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6 August 2021

The Hon. Lily D'Ambrosio MP
Minister for Energy, Environment and Climate Change
Minister for Solar Homes
Via online submission: https://engage.vic.gov.au/help-us-build-victorias-gas-substitution-roadmap

Dear Minister

Victoria's Gas Substitution Roadmap consultation

Australian Gas Infrastructure Group (AGIG) welcomes the opportunity to provide a submission to the Victorian Government's consultation on the Gas Substitution Roadmap (the Roadmap).
We commend the Victorian Government for recognising the need to accelerate the development and deployment of "all opportunities to decarbonise gas supply" and look forward to playing an active role in achieving this goal.

AGIG is the largest gas distribution business in Australia, and in Victoria we reliably distribute gas to over 1.4 million customers through over 21,000km of distribution network. Through Australian Gas Networks (AGN) (VIC & Albury) and Multinet Gas Networks (MGN), we serve much of Victoria including the Melbourne CBD, the northern, eastern and south-eastern suburbs, and much of eastern and central Victoria extending north to Wodonga and east to Bairnsdale.

We have adopted a stretch target for the full decarbonisation of our gas networks by 2040 (and 2050 at the latest) and our Low Carbon Strategy is described in Attachment E. Our Low Carbon Strategy sets out a pathway for the complete decarbonisation of the gas delivered by our networks and used by our customers. It also sets out interim targets to achieve the 2040 goal, in alignment with the Victorian Government's net zero ambitions.

We are actively delivering and investigating the potential for renewable gases such as hydrogen and biomethane for investment (summarised in Attachment E). Hydrogen Park South Australia is today delivering renewable hydrogen to South Australian customers including to households via our network and to industrial users via tube-trailer. Hydrogen Park Murray Valley will be Victoria's first renewable hydrogen production facility serving 40,000 customers in Albury and Wodonga and other users across the state.

An overview of our submission to the Roadmap is included in this letter. It makes several key points:

- AGIG welcomes concrete efforts to decarbonise the gas sector to meet Victoria's emissions reduction targets;
- The optimal decarbonisation pathway is unknown, however it is clear that our Victorian customers value having a choice for their home energy supply;
- Evidence is growing that renewable hydrogen presents a low cost, reliable and versatile means of decarbonising natural gas use; importantly because of the scale of energy delivered by the gas networks and the consequent massive electricity network reinforcement and storage costs under an electrification alternative;
- Focusing on electrification alone in the near and long term has costs, and would likely increase emissions in the near term because heating load is generally in the morning and evenings when

rooftop solar is not available and the alternative is coal-intensive mains electricity (absent a very large domestic battery that can go through the evening electricity and heat peak)

- Victoria should learn from its success in demonstrating and deploying renewable electricity;
- Clear direction and concrete support is required from Government for the renewable gas sector to build scale and to play a significant role in decarbonising gas use; and
- In the short term, the gas networks can contribute materially to emissions reduction through the mains replacement programs which are reducing fugitive methane emissions.

In addition to this document, our submission includes the following attachments which provide a full response to questions relevant to AGIG in the Roadmap consultation paper:

- Attachment A – Hydrogen pathway
- Attachment B – Biogas pathway
- Attachment C – Reducing fugitive emissions
- Attachment D – Response to gas industry transition issues and challenges
- Attachment E – About AGIG and our Low Carbon Strategy

Once again, I would like to thank the Victorian Government for the opportunity to provide this submission. AGIG looks forward to working closely with the Government as the Roadmap and policy measures are further developed. Should you have any queries about the information provided in this submission please contact Drew Pearman, Head of Policy and Government Relations (drew.pearman@agig.com.au or [redacted]).

Yours sincerely,

[redacted]

Craig de Laine
Executive General Manager Customer and Strategy

Overview of AGIG's submission

AGIG welcomes efforts to decarbonise the gas sector to meet Victoria's emissions reduction targets

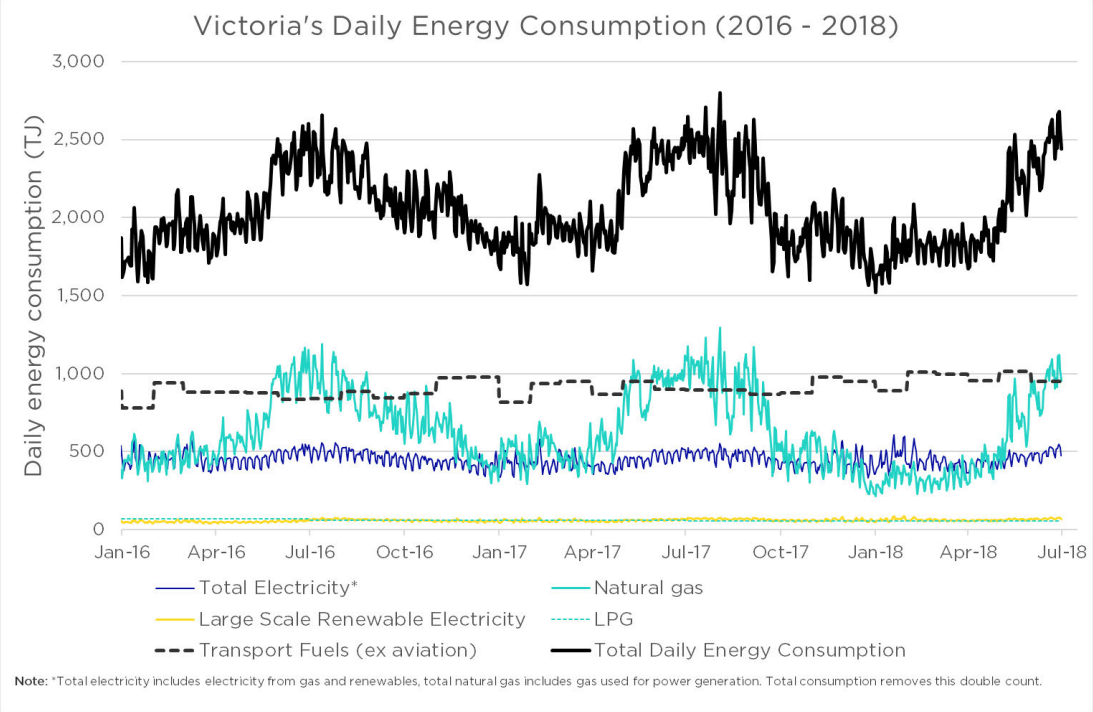
AGIG strongly supports the Victorian Government's efforts to achieve net zero emissions and its interim emissions reduction targets as required by Victoria's *Climate Change Act*. We recognise that all parts of economy including the gas sector, will need to decarbonise in order to achieve net zero emissions. The Roadmap represents the first time any government in Australia has actively sought to decarbonise natural gas usage and we welcome this step.

To decarbonise natural gas use, the Victorian Government should introduce targets for the decarbonisation of gas supply and policy frameworks to ensure this occurs.

In Victoria, natural gas represented 20% of primary energy consumption in 2018-19,[1] but only 15% of green house gas (GHG) emissions. As noted in the consultation paper, during winter peaks natural gas contributes significantly more energy than electricity and orders of magnitude more than renewable electricity – this situation will not change quickly in any scenario.

Because natural gas remains such an important and valued part of the energy mix, renewable gases like hydrogen and biogas represent a significant opportunity for Victoria to achieve its targets, while making use of Victoria's extensive gas network and minimising costs.

Figure 1: Victorian daily energy consumption 2016 to 2018



Source: Energy Networks Australia

Our goal to completely decarbonise all the natural gas in our networks with renewable hydrogen and other renewable gases demonstrates our commitment to achieving emissions reductions. In the

[1] Australian Energy Statistics 2020, Table C

medium-to-long term achieving these targets will achieve net-zero emissions from our own operations including fugitive emissions (scope 1 and 2 emissions) and for our customers (scope 3 emissions).

The optimal decarbonisation pathway is unknown

We commend the Victorian Government in exploring a range of pathways for the gas sector to reach net zero emissions and seeking to accelerate all opportunities to decarbonise gas supply.

We also recognise that the future of gas in the medium to long term remains uncertain and that no single proposed pathway represents a perfect solution to decarbonise gas usage in the immediate term – each comes with costs, benefits and uncertainties.

Decisions made today will have implications across both gas and electricity networks and for customers and may create path dependency, locking in higher cost solutions. There are opportunity costs for all customers large and small in ruling out options now that need to be fully addressed in the Roadmap.

