The role for hydrogen in decarbonising Oceania's gas grids, part 1

By **Joanna Sampson**

You could argue that the switch to hydrogen powering our homes and businesses in the future would be almost underwhelming. Just like natural gas, which is used today, hydrogen can heat homes in exactly the same way. This means there would be minimal changes to how we use gas for heating or cooking. The only difference? There would be no carbon emissions.

Australian Gas Infrastructure Group (AGIG) and New Zealand's Firstgas Group are investigating the role for hydrogen in decarbonising Oceania's gas grids, and thus powering our homes in the future. Research from both energy firms shows their distribution networks could be converted to 100% hydrogen by 2050 at the latest.

Operating New Zealand's gas transmission system, which consists of the 2,200km pipeline and 300km Maui pipeline, Firstgas also operates more than 4,800km of gas distribution network across the North Island. It is through this existing pipeline network that Firstgas plans to introduce hydrogen, and the gas distributor has committed to do this from 2030. Ben Gerritsen, Firstgas Group's General Manager of Customer and Regulation, said a conversion to 100% hydrogen

would reduce New Zealand's energy emissions by nearly 25%.

In Australia, AGIG started blending 5% hydrogen to more than 700 customers in South Australia in May. By 2030, AGIG is planning to blend 10% hydrogen across all of its gas distribution networks.

Australian Gas Networks (AGN), part of AGIG, operates approximately 25,000km of distribution networks and 1,100km of pipelines, serving more than 1.2 million consumers in South Australia, Victoria, Queensland, New South Wales and the Northern Territory. Vikram Singh, Head of Hydrogen Development at AGIG, said research indicated that net zero emissions from gas networks can be reached with hydrogen at half the cost of electrification – more on that later.

Here in part one of the interview with Gerritsen and Singh, we find out more about each company's vision and timeline.

Can you tell us more about AGIG and Firstgas' visions and timelines to deliver 100% hydrogen by 2050?

Vikram Singh, AGIG: For our distribution networks we are planning to provide a 100% carbon-free, renewable hydrogen gas supply solution for those customers that require this by 2025; to have all of our distribution networks supplying a renewable hydrogen blend of up to 10% by 2030; and to convert all our distribution networks to 100% renewable hydrogen by 2040 as a stretch target, and by no later than 2050.

But it's not just in future, renewable gas is here today. Hydrogen Park South Australia (HyP SA) is already delivering a 5% renewable gas blend to more than 700 homes and Hydrogen Park Gladstone (HyP Gladstone) is currently under development for operations in 2022. This is just the start.

Ben Gerritsen, Firstgas: Firstgas is looking to make gas greener for New Zealand by carrying hydrogen and biomethane through its gas pipelines. As part of the World Energy Council's Global Hydrogen Initiative, we've committed to introducing hydrogen into our gas pipelines starting in 2030 and ramping up to 20% (by volume) by 2035.

Our hydrogen roadmap is based around the production of green hydrogen, using renewable electricity to split water. This makes sense in New Zealand where abundant freshwater resources are available and 85% of our electricity is already generated from renewable resources, with significant further wind and solar development underway.

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A conceptual conversion strategy to move from a 20% hydrogen gas blends to a 100% hydrogen network was developed in the study. This involves converting sections of the network from blended gas to 100% hydrogen. Pure hydrogen is fed from electrolysers located within the section of the network that would be isolated from the rest of the grid, whilst the remainder of the network is fed with a hydrogen blend supplied by the main gas transmission network. This process is repeated section by section until the entire grid is fully converted.

The study estimates that conversion of the entire network from blends to pure hydrogen will take approximately 15 years, starting in 2035. The time taken to convert each individual section will depend on the network configuration, location of isolation valves and customer equipment replacements within the conversion area and will require detailed conversion plans to be developed.

As you've already mentioned Vikram, AGIG is already powering homes with hydrogen today. How is the HyP SA project going?

