
LOW-CARBON
CORRIDORS

AS THE RELATIONSHIP BETWEEN THE WATER AND ENERGY SECTORS CONTINUES TO EVOLVE AMID THE GLOBAL TRANSITION TO A LOW-CARBON ECONOMY, KEY OPPORTUNITIES ARE EMERGING FOR UTILITIES TO INTEGRATE RENEWABLE ENERGY TECHNOLOGIES ACROSS THEIR OPERATIONS. HERE, *CURRENT* ADDRESSES POTENTIAL AVENUES FOR LOW-CARBON ENERGY AND THE ROLE AUSTRALIA'S WATER SECTOR CAN PLAY IN BUILDING A GREENER FUTURE.

By Martin Kovacs

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> “PRICES ARE PROJECTED TO CONTINUE DECLINING, AND THIS MAKES THE PROSPECT OF GREEN HYDROGEN MUCH MORE ATTRACTIVE.”
>
> **HENRY SWISHER, JACOBS**

The water-energy nexus has been the subject of increasing attention in recent years, as the water and energy sectors navigate the interrelated challenges of climate change, growing demand and resource security. Utilities have been actively exploring how to match renewable energy sources, from solar to biogas generation, to their various energy requirements.

In November 2019, the release of Australia’s National Hydrogen Strategy by the COAG Energy Council Hydrogen Working Group, chaired by Australia’s Chief Scientist Dr Alan Finkel, thrust the hydrogen industry firmly into the spotlight.

Hydrogen’s effectiveness as an energy carrier, producing zero carbon emissions when used as a fuel, is attracting growing attention, with GHD Water Market Leader – Australia Rod Naylor highlighting the opportunity to position Australia as a first mover in the rapidly growing market.

“Australia currently enjoys bipartisan support for the industry at all levels of government,” Naylor said.

“This would be attractive to international investment partners seeking to participate in the development of a hydrogen supply chain, which has significant demand globally.”

THE EMERGING HYDROGEN INDUSTRY

As Australia’s National Hydrogen Strategy outlines, most hydrogen is currently produced using fossil fuels. However, the utilisation of renewable energy to power electrolysis, the process via which electricity is used to split water into hydrogen and oxygen, produces no carbon emissions.

Naylor said the water-energy nexus was particularly relevant to using electrolysis to separate water to extract the hydrogen, and stressed the importance of considering water’s role as a resource.

“If we export hydrogen, we are essentially exporting water, and this needs to be considered in the context of water security,” he said.

“If we are using hydrogen in the domestic market, there may be opportunities to re-use water throughout this process.”

As a means of addressing water security concerns, Naylor highlighted the potential to use recycled water or desalination, but also pointed to a number of obstacles industry would need to deal with.

“Australia’s experience with large-scale desalination provides a solid starting point for the hydrogen industry,” he commented.

“But there will be technical challenges to overcome – for example, the choice of water recycling or desalination technology will have an impact on overall energy requirements, life cycle cost and life cycle carbon emissions of hydrogen production.”

Naylor said that if the hydrogen industry were to match the current exports of the liquefied natural gas industry, this would amount to approximately 25 million tonnes of hydrogen per year, requiring approximately 250 million tonnes of water.

“This will be a relatively small fraction of Australia’s water resources, even under dry conditions,” he said. “But each project may need careful consideration of water security at the local level to achieve a sustainable solution.” ▶

PATHWAYS TO PRODUCTION

Jacobs Strategic Consultant for Energy Markets Henry Swisher said many governments viewed hydrogen as a transition industry, from fossil fuel-produced hydrogen, paired with carbon capture, to renewable hydrogen.

While coal still dominates the local energy mix, Swisher noted many coal-fired power plants would be reaching the end of their technical lifespans over the next two decades, while proximity to export markets and existing shipping agreements could facilitate growth of the hydrogen export industry.

Swisher said the case for green hydrogen would grow as the cost of renewable energy technologies continued to fall.

"The reason a lot of noise is being made about Australia is mainly because, compared to a lot of other countries, we have a combination of excellent renewable resources and the land space to develop those resources," he said.

"We've seen a dramatic fall in the price of solar, in particular, but also wind, over the past decade. Prices are projected to continue declining, and this makes the prospect of green hydrogen much more attractive."

Jacobs Regional Solutions Director – Drinking Water and Re-use John Poon noted significant potential existed to drive down costs as hydrogen production was expanded, with the modular nature of electrolysis technology providing a building block to scaling up operation.