Because the optimal pathway is unknown (and will largely remain so), policy should remain open to technologies that have demonstrable evidence that they have potential to play a role in achieving net zero emissions while addressing the multi-criteria assessment framework in the consultation paper.

Evidence is growing that renewable hydrogen presents a low cost, reliable and versatile means of decarbonising natural gas use

Renewable gases represent a significant opportunity for Victoria to achieve its emission reduction targets, while making use of Victoria's extensive gas network and minimising costs. Since the publication of Australia's National Hydrogen Strategy in 2019, the evidence in support of hydrogen has only strengthened.

Independent evidence that cost-effective hydrogen is on the horizon includes the most recent analyses by the Clean Energy Finance Corporation (CEFC)[2] and the Energy Transitions Initiative.[3] These analyses show that renewable hydrogen is likely to reduce in cost significantly over the next ten years; to the point where it is likely to be competitively priced against natural gas for a range of uses by around 2030 (further details in Attachment A – Hydrogen Pathway). The CEFC analysis in particular forecasts that renewable hydrogen in networks will approach the price of natural gas by around 2030 (and already is cost-competitive in several other sectors). This is driven by three factors:

- Declining electrolyser capital costs;
- Declining renewable electricity costs; and
- Installation and operational efficiencies that can be delivered as hydrogen production is deployed at scale in Australia.

Importantly, these cost reductions occur in concert with reductions in renewable electricity costs. Hydrogen plays a complementary role with renewable electricity, but to do so requires hydrogen to have active sources of demand in networks, transport and eventually hard to abate industries.

The benefits and potential applications of renewable hydrogen are broad and given that cost-competitiveness is on the horizon, government should make sure these opportunities are available to all consumers of natural gas.

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[2] CEFC 2021 *Australian Hydrogen Market Study*. See: https://www.cefc.com.au/media/nkmljvkc/australian-hydrogen-market-study.pdf

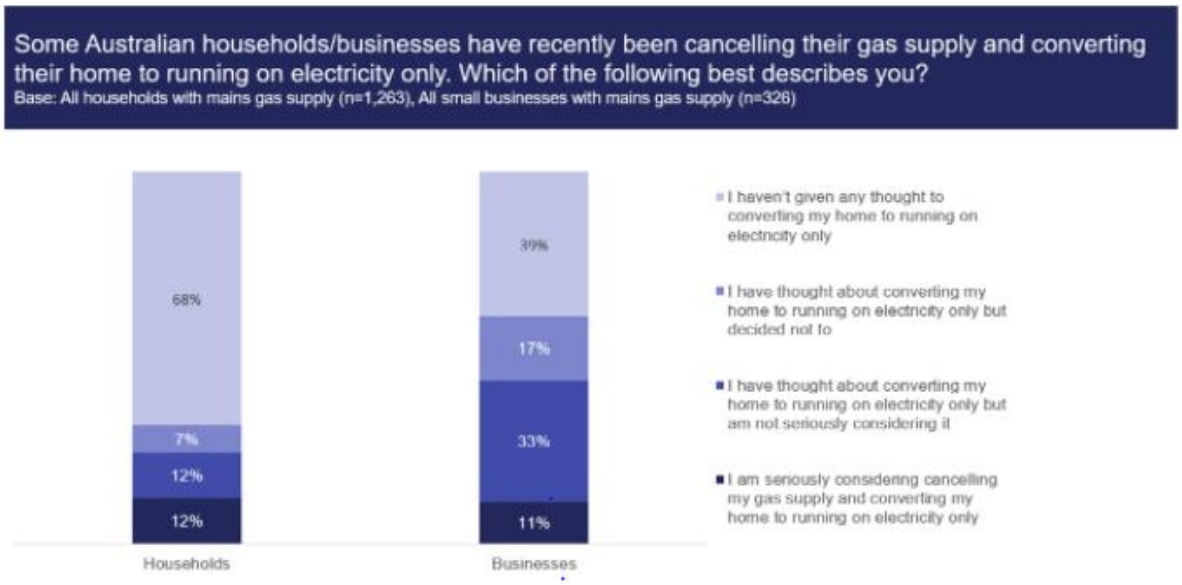
[3] Australian Industry Energy Transitions Initiative 2021 *Phase I Highlights Report.* See: https://energytransitionsinitiative.org/wp-content/uploads/2021/06/Phase-1-Highlights-Report-June-2021.pdf

- Hydrogen creates an opportunity for greater coupling across the energy sector, particularly between the electricity and gas networks to create a single integrated energy delivery system.
- The hydrogen export opportunity is significant, with markets across the globe looking for supplies of zero emissions energy many times larger than Australia's domestic requirements.
- Industrial users represent one of the most important applications for hydrogen and international examples demonstrate that hydrogen use for industrial applications is viable.
- The hydrogen fueled transport market represents an early target market in the development of a hydrogen industry and reducing emissions.

Securing all of these markets requires early demonstration and deployment of hydrogen technologies. The existing gas network can form a reliable source of demand while also delivering benefits to each of the sectors above.

Also customers like using gas in their homes; it is often a preferred fuel for cooking and heating, and customers particularly value the reliability of a gas connection. As recent customer survey data from Energy Consumers Australia shows, very few households and businesses are even thinking about replacing their gas appliances; likely because of the benefits that gas brings. Substituting natural gas with renewable gas means that end-users can continue to receive the same benefits they receive from natural gas today – affordability, safety, reliability, security of supply and equity, but with the zero emissions benefit of renewable gas.

Figure 2: Energy System costs in 2050 relative to base case



Source: Energy Consumer Australia, Sentiment Survey – June 2021

With the evidence that hydrogen costs are declining rapidly, it is increasingly clear that a gas connection to residential, commercial and industrial customers can be a zero emission energy connection. Governments should not prevent customers from taking up this option through heavy-handed policy measures that reduce choice and investment in alternatives.

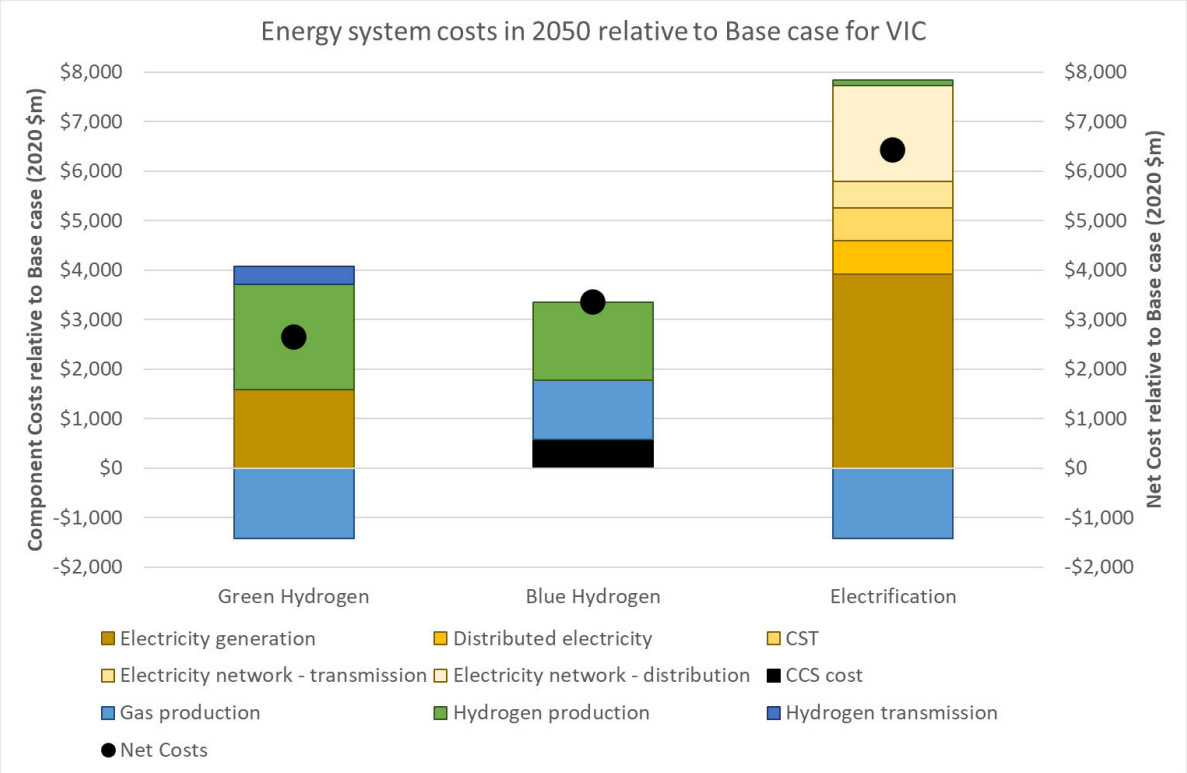
Focusing on electrification alone in the near and long term has costs

Over-emphasising electrification in policy decisions as the only pathway to achieving decarbonisation, risks increasing emissions in the near term, and increasing economy-wide costs in the longer-term.

