INTERNATIONAL PARTNERSHIP FOR
HYDROGEN AND FUEL CELLS IN THE ECONOMY

IPHE Country Update July 2017: Australia

Name	James Minto
Contact Information	James.minto@environment.gov.au, +61 2 6275 9320
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1. New Policy Initiatives on Hydrogen and Fuel Cell

The Australian Government is committed to a technology-neutral policy and regulatory framework, which supports new energy sources and enables market innovation and uptake of transformative technologies, including hydrogen.

Last year, the Australian Government tasked the independent Commonwealth Scientific and Industrial Research Organisation (CSIRO) to develop a Low Emissions Technology Roadmap. Released on 2 June 2017, the Roadmap provides a comprehensive summary of technology pathways for emissions reductions in Australia, along with the economic opportunities associated with them. Hydrogen was noted as a significant opportunity as a transport fuel and for export under two of the four pathways considered, and the CSIRO has expanded its work on hydrogen.

Australia's Chief Scientist, Dr Alan Finkel released the Final Report into Independent Review into the Future security of the National Electricity Market (NEM) on 9 June 2017. Dr Finkel's report is intended to be the blueprint for ensuring Australia's energy system remains affordable, reliable and secure while transitioning to low emission forms of generation. The report briefly explores a number of opportunities for hydrogen in the energy, transport, industry and export sectors.

Australia joined the Global Mission Innovation Initiative in 2015. Along with 22 other participating countries, Australia committed to accelerate research and development of clean energy innovations by doubling public expenditure on clean energy research and development. Mission Innovation countries have established seven Innovation Challenges as priority areas for multilateral collaboration to accelerate technology breakthroughs. Australia is looking to promote hydrogen research and development through one of these challenges, Converting Sunlight, which aims to accelerate the development and production of clean fuels using the sun's energy.

This focus has been supported by domestic action.

The $800 million Australian Renewable Energy Agency (ARENA) and the $10 billion Clean Energy Finance Corporation (CEFC) provide grants and loans in support of investment and innovation in clean energy technologies. The Australian Government has also established the Clean Energy Innovation Fund, which is jointly managed by ARENA and CEFC. This fund will have $200 million to continue to provide support for early stage and emerging clean energy technologies such as hydrogen R&D.

ARENA finalised its Investment Plan in May 2017. One of the four new priorities identified in the plan focuses on Australia's renewable export industry. The plan identifies focus areas of innovation and examples of proposals that may be considered for funding, such as:

- demonstration of renewable production methods for transportable energy storage options (such as hydrogen or ammonia);
- demonstration of on-site production, storage and power generation using renewable hydrogen; and
- research and development of hydrogen production technologies that show potential in the lab.

In February 2016, the Australian Government announced proposed reforms to the Motor Vehicle Standards Act 1989. The focus of the reforms is to reduce regulatory burden and barriers, which would include any regulatory barriers limiting the uptake of energy efficient or alternative energy technologies, such as hydrogen fuel cell or electric vehicles.

At the sub-national level, state governments are also providing support for FCH, for example through trials and support for low emissions vehicles and recharging infrastructure. The South Australian Government is expected to release a Hydrogen Roadmap in mid-2017.

2. Hydrogen and Fuel Cell R&D Update

The Australian Government supports research, development and commercialisation of new energy technologies including FCH through the Australian Research Council (ARC), the Australian Renewable Energy Agency (ARENA), the Australian Nuclear Science and Technology Organisation (ANSTO) and the CSIRO.

The CSIRO conducts research into scientific capability and new technologies relevant to hydrogen. These include research into membrane and separation technologies and solar conversion of natural gas into syngas. The CSIRO recently announced a two-year research project with $3.4 million in funding to explore breakthroughs in separating hydrogen from other gases like ammonia.

Australia participates in the International Energy Agency's Hydrogen Implementing Agreement (IEA HIA). Curtin University is the Contracting Party for Australia in the HIA. Curtin University, in Western Australia, is undertaking research in hydrogen storage.

Partly funded through the ARC, the Materials Energy Research Laboratory in nanoscale ("MERLin") is an energy research group at the University of New South Wales (UNSW) focusing on the use of hydrogen for energy and for energy storage at room temperature.

Australia is keen to keep abreast of international developments in the FCH sector. Australia will continue to keep a close watch on developments within IPHE and through our involvement in the International Energy Agency's Hydrogen Technology Collaboration Programme and Mission Innovation's Converting Sunlight Challenge. All of these initiatives

make a valuable contribution to the sharing of information on hydrogen and fuel cell developments and enhance government, industry and academia collaboration.

3. Demonstration and Deployments Update

ARENA has financially supported the University of South Australia's 'New photocathodes for solar hydrogen production' project, and the company Hydrexia to commercialise its hydrogen storage technology.

The CEFC supports hydrogen energy, such as solar-to-hydrogen fuels. In July 2015, a $50 million asset finance agreement between the CEFC and Firstmac, a leading Australian non-bank lender, has helped accelerate business and personal adoption of low emissions fuel technologies, including hydrogen fuel cell and electric vehicles.

Kawasaki Heavy Industries (KHI) and its partners have been developing a coal to hydrogen project in Victoria's Latrobe Valley using Victorian brown coal. The project is one of a number of options that KHI is examining worldwide to meet the Japanese government's energy diversification plans. The commercial viability of the project is subject to further analysis of the proposal and outcomes from a front-end engineering and design study.