Poon said the water industry had a history of developing new technologies and scaling up, and highlighted the need for the water and energy industries to work together.

"There is a significant role for the water industry to play in the decarbonised future," he said.

"There are really only two key ingredients for green hydrogen production – lots of renewable energy and water. Water is a pretty scarce resource in Australia, and the water industry is responsible for what we do with water, and recycled water has a key role to play."

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>
> **ROD NAYLOR, GHD**

OPPORTUNITIES FOR THE WATER SECTOR

A Jacobs white paper released last year – *Australia's pursuit of a large scale hydrogen economy* – evaluates the potential for sustainable hydrogen production in Australia, and recommends utilities investigate the potential revenue stream, cost savings and efficiency benefits that production could deliver.

The paper states that scope exists to use recycled water due to the prevalence of wastewater facilities throughout the country, along with their proximity to urban centres providing flexible siting options.

The paper also notes that business cases for wastewater facilities incorporating hydrogen production will be further boosted if they are adjacent to transport hubs, with Poon pointing to the opportunity for the water and energy sectors to collaborate with the transport sector.

"Locally, I think transportation is probably the area that we would like to look at," he said.

"Water utilities have a big role there, because most wastewater treatment plants are located in ideal locations for hydrogen hubs – they're on transport corridors, they're near industrial users and they're near gas networks."

Swisher pointed to the value in utilities assessing how hydrogen could be utilised in the context of larger business models.

"One example of this is that a lot of utilities have large trucks and fleets, with vehicles typically undertaking lots of trips," he said.

"So, the potential exists to combine hydrogen production equipment with co-located renewable energy, such as waste-to-energy, turning this into hydrogen and using it for onsite transport, or day-to-day use, with the eventual aim of becoming a large-scale supplier and utility of the future." ▶

SA Water Senior Manager Zero Cost Energy Future Nicola Murphy with one of the utility's existing solar arrays.

SOLAR SUPPLY

SA Water is one utility seeking to integrate renewable energy technologies across its operations, investing more than $300 million to install 154 MW of solar photovoltaic generation at around 35 sites, along with 34 MWh of energy storage devices, by the end of 2020.

SA Water Zero Cost Energy Future Program Senior Manager Nicola Murphy said the program was formed amid the backdrop of an increasingly volatile electricity market.

"It was becoming obvious to us that we needed to make some bold moves to keep pace with the changes that we were seeing in the market," she said.

"Electricity is one of our biggest operating costs. If we can sustainably reduce our operating expenses, we can ultimately keep water and sewerage charges low and stable for our customers."

Murphy said SA Water approached energy management at a portfolio level, focusing on demand scheduling, energy efficiency, storage, generation and energy market levers.

In addition to catering to SA Water's electricity needs, the energy generated will allow the utility to sell back to the market, with Murphy pointing to the importance of being able to "make the right decisions at the right time, and fairly quickly in response to market changes".

Aiding this will be the development of an energy management system overseeing the range of the utility's operations.

"A sophisticated modelling tool allows us to continually review the actual performance at the different sites, optimising how those sites operate," Murphy said.

"This involved scheduling large loads through the day, taking into consideration how the market is changing and how our generation is influencing a site – the combination of the market, the generation, the storage and then the load, bringing those together and optimising that outcome financially." ▶

> "BIG CAPITAL INVESTMENTS IN THE SYSTEM ARE NOT AS NECESSARY IF YOU HAVE FLEXIBILITY IN THE WAY THAT YOU USE ELECTRICITY."
>
> **DANI ALEXANDER, UTS INSTITUTE FOR SUSTAINABLE FUTURES**

INTEGRATING DEMAND-SIDE FLEXIBILITY

With utilities investigating the potential to harness renewable technologies across different operations, UTS Institute for Sustainable Futures Research Principal Dani Alexander highlighted the key role that demand-side flexibility can play in the energy transition.

Alexander pointed to opportunities for change that are emerging, with demand-side flexibility "finding ways to use electricity at times that better complement the system".

"Our energy system has changed from a one-way flow of electricity, from mostly large coal-fired generators to dispersed customers, to more dynamic two-way flows," she said.

"Big capital investments in the system are not as necessary if you have flexibility in the way that you use electricity."

Being able to shift demand can both bypass the need for costly additional network infrastructure and provide a pathway for renewables integration. Alexander noted that with "a large load you can make a big impact".