Analysis from Frontier Economics suggests that using Victoria's extensive gas distribution networks to deliver renewable hydrogen represents a lower cost pathway overall to achieving net zero

emissions (further details in Attachment D). Frontier Economics found that in Victoria, using renewable hydrogen is significantly cheaper than electrification to replace existing uses of natural gas (excluding power generation) because "there are significant additional electricity network costs" associated with electrification.[4]

Figure 3: Energy System costs in 2050 relative to base case



Source: Frontier Economics

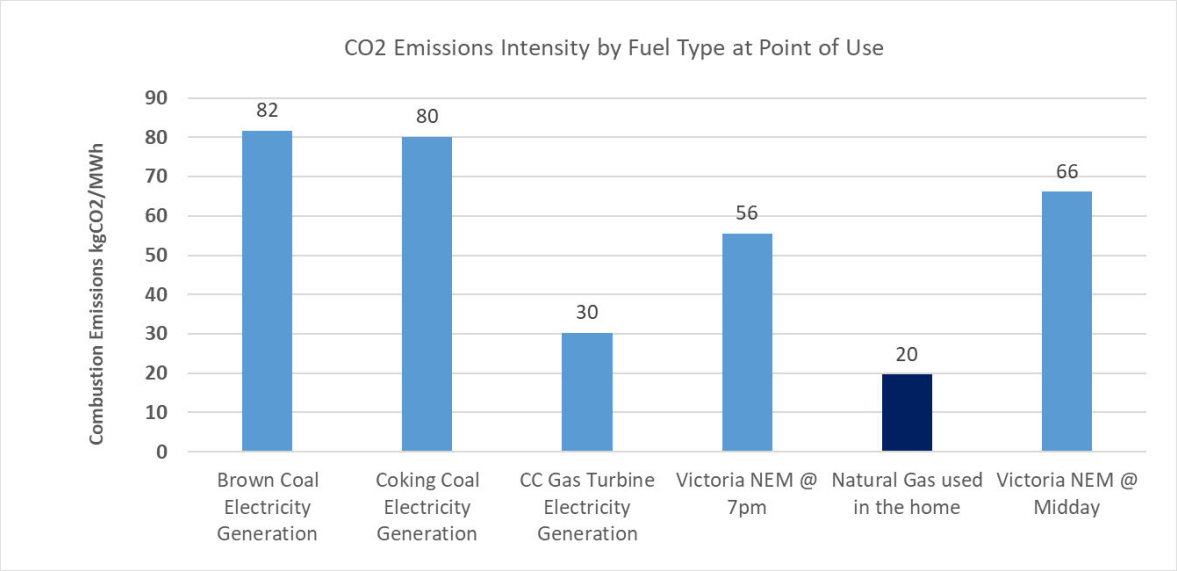
In addition to these long-term costs, in the near term switching from a gas appliance to an electric appliance with grid-electricity is also likely to increase emissions. This is likely to remain the case for some time even as the proportion of renewable electricity increases, as gas consumption peaks during winter and in the morning and evening when electric appliances would continue to draw fossil fuel electricity energy from the grid.

New modelling from the Future Fuels Cooperative Research Centre (FFCRC) and the University of Melbourne, supports this conclusion.[5] This research finds that higher levels of electrification in Victoria increase emissions between now and 2025, as winter peaks in gas demand draw energy from coal (and to a lesser extent gas fired) power generation. The research further finds no positive emissions impact of electrification out to 2035, as gas consumption in homes and businesses merely transfers to gas consumption for electricity generation. The research takes account of the relative efficiency of electric and gas appliances, as well as increasing renewable electricity generation and the closure of Loy Yang.

[4] Frontier Economics, *The Benefits of Gas Infrastructure to decarbonise Australia*. See: https://www.energynetworks.com.au/resources/reports/2020-reports-and-publications/the-benefits-of-gas-infrastructure-to-decarbonise-australia-frontier-economics/

[5] FFCRC Research programme 1.2-02 *Regional case studies on mutli-sector integration*, led by Professor Pierluigi Mancarella at the University of Melbourne

Figure 4: CO2 Emissions Intensity by Fuel Type at Point of Use in Victoria



Source: AGIG analysis

The Grattan Institute also found that "Victoria's large household winter gas heating load means that switching small-user gas loads would have significant effects on its electricity system" and that switching to electricity would increase emissions over the next decade.[6] Further the Grattan Institute explicitly note:

> *"In Victoria, encouraging households to use electricity rather than gas will generally increase emissions over the coming decade."*[7]
>
> *"It is not possible today to make definitive judgements about whether or when to electrify gas loads, or move to low-emissions gas substitutes. The factors that will determine the best approach for consumers are too uncertain and, in any case, will vary significantly between places and over time".*[8]

Therefore, in Victoria there is a particularly strong case for policy and regulatory change to encourage the development of renewable hydrogen and its use in gas distribution networks.

Given this evidence on the system wide costs and additional emissions associated with electrification, heavy-handed measures like preventing new gas connections and associated infrastructure should not form part of the Roadmap. Stopping network growth will increase both gas and electricity bills for individual customers with long-lasting ramifications – other states and territories are feeling the effects of this sort of heavy-handed policy approach. In new estates it would also preclude those customers from accessing renewable hydrogen in the future, adding significant opportunity costs.

Looking forward to our next Access Arrangement period (2023-2028), AGN and MGN combined expect to connect approximately 20,000 customers per year in Victoria, or 100,000 for the full period. Relative to grid sourced electricity this would avoid approximately 418,000 tonnes of CO_2-e emissions over the five year period, and would save approximately $264/$440 (AGN/MGN) per residential customer per

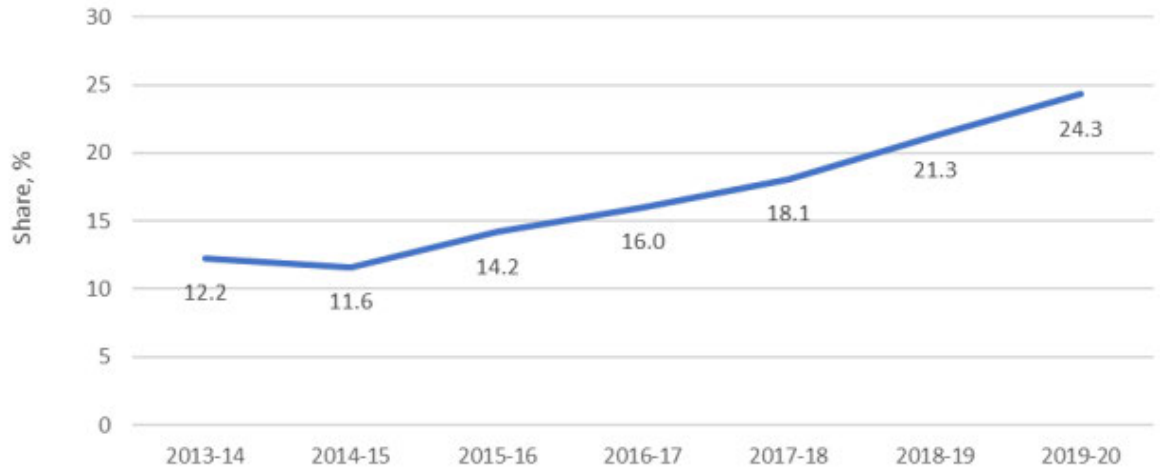
[6] Grattan Institute, *Flame out, the future of natural gas, November 2020*, p. 47. See: https://grattan.edu.au/report/flame-out-the-future-of-natural-gas/
[7] Grattan Institute, *Flame out, the future of natural gas, November 2020*, p. 52.
[8] Grattan Institute, *Flame out, the future of natural gas, November 2020*, p. 50.

year.[9] By remaining connected to the gas network, the 1.4 million customers connected to the AGN and MGN networks can avoid approximately 29 million tonnes of CO2-e over the 2023-2028 period relative to grid sourced electricity.