Vikram Singh: Located at the Tonsley Innovation District, HyP SA is an Australian first and the largest electrolyser plant, and one of only a few projects in the world to deliver a renewable gas blend to homes connected to an existing gas network.

Starting in May 2021, the renewable hydrogen is blended with natural gas and supplied to nearby homes via the existing gas network. We are also supplying to industry via tube trailers and aim to supply the transport sector in the future.

A 5% hydrogen blend is the first step to lowering greenhouse gas emissions. We are currently extending our hydrogen footprint with projects considering up to 10% hydrogen blends before ultimate 100% conversion, such as the Australian Hydrogen Centre and HyP Gladstone.

Can you tell us anymore about HyP Gladstone?

Vikram Singh: It supports Queensland's target of 50% renewable energy by 2030, and Gladstone's vision to be a key hub for Queensland's domestic and hydrogen export industry, just as it is for natural gas today.

The A$4.2m facility will produce renewable hydrogen using water and renewable electricity from the local electricity grid. The renewable hydrogen will be blended at volumes of up to 10% with natural gas, for supply to more than 770 >>

>> existing gas connections on Gladstone's entire gas network.

Beginning production in 2022, HyP Gladstone's renewable hydrogen will be the highest volume of hydrogen delivered by an existing gas network. It will also be the first project to supply a renewable hydrogen blend to small commercial and industrial facilities via the existing gas network.

Ben, we understand Firstgas is planning to trail a mix of 1% hydrogen into its networks soon. When will this take place?

Ben Gerritsen: Our results set a good foundation to our future work on hydrogen. We will build up our experience of dealing with hydrogen on our networks over the coming years. We will begin design work in 2021 on a physical trial on a pipeline network that is blend ready (or nearly blend ready) to start building that experience. We would start with a small amount of hydrogen (1% by volume) and build to 20% by volume over the trial. Planning is underway and our aim is to start this trial in the next few months.

What are the advantages of converting the network to hydrogen and powering homes in this way rather than replacing gas with, say, electricity?

Vikram Singh: By blending and ultimately replacing natural gas with renewable gas, we can use our existing gas infrastructure to supply a cleaner energy to our customers. It also means customers retain their choice of energy supply, and those industries relying on gas can continue to access it.

"Research indicates that net zero emissions from gas networks can be reached with hydrogen at half the cost of electrification"

Research indicates that net zero emissions from gas networks can be reached with hydrogen at half the cost of electrification[1]. This is supported by a series of reviews, studies, research and analysis to inform Australia's National Hydrogen Strategy that further indicates replacing natural gas with hydrogen is cheaper than replacing with renewable electricity.

Hydrogen production through electrolysis grows the market for renewable electricity and brings together gas and electricity networks, using the gas network like a giant battery to store excess renewable electricity.

Ben Gerritsen: Electrification of our energy system is a hot topic right now. The cost of an electrification-only approach to decarbonisation is likely to be higher than incorporating hydrogen into existing gas networks. Work by Firstgas, PowerCo and Vivid Economics in 2018 determined that a decarbonised gas system in conjunction with increased electrification would likely provide a lower cost pathway to a net zero emissions energy system than a purely electric one.

We also know that consumers value the use of gas for reasons other than price. Some gas uses will be very difficult to electrify as they rely on the high heat value that is delivered by molecules or the effect of a flame, for instance in commercial kitchens. Our customer research also highlights that many New Zealand homes value the comfort and convenience of gas appliances, with electric alternatives not yet available here that provide similar benefits. H2V

Keep an eye out for part 2 of the interview with AGIG and Firstgas, which will be published on H2 View's website later in August.

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Reference

1. Frontier Economics (2020), value of gas infrastructure https://www.energynetworks.com.au/resources/reports/2020-reports-and-publications/the-benefits-of-gas-infrastructure-to-decarbonise-australia-frontier-economics/