Norwegian company Yara exports ammonia from its production plant in Western Australia and is working towards a trial of a 2.5MW solar array to power its electrolysis process, with the possibility of eventually fuelling its entire operations using the region's abundant sunlight.

4. Events and Solicitations

Australia will hold the 8th International Conference on Hydrogen Production from 29 to 31 July 2017 in Brisbane.

5. Investments: Government and Collaborative Hydrogen and Fuel Cell Funding

The $800 million Australian Renewable Energy Agency (ARENA) and the $10 billion Clean Energy Finance Corporation (CEFC) provide grants and loans in support of investment and innovation in clean energy technologies. The Australian Government has also established the Clean Energy Innovation Fund, which is jointly managed by ARENA and CEFC. This fund will have $200 million to continue to provide support for early stage and emerging clean energy technologies, including hydrogen. ARENA finalised its Investment Plan in May 2017. One of the new four priorities identified in ARENA's investment plan includes a focus on Australia's renewable export industry.

In August 2016, the Australian Capital Territory (ACT) Government announced plans for hydrogen energy storage in Canberra. The plan encourages international business to bring $180 million of hydrogen energy storage, including hydrogen-fuelled car fleet and hydrogen from renewables service stations to Canberra.

In December 2016, the South Australian Government and Adelaide City Council jointly announced a feasibility study with hydrogen utility company, H2U, into establishing SA's first hydrogen refuelling station. This is part of H2U's plans to establish an initial network of 14 stations nationally. The study will look at opportunities for fuel cell powered vehicles in the council's services and the State bus fleets, with hydrogen produced on-site from renewable electricity using electrolysis technology. The SA government is also looking at the potential of supplying renewable hydrogen to other states and internationally.

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Transportation	Target Number	Current Status	Partnerships, Strategic Approach	Policy Support
Fuel Cell Vehicles[1]	No set target across Commonwealth, State and Territory Governments	May 2017	• Hyundai Motor Company Australia (Hyundai) released a test fleet of ix35 hydrogen fuel cell vehicles (FCVs) in Australia in April 2015. • The launch showcased Hyundai's onsite solar powered hydrogen refueling station and the company's partnership approach to develop hydrogen refueling infrastructure along the east coast of Australia.	• Nil
H_2 Refueling Stations	**Target Number**	**Current Status**	**Partnerships, Strategic Approach**	**Policy Support**
Stationary	**Target Number[2]**	**Current Status**	**Partnerships, Strategic Approach**	**Policy Support**
Small[3]	No target	Announced project –	• In the ACT, Neoen and Megawatt Capital will provide $55 million in	• ACT is set to have 100% renewable electricity by 2020

[1] Includes Fuel Cell Electric Vehicles with Range Extenders
[2] Targets can be units installed and/or total installed capacity in the size range indicated
[3] <5 kW (e.g., Residential Use)

		feasibility and design stages	partnership with Siemens and Hyundai to establish a 1.25MW hydrogen electrolyser. The initiative, to be established in Canberra, will include a refuelling station and service centre and an initial fleet of 20 hydrogen fuelled cars including a technical support and research program. Siemens will also establish an office in Canberra's renewable energy innovation precinct. • Union Fenosa will provide $125 million including a research and development partnership with the Australian National University and ActewAGL Distribution. This will focus on renewable energy power to gas (ReP2G); investigating efficiencies in the production of hydrogen from renewables; and, how it can then be introduced to the ACT gas network or provide support to the electricity network. A pilot testing facility will also be established in the ACT to produce hydrogen from water using the ACT's 100% renewable electricity supply.	

H_2 Production	Target[4]	Current Status	Partnerships, Strategic Approach	Policy Support
H2 Production	Not Determined	Feasibility Stage.	Renewable Hydrogen' is another company currently assessing the feasibility of large-scale hydrogen production, in this case via electrolysis in the Pilbara. The intention is to build a solar farm that feeds directly into a series of electrolysers in order to produce zero emissions hydrogen. The system would be built adjacent to the Yara Pilbara Fertilisers plant where hydrogen can be converted into ammonia, a suitable carrier for long distance transport (i.e. shipping to Japan). The ammonia could then be converted back to hydrogen for use at the end of the supply chain.	
Energy Storage from Renewables	**Target[5]**	**Current Status**	**Partnership, Strategic Approach**	**Policy Support**
Power to Power[6] Capacity				

[4] Target can be by quantity (Nm^3, kg, t) and by percentage of total production; also, reference to efficiency capabilities can be a target
[5] Can be expressed in MW of Installed Capacity to use the electricity from renewable energy generation, and Annual MWh of stored energy capacity
[6] Operator has an obligation to return the electricity stored through the use of hydrogen back to electricity

Power to Gas[7] Capacity			Australian company Infratech Industries (media release 6 April 2017), in collaboration with the University of Newcastle has launched a world-first 'Energy-on-Demand' power, oxygen and hydrogen system.	
Power to Gas trial		Initial Start-up Phase	Jemena is working on a Power to Gas trial to demonstrate how excess renewable energy can be converted to hydrogen to be stored in gas pipelines to be used when and where it is needed.	

[7] Operator has the opportunity to provide the stored energy in the form of hydrogen back to the energy system through multiple channels (e.g., merchant product, enriched natural gas, synthetic methane for transportation, heating, electricity)