Victoria should learn from its success in demonstrating and deploying renewable electricity

Victoria has had significant success in demonstrating and deploying renewable electricity generation at scale. The share of renewable energy in Victoria's electricity generation has increased steadily in recent years from around 11.6% in 2014-15 and 14.2% in 2015-16 to approximately 24.3% over the 2019-20 financial year.[10]

Figure 5: Victorian renewable electricity generation share, 2013-14 to 2019-20



Source: Department of Environment, Land, Water and Planning

The level of renewable electricity deployment, uptake and acceptance would not be where it is today without clear targets and concrete support from the Victorian Government through various policy mechanisms:

- **Legislated renewable energy targets** (the Victorian Renewable Energy Target, VRET) introduced in 2017 which provides greater policy certainty and investor confidence and bringing on large scale investment from industry. The VRET is one of the key drivers contributing to the development of renewable energy projects in Victoria.
- Supporting measures to achieve the VRET including the 2017 **Victorian Renewable Energy Auction Scheme** (forthcoming second round Auction) which provides long-term certainty for the private sector to invest in Victoria's renewable energy industry by guaranteeing up to 650MW of new renewable energy.

[9] Forecast connection growth is a preliminary estimate that is being further refined as part of the AGN and MGN Access Arrangement processes. We will present a more detailed forecast as part of our submission to the Australian Energy Regulator in July 2022. Emissions savings are based on appliance end use consumption and National Greenhouse and Energy Reporting emissions factors, assuming a decreasing emissions intensity of the Victorian grid as renewable electricity generation increases.
[10] DELWP, *Victorian Renewable Energy Target 2019-20 Progress Report.* See https://www.energy.vic.gov.au/__data/assets/pdf_file/0026/506825/VRET_2019-20_Progress_Report.pdf

- **Using Government purchasing power** to provide the necessary revenue certainty for the project developers to underwrite their projects, such as the $48.1 million Victorian Government Renewable Certificate Purchasing Initiative.
- **Rebates initiatives** to increase uptake of renewable technologies such as the $1.3 billion nation-leading Solar Homes program, which continues to provide rebates on rooftop solar systems, batteries and solar hot water systems for 770,000 Victorian households over ten years and result in over 1 million Victorian homes powered by renewable energy.

Clear direction and concrete support is required from Government for the renewable gas sector to build scale and to play a significant role in decarbonising gas use

We can apply the positive and successful experience in demonstrating and deploying renewable electricity to the renewable gas sector. Government support is required for the renewable gas sector to give the industry confidence to invest in new renewable gas projects, supply chain development and local jobs, to ensure a sustainable, growing economy for the State. We would suggest the following early measures:

- **Introduce binding targets for the decarbonisation of gas supply** and policy frameworks to ensure this occurs. A Renewable Gas Target could be introduced to require hydrogen or other renewable gases to replace natural gas up to the equivalent of 10% (by volume) by no later than 2030. As a first step this could take the form of a contract-for-difference broadly based on the VRET design.

  Renewable hydrogen remains in the early stages of commercial demonstration. Therefore it needs support to reduce the risks faced by first-movers (higher costs than will be the case in 10 years) and building scale as costs decline. A contract-for-difference approach balances the need to support first movers by providing longer-term certainty over demand and revenue, while also encouraging broader market development and scale. The approach could be adjusted over time as costs decline, markets develop and scale is achieved.
- **Continued support for gas blending demonstration projects** to demonstrate feasibility and build scale. Early stage renewable gas blending projects to demonstrate commercial viability are crucial to help prove a viable pathway forward for 10% blending by 2030, accelerating to 100 per cent renewable gas networks by 2040. They also provide an opportunity to provide hydrogen for other uses – being designed with the flexibility to provide hydrogen to transport users and tub-trailers.
- **Regulatory reforms** to enable renewable hydrogen and other gases to displace natural gas in gas networks and broader gas markets. Many of these reforms are underway and should be prioritised. Displacing natural gas represents an efficient means of building scale in the production of renewable hydrogen while maintaining flexibility to serve other markets.
- **Introduce a hydrogen ready appliance mandate from 2025** to provide investment certainty and stimulate action to reduce risk borne by appliance manufacturers in relation to research and development costs. Changing appliances is the one action (and cost) that is required in almost all scenarios for the decarbonisation of natural gas use (renewable hydrogen and electrification). Similar measures are being adopted in the UK. By establishing clear standards in the near-term Government can help ensure this change process takes place over time.

In the short term, the gas networks can contribute materially to emissions reduction through the mains replacement programs which are reducing fugitive methane emissions

We are investing to significantly reduce our emissions today. Mains Replacement Programs (MRP) in AGN and MGN have a significant effect on our fugitive emissions. The AGN MRP is scheduled for completion in 2022, with significant emissions reductions already achieved as a result. To give a sense of the scale of these programs, the ongoing MGN MRP, due for completion in 2032, could avoid

cumulative scope 1 emissions by over 600,000 tonnes between now and 2032. Accelerating the MRP for completion before 2030 could add to this cumulative total by avoiding an additional 115,000 tonnes of CO2-e between now and 2032. Further detail is found in Attachment C.

Conclusion

Overall, the emphasis of our submission is to outline our support for Victoria's emissions reduction targets, and to reiterate the positive role that can be played by renewable gases and renewable hydrogen in particular, and Victoria's gas distribution networks. The optimum path to achieving net-zero will never be known, but by setting clear direction and by providing concrete mechanisms to achieve net zero, all sectors of the economy will make a contribution

Australian Gas Infrastructure Group

Benefits of keeping options open and investing in renewable gas to decarbonise natural gas use: Assessment against the Roadmap multi-criteria assessment and outcomes framework measures

	Now	2030	2050
Emissions Reduction	Natural gas is generally lower emissions than grid electricity in Victoria.	10% blended renewable hydrogen provides scale and a platform for complete decarbonisaton of natural gas. Mains replacement programs help secure significant emissions reductions.	Remaining open to renewable hydrogen today provides a pathway to zero emission renewable hydrogen networks in the future.
Energy security and reliability	Natural gas makes up around 20% of primary energy consumption in Victoria and 61% of household use.	Unavoidable investments in gas network reliability benefit natural gas consumers today and renewable gas consumers in the future.	A diverse energy supply helps ensure security and reliability. Hydrogen creates an opportunity for greater coupling across the energy sector, particularly between the electricity and gas networks to create a single integrated energy delivery system.
Affordability and equity	Natural gas is generally lower cost than grid electricity for our residential customers.	Growing evidence suggests that cost-effective renewable hydrogen is on the horizon around 2030.	Investments and policy today lay the groundwork for building scale and achieving affordable renewable hydrogen.
Safety	Hydrogen Park South Australia is safely delivering a 5% renewable hydrogen blend to South Australian network customers.	Delivering Mains Replacement by 2030 means our Victorian distribution networks are 'hydrogen ready.' A hydrogen ready appliance mandate will mean customers can be confident their appliances can deliver 100% hydrogen safely.	The Australian Hydrogen Centre and Future Fuels CRC are developing a pathway to make the transition to 100% renewable gas networks.
Market viability	Based on project activities, renewable hydrogen costs have already declined significantly.	Renewable hydrogen is expected to reach cost competitiveness around 2030, aligning with the Federal Government's aspiration of 'H2 under $2.'	Renewable hydrogen costs are forecast to sharply decline ($1.50/kg) by 2050.

Social licence	Our customers like the benefits that natural gas brings, but want gas networks to play a role in delivering ways to reduce emissions. Ongoing consumer engagement will occur to grow social acceptability and consumer confidence in renewable gases.		
Social impacts	Customers will continue to have a choice in their source of energy, just like the choices they have today. Maintaining choices will enable the greatest chance of achieving the lowest cost pathway to net-zero emissions.		
Economic impacts	Renewable hydrogen represents a significant opportunity to create new jobs and to reskill the existing plumbing and gas-fitting workforce. It also presents a significant opportunity to maintain gas appliance manufacturing in Victoria.	Up to 7,600 jobs are forecast to be generated nationally through emerging hydrogen opportunities, and hydrogen could add around $11 billion each year to the national economy by 2050.	
Environmental impacts	Work underway to develop an approach to integrating renewable hydrogen production and sustainable water use. Co-locate hydrogen projects (HyP Murray Valley) with Wasterwater Treatment.	A 10% hydrogen blend requires 448 mega litres (ML) of water per annum, less than half of Melbourne's average daily water consumption.	Hydrogen will make use of strong alternative water sources, including water recycling and wastewater resources.

