

## How Australia Is Looking to Develop a Hydrogen Economy

Policymakers see hydrogen as a key carrier for exporting renewable energy. JASON DEIGN DECEMBER 19, 2018 Australia's first hydrogen test station opened this month amid a wider strategy to use gas as a storage medium for renewable energy. The station, established by energy provider Evoenergy and the Canberra Institute of Technology at a CIT facility in Fyshwick, a retail and light industry suburb on Canberra's outskirts, is designed to test the use of pure hydrogen in existing gas infrastructure. The test results will be used to inform future implementation of hydrogen in the Australian Capital Territory and the rest of the country, CIT said in a press release. "As this new energy source is set to replace gas, our apprentice plumbers will be trained in how hydrogen will be distributed and connected to homes," it said. Australia's lawmakers increasingly see hydrogen as a replacement for domestic natural gas, and potentially the source of a major export industry. In November 2017, the Hydrogen Council, a global coalition, issued a report claiming hydrogen could cover 18 percent of the world's final energy demand by 2050, creating a USD \$2.5 trillion industry and 30 million jobs. Australia wants a piece of that action. The export potential is driving most of the interest in renewable hydrogen development in Australia. In August, the Australian Renewable Energy Agency (ARENA) published a study by ACIL Allen Consulting that estimated hydrogen exports could provide 2,800 jobs and add AUD \$1.7 billion (USD \$1.2 billion) a year to the economy by 2030. The study identified Japan, China, the Republic of Korea and Singapore as major prospective markets for Australian hydrogen by 2025. Japan, in particular, is already being regarded as a potential customer for renewable hydrogen produced in Australia. Dr. Daniel Roberts, leader of the hydrogen energy systems future science platform at the Australian Commonwealth Scientific and Industrial Research Organization (CSIRO), said the market opportunity for Australia is "big and growing." Japan is aiming to get 40 percent of all its energy from hydrogen by 2050, he said. This could amount to almost 38 million tons a year. "That's a lot of hydrogen," said Roberts. Exports are also important because domestic uptake of hydrogen-based applications such as fuel-cell vehicle transport is still in its infancy, said Roberts. "Australia lags other countries in the uptake of novel transport solutions, and we are lagging in the deployment of the required infrastructure, such as hydrogen refueling stations," he said. "These factors, along with current demand in countries like Korea and Japan, make many people consider the export opportunity as the first mover." The trick will be to get the hydrogen from Australia to these other Asia-Pacific markets in a cost-effective way. To do this, Australia has to master creating hydrogen from renewable energy and then storing and moving it around on a massive scale. In August, CSIRO claimed a breakthrough on the transportation front. The research body unveiled a membrane technology that separates ultra-high-purity hydrogen from ammonia, while blocking all other gases. "This technology will pave the way for bulk hydrogen to be transported in the form of ammonia, using existing infrastructure, and then reconverted back to hydrogen at the point of use," said CSIRO in a press release. Elsewhere, Kawasaki Heavy Industries is working with the Commonwealth and Victoria governments on a project to commercialize liquid hydrogen made from gasifying brown coal. Kawasaki Heavy Industries is undertaking the AUD \$500 million (USD \$359 million) project with an eye on global hydrogen markets. Nevertheless, it "faces environmental challenges posed by the carbon emissions released when burning coal to create hydrogen," the Financial Times reported. Another project, being developed by Northern Oil with support from the Queensland government, would use solar to power an electrolyzer for green hydrogen production at Yarwun, on Australia's northeast coast. The site, close to Queensland's largest cargo port, would make it easy for the hydrogen to be shipped to Japan on specially designed tankers, ARENA said. Separately, in July ARENA announced AUD \$1.5 million (USD \$1.1 million) for a green hydrogen innovation hub at Jandakot, Western Australia. There, the gas company ATCO will trial the production, storage and use of renewable hydrogen in a commercial-scale microgrid. Green hydrogen will be produced from on-site solar using electrolysis, fueling a range of appliances after being blended into a natural-gas pipeline, ARENA said. Claire Johnson, chief executive officer at Hydrogen Mobility Australia, an industry group, said Australia's hydrogen sector had reached "a critical juncture," transitioning from research and development, pilot projects and demonstrations to "building scale." Scaling up hydrogen production would help bring down costs, she said. Once the industry achieves that, it could be well-positioned to export the gas to Asia. "Australia has trusted, long-term trading relationships with countries who have announced their commitment to a hydrogen society, such as Japan," she said. "We have a strong foundation to move into this new energy space." While exporting hydrogen is the main focus of much of the industry development to date, insiders also believe Australia could eventually develop a significant domestic market. Johnson said the domestic hydrogen sector is focused on two areas: transport and natural-gas grid injection. "Both have enormous potential to support Australia's decarbonization, energy security and grid stability efforts," she said. Australia's industry players and government bodies see domestic and export hydrogen markets as complementary, said Johnson. "This two-pronged pathway is particularly important from a capability standpoint," she said. "Australia needs to develop local skills now to support an export sector in the future. A domestic focus will assist us." Underlying the rush to develop the domestic and export hydrogen sectors is a question over what Australia can usefully do with the excess energy production that will come from a growing level of intermittent renewable generation sources. Australia has near-perfect conditions for solar energy, and its wide-open spaces offer plenty of potential for building out PV and wind plants. In June, ARENA said there had been AUD \$10 billion (USD \$7 billion) of investment in large-scale renewable generation in 2017, accompanied by 1.1 gigawatts of new rooftop solar. Renewable energy penetration had hit 45 percent in South Australia and 16 percent in Victoria, ARENA said. Queensland is on track to reach a target of 50 percent renewables by 2030. This growth in intermittent renewables is forcing Australian energy companies to seek ways of managing imbalances between generation and demand. Australian utility AGL, for example, is putting together a virtual power plant based on the world's biggest aggregation of household solar and behind-the-meter batteries. In front of the meter, meanwhile, Australia not only has the world's

biggest battery system, with more large-scale systems in the pipeline, but it is also planning up to around 363 gigawatts of new pumped hydro storage. This storage will help Australia make better use of renewable generation but won't allow the country to replace the revenue it gets from exporting coal and liquefied natural gas (LNG). Neither will hydrogen, to begin with: The export revenues forecast for 2030 in the ARENA/ACIL Allen Consulting report are only around 1 percent of what Australia got from resource and energy exports in 2014. It's a start, though, and Australia's industrial concerns are excited about the prospects. Martin Hablutzel, head of strategy for Siemens in Australia, said he expected hydrogen to play "a major role" in the energy systems of the future. "With increasing renewable electricity being generated, hydrogen is an ideal bridge between that electrical energy and other applications, such as transport, decarbonizing gas networks for industry and households, and also for re-electrification," he said. Although hydrogen is not easy to handle, it can be turned into more malleable compounds such as methanol, ammonia or synthetic methane using mainstream industrial processes, he noted. "I believe its importance will grow very rapidly as increasingly large demonstration projects come online, similar to how grid-scale wind and solar developed from small-scale and niche applications," he said. The hope is that one day Australia will be able to replicate with hydrogen what it has achieved with LNG. According to the energy markets business wire S&P Global Platts, Australia is set to become the world's largest exporter of LNG by 2020, overtaking Qatar. Why not try the same trick with hydrogen? "Our status as an energy export superpower positions us well as a reliable supplier," said Hablutzel. "Admittedly, there is a race on with other countries. But Australia is certainly well-positioned to play a major role."