduction of iron; Renewable electricity and inert anodes	AUD $39 million Heavy Industry Low-carbon Transition (HILT) CRC	ARENA provided an $11 million grant to Alcoa to trial electrification of steam production for process heat at its Wagerup alumina refinery in Western Australia. ARENA also provided a $579,000 grant to Rio Tinto to assess the viability of hydrogen calcination at its Yarwun alumina refinery in Gladstone, Queensland. Both	https://www.hiltcrc.com.au/

					projects will help decarbonise alumina, Australia's sixth largest export	

The Australian Government has been driving investment in a number of key technologies, to accelerate the domestic and global transition to net zero. These include: clean hydrogen, ultra low-cost solar, energy storage, and green steel and aluminium. These investments feed into many aspects of our economy, and will enable the transition in a number of ways.

Under the Government's Powering Australia plan, Australia will look to drive the uptake of technology and innovation in existing industries, while investing in the technology and industries of the future to help meet the goals of the Paris agreement. Through the National Reconstruction Fund, the Government is planning to support the uptake of clean energy and green technologies, including in: wind turbine component manufacturing; battery and solar panel supply chain and manufacturing; modernising steel and aluminium manufacturing; hydrogen electrolysers; new livestock feed to reduce methane emissions; bioenergy and biomass; and innovative packaging solutions for waste reduction.

The Australian Energy Market Operator (AEMO) has recently updated its Integrated System Plan in 2022. This plan provides a roadmap for the National Energy Market and the transition to net zero emissions in the electricity sector. The ISP was developed with extensive consultation, with involvement of over 1,500 stakeholders. This Plan will enable and facilitate the transition to renewables, which are expected to meet 83% of the energy required for the National Energy Market by 2030-31. AEMO is developing a plan for the energy sector that will take the ISP forward.

The Australian Government is investing in these technologies through deployment of infrastructure that supports increased renewable energy integration with the electricity grid, including a $20 billion investment in Rewiring the Nation.

Investments are also being made through agencies including ARENA (Australian Renewable Energy Agency) and CEFC (Clean Energy Finance Corporation), and through Cooperative Research Centres.

2.2 Tracking Progress (Optional)

To measure progress against the Powering Australia plan and the emissions reduction target, the Australian Government has announced it will introduce an annual statement to Parliament by the Prime Minister or Minister for Climate Change and Energy on climate policy. This is intended to improve integrity in decision-making and transparency on climate change policy and progress. The statement will include reporting on progress against national targets and international developments, with the first statement will be delivered by the end of 2022. Separately, the Australian Government has announced the domestic Climate Change Authority will provide independent, expert advice to Government on climate change policy and emissions reduction targets, and will provide input to the Annual Statement to Parliament.

The Australian Government measures the impacts and progress of investments in clean energy technology by tracking funding; enabling policies; progress on international partnerships; co-investment, and jobs supported. It also tracks other impacts including costs for clean technologies, deployment of these technologies, exports supported by these technologies, and emissions reductions enabled by these technologies.

Australia has a number of public organisations that support research, development, demonstration and early-stage commercialisation of clean energy technologies. Some of these organisations also publish information that tracks project progress and investments.

3. Private Sector Engagement (Optional)

Australia has a number of public organisations that support research, development, demonstration and early-stage commercialisation of clean energy technologies through co-investment with the private sector. This includes the Department of Climate Change, Energy, the Environment and Water (DCCEEW), the Department of Industry, Science and Resources (DISR), the Department of Education (DoE), Clean Energy Regulator (CER), Australian Renewable Energy Agency (ARENA), Clean Energy Finance Corporation (CEFC), Australian Research Council, Cooperative Research Centres and the Commonwealth Scientific & Industrial Research Organisation (CSIRO).

Most of the relevant programs are administered under a competitive, merit-based mechanism. Many are also designed to attract co-investment from other parties, including private sector entities. The Australian Government has committed to at least AUD$24 billion in public investment across the electricity, industry, agriculture and transport sectors over the coming years, which is expected to drive AUD$76 billion in total public-private investment. Government investment from the named entities can take the form of grants, tailored debt finance or equity.

The Australian Government supports innovation and investment in research and development in the private sector through the Research and Development Tax Incentive (R&DTI). The R&DTI offers a tax offset for companies conducting eligible R&D activities. It encourages investment in R&D to help companies grow and innovate.

4. International Collaboration (Optional)

Australia is taking action to become a renewable energy superpower. To achieve this, the Australian Government is prioritising cooperation with our international partners to accelerate technology development that will underpin a secure and clean energy transition. Collaboration with our international partners will provide the certainty and confidence for the scale of investment needed to transition to clean-energy economies.