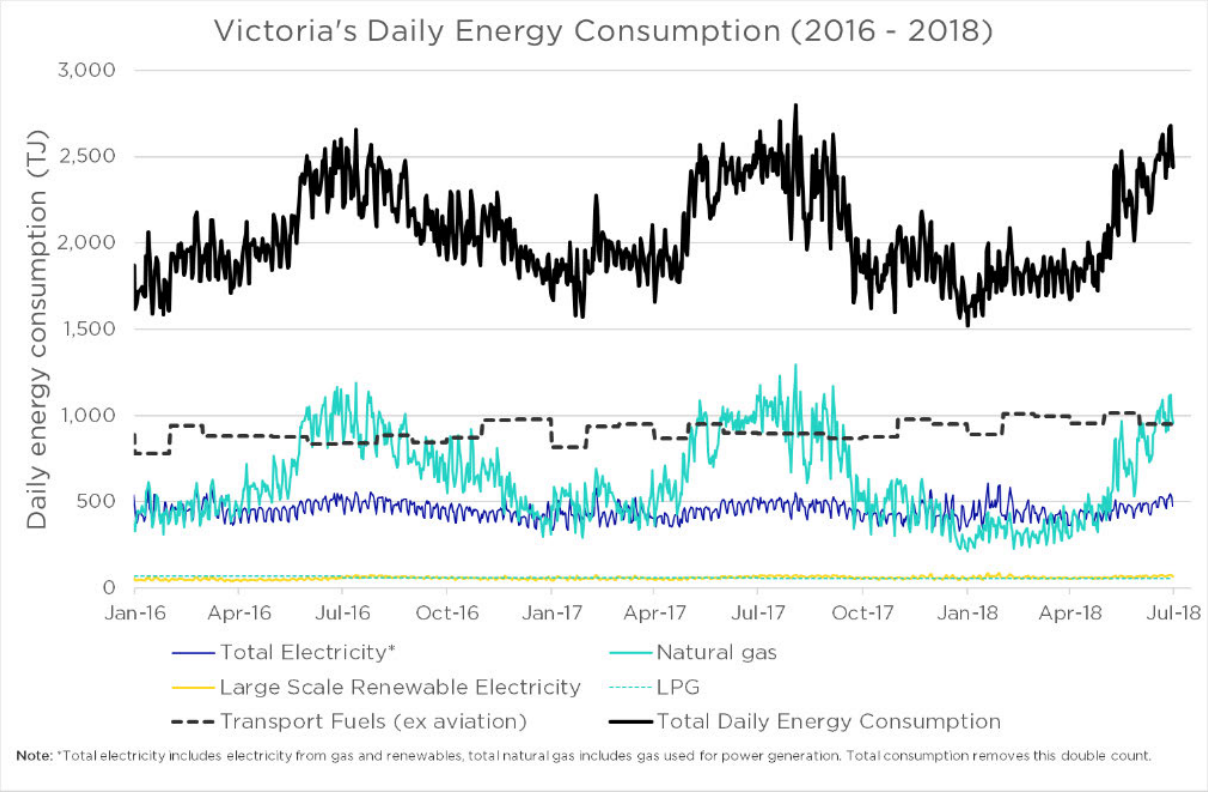
Attachment A: Hydrogen Pathway

1 What are the key benefits, risks, and potential impacts on various end-users, on energy affordability, safety, security, reliability and equity?

Substituting natural gas with renewable hydrogen means that end-users can continue to receive the same benefits they receive from natural gas today – affordability, safety, reliability, security of supply and equity, but with the zero emissions benefit of renewable hydrogen.

In Victoria, where natural gas is likely to remain an important part of the energy mix for years to come, hydrogen represents a significant opportunity to achieve emissions reduction targets, while making use of Victoria's extensive gas network and minimising costs. Figure 1 below shows Victoria's total daily energy consumption from 2016 to 2018. It shows that during winter peaks gas provides around double the energy provided by electricity. This chart makes plain why it is very expensive and not practical to decarbonise all existing uses of gas through electrification – there is a significant quantity of energy.

Figure 1: Victorian daily energy consumption 2016 to 2018



Source: Energy Networks Australia

Importantly, consumers will continue to have a choice in their source of energy, just like the choices they have today. As discussed in further detail in Q6 below, customer research conducted across AGIG operations reveal that customers like using gas in their homes, and it is often a preferred fuel for cooking and heating. If customers like the benefits of gaseous forms of energy, it is incumbent on energy providers and governments to find solutions that meet their needs, while achieving net zero emissions.

For large commercial and industrial users in 'hard to abate' sectors that currently use natural gas for industrial processes (particularly those with high heating requirements) and industrial feedstock, substituting natural gas with hydrogen offers a pathway to decarbonisation.

Unlike natural gas, transporting and storing hydrogen in our networks also presents a significant opportunity for integrating hydrogen markets with the wider energy market. The potential role of hydrogen electrolysers and networks in providing ancillary and storage services is explored further in response to Q2 below.

There are uncertainty, risks and potential impacts on end-users as Victoria decarbonises gas use. That is why government and industry have an important role in working collaboratively to find solutions to minimise the risks and disruptions on end-users during the transition.

In the context of uncertainty governments, networks and other stakeholders should allow time to fully examine the viability of renewable hydrogen and other options for achieving net zero emissions. This will reduce the risk of making pivotal decisions too early, increasing costs for customers unnecessarily. Decisions made today will have implications across both gas and electricity networks and for customers and may create path dependency, locking in higher cost solutions.

We are committed to being part of the solution and are undertaking a number of initiatives to identify and take action to address the risks and opportunities for renewable gases in the network. We are closely working with governments, industry and research organisations on key areas including:

- Delivering renewable gas blending projects – each of AGIG's renewable gas projects help prove a viable pathway forward for blending hydrogen into existing gas networks with the goal of achieving 100 per cent renewable gas networks. These projects help to test and establish safety, technical and energy market regulatory frameworks for hydrogen, unlock potential of other complementary markets and lead to the commercial readiness of hydrogen;
- Undertaking feasibility studies – we are working with the Australian Hydrogen Centre to develop feasibility studies on 10 per cent renewable hydrogen in the Victorian gas distribution networks and developing a pathway to make the transition to 100 per cent hydrogen networks; and
- Finding solutions for our customers such as providing a 100 per cent carbon-free, renewable hydrogen gas supply solution for those customers that require this, including for new sub-divisions and/or multi-story towers renewable connections for new subdivisions.

2 What is the scale of the opportunities and potential to accelerate uptake?

The scale of the opportunity for a renewable hydrogen economy in Victoria is significant. As identified by the Victorian Government, renewable hydrogen can activate options for decarbonising Victoria's gas, freight, transport and industrial sectors, supporting more renewable energy in the electricity system, and exporting renewable energy to the rest of the world.[1]

In order to accelerate the potential uptake of hydrogen, we consider the use of renewable hydrogen in Victoria's existing gas networks represents the ideal near term opportunity to:

- decarbonise the gas distribution network to meet Victoria's emissions reductions target, including its 2025 and 2030 interim targets;

[1] DELWP, *Victorian Renewable Hydrogen Industry Development Plan.* See: https://www.energy.vic.gov.au/__data/assets/pdf_file/0021/513345/Victorian-Renewable-Hydrogen-Industry-Development-Plan.pdf

- stimulate early hydrogen demand growth and activate a range of complementary markets discussed in more detail below; and
- lower the costs of renewable hydrogen production overtime so that it reaches cost competitiveness by 2030 as predicted by a number of independent studies as discussed in Q5.

The National Hydrogen Strategy has identified blending hydrogen in gas networks as one of three measures for building widespread domestic hydrogen demand, along with industrial feedstocks and transport.[2] The Clean Energy Finance Corporation (CEFC) notes that displacing natural gas provides a potential transitional use to reach large scale deployment of renewable hydrogen at pace,[3] without which we may miss the opportunity to decarbonise those hard-to-abate sectors which will take longer to achieve cost-competitiveness.

As costs rapidly decline we believe the transition to renewable hydrogen can be rapidly scaled up to replace all natural gas in our distribution networks by 2040. The Australian Hydrogen Centre is currently undertaking work on the feasibility of this transition and will provide its report to the Victorian Government as soon as this is available.

Scale of opportunities

Electricity markets and renewable electricity production

Hydrogen creates an opportunity for greater coupling across the energy sector, particularly between the electricity and gas networks and this is increasingly recognised, including in the Victorian Government's *Renewable Hydrogen Industry Development Plan*.[4] Key benefits of renewable hydrogen include:

- provides highly valued services to the National Electricity Market, such as essential system services and demand response;
- act as a carrier to export renewable electricity;
- can be used as a form of large scale storage solution to support electricity generation; and
- can be used as a feedstock for electricity generation.