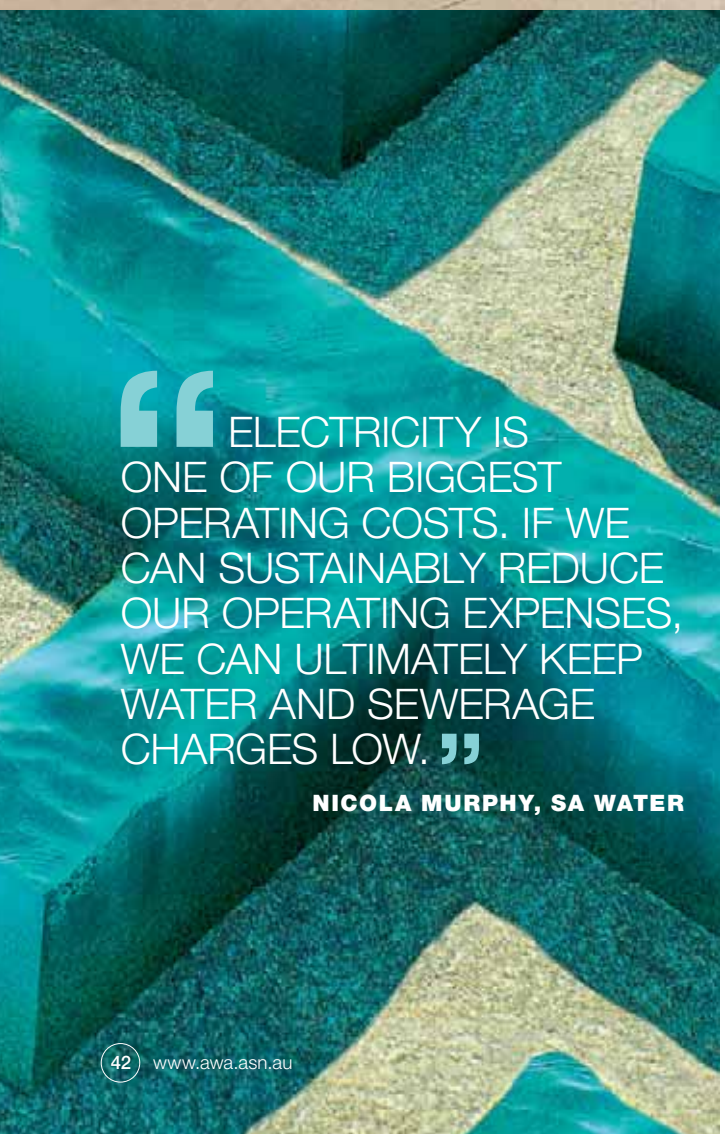
"When we're talking about efficient emissions reduction, we want big shifts in load to match the renewables that are coming online," she said.

To this end, as large energy users, utilities have an opportunity to influence a better energy transition.

"From a utility's perspective with a large load, there is huge potential to facilitate renewables for both the site's and the system's benefit," Alexander said.

"At a system level, industrial load-shifting is a game changer, because it shows how we can practically transition to 100% renewables with wins all round." ▶

Yarra Valley Water waste-to-energy plant.



RETHINKING WASTE

Yarra Valley Water’s (YVW) ReWaste waste-to-energy facility in Wollert has been in operation for more than two years, producing enough energy each year to power up to 1500 homes.

YVW Managing Director Pat McCafferty explained that the facility, which converts commercial food waste into renewable energy, powers both itself and the Aurora sewage treatment plant, generating enough excess energy to export to the electricity grid.

“The process for treating sewage and producing recycled water is very similar to processing food waste, so YVW harnessed its existing knowledge and built on it to explore this new way of producing its own energy,” McCafferty said.

McCafferty pointed to a range of benefits delivered by the facility, which has converted more than 60,000 tonnes of food waste into energy, saving YVW $1 million to date on energy, and helping the utility maintain affordable bills for its customers.

“The plant generates 90% less greenhouse gas than using fossil fuels from the grid and saves 8500 tonnes of carbon per year,” McCafferty said.

“In addition, there are significant greenhouse gas reductions achieved from reduced food waste in landfill.”

YVW, which has also invested in several solar projects, is aiming to generate 100% of its own energy by 2025.

“The success of the plant shows that environmental projects can help not only to reduce an organisation’s carbon footprint, but also help them save money, which can benefit customers when these savings are passed on,” McCafferty said.

“On the back of the plant’s achievements, YVW is now looking to set up a second waste-to-energy facility, as the problem of waste isn’t going away and we are looking to do more.”