Australia is prioritising international collaboration on clean energy technology through bilateral partnerships, as well as established and emerging multilateral fora, including the Quad, Clean Energy Ministerial, Mission Innovation, LeadIT, Indo-Pacific Economic Framework, International Energy Agency, APEC, G20, and UNFCCC including the Breakthrough Agenda. To achieve our clean energy priorities, Australia is focused on working with our international partners to:

- accelerate the development and deployment of clean energy technology;
- develop new clean energy supply chains;
- establish favourable market conditions for clean energy trade and uptake;
- deepen cooperation on technology deployment through technical assistance and capacity building;

In July 2022, Australia co-hosted the Sydney Energy Forum with the International Energy Agency, bringing together government and industry from the Indo-Pacific to share and discuss the challenges and opportunities of the global energy transition. The Sydney Energy Forum represents Australia's commitment to be a global leader on climate action, and highlights our priority of strengthening regional cooperation on clean energy technology.

At the Sydney Energy Forum, Australia and the United States announced the Net Zero Technology Acceleration Partnership. This Partnership will drive investment and trade in, and the development and deployment of, low and zero emissions technologies, including long duration energy storage, digital grids, hydrogen, and carbon dioxide removal, including direct air capture, as well as cooperation on critical minerals supply chains.

5. National Energy Innovation Ecosystem (Optional)

Table 3: CLEAN ENERGY INNOVATION INSTITUTIONS

Institution name	Description of role	Innovation priority(ies) that they contribute to (taken from Table 2)	Description of funding modalities (e.g. grants, co-investment, where in tech development cycle focused)	Links
Australian Research Council (ARC)	The Australian Research Council (ARC) expands knowledge and innovation for the benefit of the Australian community by funding the highest quality research, assessing the quality, engagement and impact of research, and providing advice on research matters.	The ARC's research priorities include: energy and advanced manufacturing.	The ARC is focused from early-stage R&D to market demonstration	https://www.arc.gov.au/funding-research/apply-funding/grant-application/science-and-research-priorities
Cooperative Research Centres (CRCs)	The government supports industry-led collaborative research through grants under the Cooperative Research Centres (CRC) Program. CRCs have established projects in areas of competitive strength that align with government priorities, including developing and deploying low emissions technologies	CRCs have established projects in areas of competitive strength that align with government priorities, including: HILT CRC, Future Fuels CRC and Reliable Affordable Clean Energy (RACE). These CRC's priorities include clean hydrogen, industrial decarbonisation, and improving energy technology businesses.	CRCs are focused from early-stage R&D to deployment and commercialisation	https://business.gov.au/grants-and-programs/cooperative-research-centres-crc-grants/current-cooperative-research-centres-crcs
Commonwealth Scientific and Industrial Research Organisation (CSIRO)	The Commonwealth Scientific and Industrial Research Organisation (CSIRO) works with	Clean hydrogen production, energy storage, industrial decarbonisation and agricultural emission reduction.	CSIRO is focused from early-stage R&D to deployment and commercialisation	https://www.csiro.au/en/research

	universities, research institutes and industry to develop technologies and support commercial uptake across many areas of the economy, including low emission technologies.			
Australian Renewable Energy Agency (ARENA)	To support the global transition to net zero emissions by accelerating the pace of pre-commercial innovation, to the benefit of Australian consumers, businesses and workers.	Optimise the transition to renewable electricity Commercialise clean hydrogen Support the transition to low emissions metals	Since 2012, ARENA have supported 625 projects with $1.86 billion in grant funding, unlocking a total investment of almost $8.04 billion in Australia's renewable energy industry. ARENA is focused from early-stage R&D to deployment and commercialisation	https://arena.gov.au/about/
Modern Manufacturing Initiative (MMI)	The Modern Manufacturing Initiative (MMI) supports projects from market demonstration through to commercial scale-up. This includes translating high-quality research into marketable products, integrating intermediate products into new domestic and global value chains, entering new markets and creating transformational business-to-business and business-to-research collaborations.	Priorities under the Recycling and Clean Energy National Manufacturing Priority roadmap highlight opportunities in hydrogen technologies, batteries, next-generation photovoltaic modules, and low emissions metals	The MMI is focused from market demonstration to diffusion.	https://www.industry.gov.au/news/modern-manufacturing-initiative-and-national-manufacturing-priorities-announced
Clean Energy Finance Corporation (CEFC)	The Clean Energy Finance Corporation (CEFC) works with the private sector to demonstrate the financial viability of near-commercial low emissions technologies and the bankability of new revenue streams. The CEFC takes a commercial approach, providing tailored debt finance and equity to businesses and projects.	New technologies highlighted as CEFC investment opportunities include hydrogen, grid, and energy storage.	CEFC is focused from deployment and commercialisation to market diffusion.	https://www.cefc.com.au/media/pfupku4s/cefc_2021-22_corporate plan.pdf