The AEMC considers that the development of Renewable Energy Zones (REZ) now planned in Victoria, would likely see an even greater mutual benefit.[5] Hydrogen production and export projects can be located in parts of the grid where they can help to absorb plentiful renewable generation output, both on annual and within day timeframes. This represent a significant benefit over several existing storage technologies.

GHD and ACIL Allen have also identified several benefits to the electricity system in connecting small-scale hydrogen production facilities (<10MW) to substations with relatively high penetration of renewable generation. These benefits include soaking up excess nearby rooftop PV, allowing the connection of additional renewable generation, minimising the need for export constraints on

[2] COAG Energy Council, *Australia's National Hydrogen Strategy*. See: https://www.industry.gov.au/sites/default/files/2019-11/australias-national-hydrogen-strategy.pdf
[3] Clean Energy Finance Corporation, *Australian Hydrogen Market Study*. See: https://www.cefc.com.au/media/nkmljvkc/australian-hydrogen-market-study.pdf
[4] Victorian Government, *Victorian Renewable Hydrogen Industry Development Plan*, Outcome 8.
[5] AEMC, *Hydrogen: the new Australian manufacturing export industry and the implication for the NEM.* See: https://www.aemc.gov.au/hydrogen-new-australian-manufacturing-export-industry-and-implications-national-electricity-market

local renewable generators or network upgrades required to allow unconstrained operation of the local renewable generation.[6]

Our HyP Murray Valley project proposal will demonstrate the potential value of hydrogen production in providing storage and ancillary services for electricity markets. This approach will improve the economics of hydrogen production facilities, renewable electricity generators and electricity markets.

While the lasting interactions between electricity and gas networks will take time to emerge, it is important we begin to recognise the potential for investment in one sector (hydrogen) to reduce the costs in another (electricity) particularly in light of the development of Victoria's REZs.

Export opportunities

Renewable hydrogen enables the export of renewable energy. As recognised by the Victorian Government, enabling the export or our renewable energy through hydrogen will further stimulate investment in renewable energy by enabling renewable energy operators to also trade in the gas and international energy markets – not just domestic electricity.[7]

The hydrogen export opportunity is significant, with markets across the globe looking for supplies of zero emissions energy many times larger than Australia's domestic requirements. Initial blending of hydrogen in distribution networks is an important step towards the development of the Australian hydrogen export industry. Without practical experience installing electrolysers, managing balance of plant costs, and managing renewable electricity generation in concert with hydrogen production, we are unlikely to have the scale and experience necessary to support an export industry.

Industrial use

Industrial users represent one of the most important applications for hydrogen but also present some of the biggest challenges. Current industrial users of natural gas for feedstock, heat and as a reductant, represent some of the most challenging applications to achieve cost-effective emissions reductions.

The Australian Industry Energy Transitions Initiative report found that for the five focus supply chains (those identified to make a critical contribution to Australia's economy), renewable hydrogen could be a potential long-term solution to reduce emissions in the following supply chains:[8]

- iron and steel supply chain –
    - iron ore production - Hydrogen fuel-cell electric vehicles (FCEVs) are an alternative option to fully decarbonise mining haulage. FCEVs are already commercially available in the light vehicle market but are increasingly being used in heavier applications such as trains and trucks, suggesting promise for mining haul trucks;
    - steelmaking - DRI-EAF production pathway using pure hydrogen as a reductant (H2-DRIEAF) is emerging as the most promising long-term option for decarbonising steel production;

[6] GHD Advisory & ACIL Allen Consulting (for DELWP), *Hydrogen to Support Electricity Systems*. See: https://energyministers.gov.au/sites/prod.energycouncil/files/publications/documents/nhs-hydrogen-to-support-electricity-systems-report-2020_0.pdf

[7] Victorian Government, *Victorian Renewable Hydrogen Industry Development Plan.*

[8] Australian Industry Energy Transitions Initiative *Phase 1 Technical Report*, See: https://arena.gov.au/assets/2021/06/australian-industry-energy-transitions-initiative-technical-report.pdf

- Aluminum supply chain - Hydrogen is able to replace gas firing in boilers for the production of low temperature heat in the digestion process and used in the high temperature process heat for calcination; and
- Chemicals - the creation of hydrogen in the ammonia production process currently relies on steam methane reforming (SMR), but this process could be decarbonised through the use of electrolysers with renewable electricity, eliminating the need for the fossil fuel feedstock and the combustion related emissions from the process.

These examples demonstrate that hydrogen use for industrial applications is technically viable and forecast to be cost effective (see below). We note that for some of our largest Victorian demand customers in these sectors and others with very high heat requirements, renewable hydrogen represents a pathway to decarbonisation. It also represents a pathway to develop new industries and jobs.

However we do recognise that a key factor depends on the commercial competitiveness of renewable hydrogen production and that gas blending into networks could increase scale and lead to a rapid decline in costs. Achieving these cost declines requires electrolysers to be deployed in Australia now so that balance of plant costs and industry experience can be developed. This deployment needs to start before renewable hydrogen is cost-competitive for most industrial applications – blending and transport markets represent perfect stepping stones to develop this experience.

As an example, under AGIG's HyP Murray Valley proposal, spare capacity will be available to provide hydrogen via the network or tube trailer to Victorian energy users including industrial customers, further contributing to the development of a hydrogen industry and reducing emissions.

AGIG is also demonstrating the potential to serve industrial markets through its recently signed agreement with BOC Ltd (BOC) to install tube trailer refilling infrastructure at HyP SA. Through this agreement, we are currently supplying BOC with renewable hydrogen to meet the needs of industrial customers in South Australia and beyond.[9] We expect similar tube trailer to industry opportunities, displacing natural gas or hydrogen produced via fossil fuels, to play a key role in building capability in Victoria before larger scale opportunities are secured.

These examples demonstrate the important synergies between network blending and building capability for industrial hydrogen use.

Transport markets

As recognised by the Victorian Government, hydrogen can be deployed across a broad transport spectrum from heavy vehicles, trains and ships to passenger and small vehicles, to industrial vehicles such as forklifts and as a future pathway for aviation.[10] International examples are growing of public transport as a driver of uptake for hydrogen fueled transport (these include examples of hydrogen buses[11] and trains[12] already in use). Passenger vehicles are already available albeit with limited refueling opportunities.[13]

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[9] See: https://www.australiangasnetworks.com.au/our-business/about-us/media-releases/new-sa-hydrogen-plant-to-supply-industry

[10] Victorian Government, *Victorian Renewable Hydrogen Industry Development Plan.*

[11] See: https://www.rfi.fr/en/science-technology/20191218-france-unveils-hydrogen-bus-fleet-no-carbon-pollution-macron-strikes-pen

[12] See: https://www.theguardian.com/environment/2018/sep/17/germany-launches-worlds-first-hydrogen-powered-train

[13] See: https://www.toyota.com.au/news/toyota-australia-extends-hydrogen-mirai-fcev-loan-program

Development of a hydrogen fuel cell industry has the added benefit of improving transport energy security by capitalising on the domestic energy sources we do have. The Department of Environment and Energy observes "a long-term transport energy transition strategy could support some short-term increase in renewable fuels with the aim of creating the right environment for alternative fuel sources to scale up to become globally competitive. Increased diversity in fuel sources will provide more options in managing future disruptions."[14]

Providing transport fuels domestically rather than through imports will therefore substantially improve energy security in Australia. As with the development of the hydrogen economy more generally, this will maintain choice in transport fuels into the future and create a significant low-carbon industry in Australia.

As with electric vehicles the widespread adoption of hydrogen will require additional refuelling infrastructure which is often subject to market failures as technology is refined, costs reduced and consumer adoption accelerates. To maximise spill-over benefits and efficiency, hydrogen production could be co-located for blending into networks, refueling light and heavy vehicles, and tube trailer for use away from major gas networks. Co-location and maximising the potential uses of renewable hydrogen can also reduce the overall costs of the transition.

3 What are the key technical, regulatory and economic barriers?

We are taking several important actions in investigating the commercial, regulatory, technical and safety barriers for alternative gases in our networks.

Technical barriers

As recognised by the Victorian Government, hydrogen can be blended with natural gas at low levels (10% by volume) through the gas distribution network without needing to replace pipelines, appliances and meters. GHD's investigation of the technical impacts of blending 10% hydrogen (by volume) into the gas distribution networks found no significant impact or implications to gas quality, safety and risk aspects, materials, network capacity and blending.[15]

We note that the UK HyDeploy project has successfully demonstrated up to 20% volume of blended hydrogen and natural gas part of the private gas network at Keele University campus in Staffordshire.[16]

Energy Pipelines CRC's review of the performance of network materials including the long-term integrity of steel, copper and plastic piping systems and their compatibility with renewable gas, particularly hydrogen into existing gas distributions systems at levels up to 30% found that: [17]

- degradation of plastic pipes has not been found to be an issue. Leakage rates due to permeability of plastics to hydrogen, while higher than for methane, is not significant and does not change the risk profile from using gas in networks at levels of hydrogen up to 30%; and

[14] Department of Energy and Environment, *Liquid Fuel Security Review*, *Interim Report.* See: https://www.energy.gov.au/sites/default/files/liquid-fuel-security-review-interim-report.pdf

[15] GPA Engineering (for the SA Government), *Hydrogen in the Gas Distribution Networks*. See: https://energyministers.gov.au/sites/prod.energycouncil/files/publications/documents/Hydrogen%20in%20the%20gas%20distribution%20networks%20report%202019.pdf

[16] See: https://hydeploy.co.uk/

[17] Energy Pipelines CRC (for ENA), *Identifying the commercial, technical and regulatory issues for injecting renewable gas in Australian distribution gas networks*. See: https://www.energynetworks.com.au/resources/reports/identifying-the-commercial-technical-and-regulatory-issues-for-injecting-renewable-gas-in-australian-distribution-gas-networks-research-report-energy-pipelines-crc/

- the permeability of hydrogen is insignificant through cast iron and steel is insignificant, however absorbed hydrogen can cause embrittlement, but for gas distribution networks operating at low pressure are not particularly susceptible to hydrogen embrittlement.

Ensuring the safety and reliability of our networks in delivering gas including renewable gases is a key priority for our business. It is important to emphasise that hydrogen is already safely produced in Australia, and for AGIG, we are currently safely transporting hydrogen through the gas distribution network at a blend of 5% without significant change.

Our first renewable hydrogen blending project HyP SA, which is currently operational, demonstrates the technical feasibility of production and blending technology in an Australian context and also underpins further research and business cases, which can pave the way for commercial production. For example, HyP SA project provides a test bed for regulators in implementing safety, environmental and other regulation specifically for hydrogen.

In developing HyP Murray Valley, we are continuing to work closely with Energy Safe Victoria and DELWP to provide assurance that hydrogen is safe for deployment through the network and for use in appliances.

Building upon our demonstration projects, we are also delivering feasibility studies on blending 10% renewable hydrogen into towns and cities, and plans for a 100% hydrogen future through the Australian Hydrogen Centre as we recognise that 100% switch to hydrogen, would require adjustments to household gas appliances, gas metering equipment and possibly some pipe fitting.

Appliances:

In Australia, any Type A appliance sold in the market is already tested for 13% hydrogen as a limit. Consistent with this, the characteristics of small amounts of hydrogen blends with natural gas up to 10% are consistent within the limits outlined in AS 4564 – Specification for General Purpose Natural Gas.

To support delivery of our HyP SA project, we undertook our own appliance testing program in which an Australian certified laboratory tested Australian appliances with various percentages of hydrogen. These test results indicated that appliances will work safety and reliably with a 5% hydrogen blend.

There is also significant international and domestic industry testing underway. For example, the Future Fuels CRC (FFCRC) embarked on a project to test appliances for hydrogen compatibility using the Australian Gas Association's accredited testing laboratory, with results suggesting that appliances could operate safely with blends of at least 10-20% hydrogen.

In addition to laboratory testing, our future demonstration projects such as Hydrogen Park Gladstone (to be operational in 2022) and Hydrogen Park Murray Valley (expected to be operational 2023) will provide valuable insights into the practical impacts of operating existing appliances and equipment with 10% blended gas.

In terms of Type B appliances, we note that the FFCRC is undertaking further work and research to assess the compatibility of Type B appliances for use with 10% blended gas, and to determine the upper limits for blending of hydrogen into natural gas.

Conversion of networks to 100% hydrogen will require a widespread program to replace existing natural gas appliances with alternatives that can operate safely and effectively on 100% hydrogen. The Australian Hydrogen Centre is currently investigating the optimal pathway for conversion of appliances from natural gas to 100% hydrogen. Initial findings from this study suggest:

- There are clear activities that need to be delivered in the short-term, to support development and deployment of appliances that can operate safely and reliably on 100% hydrogen. These include development of regulations and standards, development and testing of appliances and effective customer communications among other items.
- Development and deployment of "hydrogen-ready" appliances is likely to be the optimal pathway for the appliance sector. Hydrogen-ready appliances are those that can run on natural and/or blended gas, but can be quickly converted to run on 100% hydrogen at the time of network conversion. This approach minimises customer disruption and inconvenience, as well as reducing costs of conversion given hydrogen-ready appliances can be purchased by customers as and when their existing appliances come to the end of their life (i.e. costs are absorbed into the natural attrition of appliance turnover).
- There is significant uncertainty which is holding back investment in research and development in the appliance sector. Direction from government on a preferred pathway may be what is required in order to stimulate action. For example, government introducing a mandate supportive of hydrogen ready appliances could reduce risk borne by appliance manufacturers in relation to research and development costs.

We note that in the UK, Government is actively considering mandating all newly installed gas boilers to be hydrogen ready (capable of being used with hydrogen blends and 100% hydrogen with only minor modifications) from 2025. Hydrogen-ready boilers are the least disruptive means of decarbonising homes as they offer the opportunity for people to continue to heat, cook and use hot water in the same way they do today, without ripping out pipes, boilers, and in some cases floors.[18]

Recently, the UK Climate Change Committee has given their strongest ever support for hydrogen boilers, and by implication, hydrogen for heat. In their annual progress report to Parliament, they recommend that the should "set requirements for all new gas boilers to be hydrogen-ready by 2025 at the latest, as well as to work with Ofgem to identify "priority candidate areas for hydrogen" for heat.[19] We consider that Victoria should adopt a similar approach.

Importantly, the costs of this appliance change should be broadly equivalent to a change to electric appliances.

The UK's four largest boiler manufacturers have just announced their price commitment that, hydrogen-ready boilers will cost no more than natural gas variants. Worcester Bosch, Vaillant, Baxi and Ideal, the four companies involved, believe that with the price promise it could save consumers up to £2.3bn ($3.2bn) according to modelling. "The boiler manufacturers have developed a boiler that works; they support a 2025 mandatory roll-out of the technology and now they've found a way to keep costs down."[20]

Regulatory and economic barriers

There are number of regulatory and economic barriers that need to be addressed by the Victorian Government to achieve the rapid and widespread deployment of hydrogen in Victoria, as has

[18] Heating and Hotwater Council. See: https://www.hhic.org.uk/news/uk-boiler-manufacturers-lead-eu-in-committing-to-hydrogen-future-pm-told

[19] The UK Climate Change Committee, *Joint Recommendations 2021 Report to Parliament*. See: https://www.theccc.org.uk/wp-content/uploads/2021/06/CCC-Joint-Recommendations-2021-Report-to-Parliament.pdf

[20] See: https://www.h2-view.com/story/hydrogen-ready-boilers-will-cost-no-more-than-natural-gas-variants-confirms-the-uks-four-largest-boiler-manufacturers/

occurred for renewable electricity. This includes direct incentives to deploy hydrogen for use in gas networks and other applications.

At present, the emissions reductions achieved by renewable hydrogen (and the potential for significant future reductions) are not recognised under any scheme in Victoria or Australia. This is contrasted with the situation for renewable electricity which has and continues to receive support and incentives from governments. The level of renewable electricity deployment, uptake and acceptance would not be where it is today without clear targets and concrete support from the Victorian Government through various policy mechanisms:

- **Legislated renewable energy targets** (the Victorian Renewable Energy Target, VRET) introduced in 2017 which provides greater policy certainty and investor confidence and bringing on large scale investment from industry. The VRET is one of the key drivers contributing to the development of renewable energy projects in Victoria.
- Supporting measures to achieve the VRET including the 2017 **Victorian Renewable Energy Auction Scheme** (forthcoming second round Auction) which provides long-term certainty for the private sector to invest in Victoria's renewable energy industry by guaranteeing up to 650MW of new renewable energy.
- **Using Government purchasing power** to provide the necessary revenue certainty for the project developers to underwrite their projects, such as the $48.1 million Victorian Government Renewable Certificate Purchasing Initiative.
- **Rebates initiatives** to increase uptake of renewable technologies such as the $1.3 billion nation-leading Solar Homes program, which continues to provide rebates on rooftop solar systems, batteries and solar hot water systems for 770,000 Victorian households over ten years and result in over 1 million Victorian homes powered by renewable energy.