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Clean Energy Regulator (CER)	The Clean Energy Regulator (CER) administers Australian Government schemes for measuring, managing, reducing and offsetting Australia's greenhouse gas emissions. These include the Emissions Reduction Fund (ERF) and Safeguard Mechanism, the Renewable Energy Target, the National Greenhouse and Energy Reporting Scheme and the Australian National Registry of Emissions Units.	CER is developing certification frameworks and platforms to give confidence to investors and consumers as new technologies and industries evolve. These include the Guarantee of Origin Scheme for Hydrogen, and the Australian Carbon Exchange.	The CER is focused from market growth to diffusion.	https://www.cleanenergyregulator.gov.au/About
Australian Energy Market Operator (AEMO)	Australian Energy Market Operator (AEMO) manages electricity and gas systems across Australia. They also provide strategic forecasting and planning services.	AEMO published a comprehensive roadmap for the National Electricity Market, the 2022 Integrated System Plan (ISP). This roadmap will support the energy system transformation to net zero emissions.,	AEMO is focused on managing system stability during renewable deployment and diffusion.	https://aemo.com.au/

6. Further Supporting Evidence (Optional)

Through Powering Australia, $200 million is being invested in 400 new community batteries across Australia. This will maximise the benefits of Australia's rooftop solar transformation, support the grid and provide shared storage for up to 100,000 households. The government is also investing $100 million to deliver 85 solar banks around Australia. This will provide access to solar for around 25,000 households who are unable to install rooftop solar, including renters and low-income households. This will help to lower the price of energy for these households and support our emissions reduction goals.

The Towards Net Zero Mission of the Commonwealth Scientific and Industrial Research Organisation (CSIRO) is focused on working together with Australian regions and industries to achieve net zero emissions. This mission will develop and demonstrate high abatement technologies to support Australian and global emissions reduction.

The CSIRO's Hydrogen Industry Mission is aimed at building Australia's hydrogen industry. This Mission will focus on research, development and demonstration, and will include feasibility studies, strategy, and collaborative hydrogen production demonstration projects.

Annex A – National Innovation Pathway Roundup Survey Questions

1.1 Summary: Please provide a summary of your national clean energy innovation strategy i.e. the overall policies, framework and/or goals that help to define the innovation priorities you will describe in Section 2. We recommend including information about your national climate or energy targets (such as NDCs or renewable energy targets) as well as national innovation strategies and policies. You can share links to relevant documents in Table 1.

1.2 Methodology: Please describe the methodology to develop your national clean energy innovation strategy such as analysis, modelling or stakeholder engagement and include any links to relevant documents in Table 1. This will be used to help share learning between members**.**

2.1 Overview of Clean Energy Innovation Priorities: Please provide a list of your national clean energy innovation priorities (i.e. specific technologies, sectors or needs). Please complete Table 2 to provide information about where you are focusing in the innovation cycle for each priority; any targets or goals; RD&D interests; current allocated budgets (including specific demonstration funding) and links to relevant strategies or reports. In the text box following please provide a brief description of how you plan to respond to each innovation priority in the coming years, such as through future plans over the next 3-10 years to mobilise further investments for innovation, launch new major programmes and timelines for major demonstration projects**.**

2.2 Tracking Progress: Please describe how you plan to measure progress towards addressing your identified energy innovation priorities. Please describe any governance processes to manage and review energy innovation efforts and, where able, please list tracking indicators that are commonly used (e.g. such as patents, publications, rates of company formation, follow-on capital and private co-investment, technology performance upgrades).

3. Private Sector Engagement: Please can you describe your strategic approach and priorities to engagement with the private sector to address the clean energy innovation priorities identified in section 2. This could include for instance prioritising co-funding of RD&D initiatives; incubator/accelerator programs that are funded (in part or fully) by the private sector; tax credits and other fiscal incentives; initiatives that the private sector can engage with, grants, de-risking instruments such as loan guarantees etc.

4. International Collaborations: Please describe your strategic approach to international collaboration to tackle your clean energy innovation priorities (e.g. do you have an international strategy, or particular types of collaboration you are prioritising).

5. National Energy innovation Ecosystem: Please provide an overview of your national institutions, funders and organisations and describe how they contribute to tackling the innovation priorities identified in Section 2. Please either provide this information in the box or complete Table 3.

6. Further Supporting Information: Please add below any further information about your national energy innovation needs or approaches to tackling these that has not been covered above.

Mission Innovation – Catalysing Clean Energy Solutions For All