Deploying renewable energy technologies and lowering their costs helps improve the business case for hydrogen and we support continuing activity to support renewable electricity. Yet renewable hydrogen represents a proven technology with significant potential to reduce emissions. The public good of innovation and potential for low cost emissions reductions suggests that hydrogen also warrants similar support.

We can apply the positive and successful experience in demonstrating and deploying renewable electricity to the renewable gas sector. Government support is required for the renewable gas sector to give the industry confidence to invest in new renewable gas projects, supply chain development and local jobs, to ensure a sustainable, growing economy for the State. We would suggest the following early measures:

Policy incentives for hydrogen would recognise that emerging energy technologies usually require both upfront capital support (e.g. through Victorian Government and ARENA funding) as well as a secure and predictable market and revenue stream established by policy (e.g. elements of the NSW Renewable Energy Action Plan, through the Commonwealth renewable energy target, contracts-for-difference etc.). Both capital and revenue support have been and continue to be available for large-scale renewable electricity (large scale solar in particular).

We consider a binding Renewable Gas Blending Target could be introduced to require hydrogen or other renewable gases to replace natural gas up to the equivalent of 10% hydrogen (by volume) by no later than 2030. This would provide greater policy certainty and investor confidence for the renewable gas industry in Victoria. We note that the Victorian Renewable Energy Target has been and continues to be one of the key drivers contributing to the development of renewable energy projects in Victoria.

As a first step this could take the form of a contract-for-difference (CfD) broadly based on the VRET design. We expect that hydrogen should be able to secure a price on gas markets at least equivalent to the price for natural gas (this requires adjustment to market rules that is underway as discussed below). However, for initial projects the costs of producing hydrogen remain above those for natural gas. A CfD would allow the difference between the price of natural gas and hydrogen to be recovered via network tariffs. For blends up to 10% we expect this cost to be very low – a very small proportion of a customers overall gas bill, which are expected to decline as part of the AA reviews underway. And as noted further below these costs are expected to decline rapidly such that the difference with natural gas is forecast to be very low by 2030.

A CfD can limit the additional costs to consumers, while providing renewable hydrogen producers with some long-term assurance over revenue streams – essentially to underpin significant upfront capital investments. As costs come down, future projects will deliver much lower cost hydrogen as economies of scale are achieved. A CfD can also establish Victoria's renewable hydrogen production capabilities at a smaller scale, before using this same technology to transform hard to abate sectors including industry.

The primary benefit of renewable hydrogen is its potential to achieve the emission targets at a lower cost to the economy as a whole, than relying solely on electrification. Achieving these benefits requires an approach which recognises the economy wide benefits of hydrogen and combines incentives, support and regulation. An incentive mechanism, like a CfD, is required to do this and to achieve Victoria's net zero target at lowest cost.

We note that the Victorian Government is currently taking active steps to many regulatory barriers, such as undertaking a deep dive investigation of potential policy mechanisms to support the increased uptake of renewable options such as hydrogen and biogas.

Further, the Victorian Government has introduced a Bill[21] to amend the National Gas Victorian Act (NGVA) which will enable the Minister for Energy, Environment and Climate Change to declare that hydrogen for example, or any other gas, blended with natural gas constitutes 'natural gas' and consequentially falls under the national gas regulatory framework. We welcome this is an interim step until the national gas regulatory framework reforms with respect to renewable gases are developed and implemented.

We support this important step towards establishing a hydrogen economy in Victoria and note there are also other regulatory barriers that must also be addressed such as ensuring hydrogen is appropriately accounted for in settling the Declared Wholesale Gas Market, to address heating values and to modify customer bills.

We welcome the progress the Victorian Government has made to date and note that the changes described above are needed quickly before we can start blending hydrogen into the gas networks in Victoria.

4 What are the roles to be played by government, industry and how will consumers preferences be accounted for in the transition?[22]

Both Government and industry have important roles to play in developing and supporting the transition to decarbonising gas usage. Government action is required to remove market barriers, efficiently build supply and demand, and accelerate Victoria's global cost-competitiveness through policy support and investment incentives to underpin long-term commercial investment, as discussed in our response to Q3 above.

[21] Energy Legislation Amendment Bill 2021
[22] Our response also applies to the Biogas Pathway in Attachment B.

This will equip industry to scale up quickly as markets for renewable gas mature overtime. We note that industry, including AGIG have been taking a leading role in the delivery of renewable hydrogen technologies and the development of Australia's hydrogen industry more broadly as discussed in our response to Q1 above.

We think it is important for both Government and industry to account for consumer preferences in the decarbonisation transition and that ongoing and effective consumer engagement is required to build social acceptance for renewable gas. In our experience, ongoing community engagement was pivotal in developing AGIG's first renewable gas production facility, HyP SA.

In the early stages of project scoping, we developed a comprehensive community engagement program, designed to provide the community with as much information as required, in an easily accessible manner. This program considered work already completed by the University of Queensland[23], and also took into account results of Focus Group testing conducted by AGN.

We then engaged with the Mitchell Park community through various channels such as letters, brochures, access to our dedicated webpage blended gas, and various factsheets to ensure the key concerns customers might have such as; any bill impacts, quality of gas they would receive, safety issues including, were addressed.

To date, the community response to our program has been in line with that of the Focus Group testing. That is generally a neutral to positive response, and a general appetite for efforts to reduce carbon emissions.

Based on our experience at HyP SA it is clear that government and industry need to work together to assure the community that safety expectations are being addressed, while also addressing environmental, cost and reliability concerns in the community. Our Focus Group testing indicated that the community seeks independent (non-industry) validation that the pursuit of renewable gas is safe and in their best interests. Therefore, as standards and regulations are amended to better allow for renewable gas blending, and as project proposals are assessed by regulators, open and transparent engagement with the community for parties outside of industry will be essential to maintain trust.

Since HyP SA, we have taken our learnings and have been undertaking various engagement activities with our customers across multiple forums to understand the implications of and attitudes to lower emissions. These activities include market research, customer satisfaction surveys, consultation workshops, individual direct consultation, and a dedicated online engagement forum, Gas Matters.[24] In addition, Our Voice of the Customer research remains a key long term measure and reference point for how our current and potential customers view natural gas as a product and the service we provide. It also allows testing of changes to our services particularly as we plan towards future Access Arrangements.

5 What are the likely timings of technical maturity and economic viability?

Likely timing of technical maturity

It is important to make the point that existing gas distribution networks that have already been upgraded to polyethylene pipes or equivalent are already suitable for transporting hydrogen ('hydrogen ready').

[23] The University of Queensland (Report for ARENA), *The Australian public's perception of hydrogen for energy*. See: https://arena.gov.au/assets/2018/12/the-australian-publics-perception-of-hydrogen-for-energy.pdf

[24] AGIG, *Gas Matters*. See: https://gasmatters.agig.com.au/

The replacement of remaining old cast-iron pipes and unprotected steel mains with new polyethylene pipes, is already underway across all major Australian gas distribution networks including in Victoria. This important program is primarily driven by safety and operational reasons and aims to significantly improve the integrity of the network.

This mains replacement work has the added benefit of making gas distribution networks hydrogen ready, but will have to occur in any case. Most network equipment is already able to operate with small volumes of hydrogen (around 10 percent) blended into natural gas. Most distribution pipelines will be converted to polyethylene pipes by 2035, allowing the wide-scale transport of hydrogen gas in the medium to lower pressure distribution pipelines.[25] The progress of our Mains Replacement Program in Victoria is discussed in our response to reducing fugitive emissions in Attachment C – Reducing Fugitive Emissions.

In terms of blending hydrogen into gas distribution networks, we consider blending of up to 10 percent by volume of renewable and decarbonised gases by 2030 and full network conversion to 100 percent renewable gases by 2050 and preferably by 2040, in line with Victoria's emissions reductions targets, could be technically feasible. As discussed in Q2, continued delivery of blending demonstration projects with increased blending volumes to demonstrate technical feasibility is critical, along with appropriate policy support and incentives to build scale.

Likely timing of economic viability

In terms of the likely economic viability of renewable hydrogen, the Commonwealth Government has an aspirational economic goal of producing hydrogen under $2 per kilogram – or "H2 under $2" and that achieving '$H_2$ under 2' at the site of production will be a key step in unlocking hydrogen industry growth.[26]

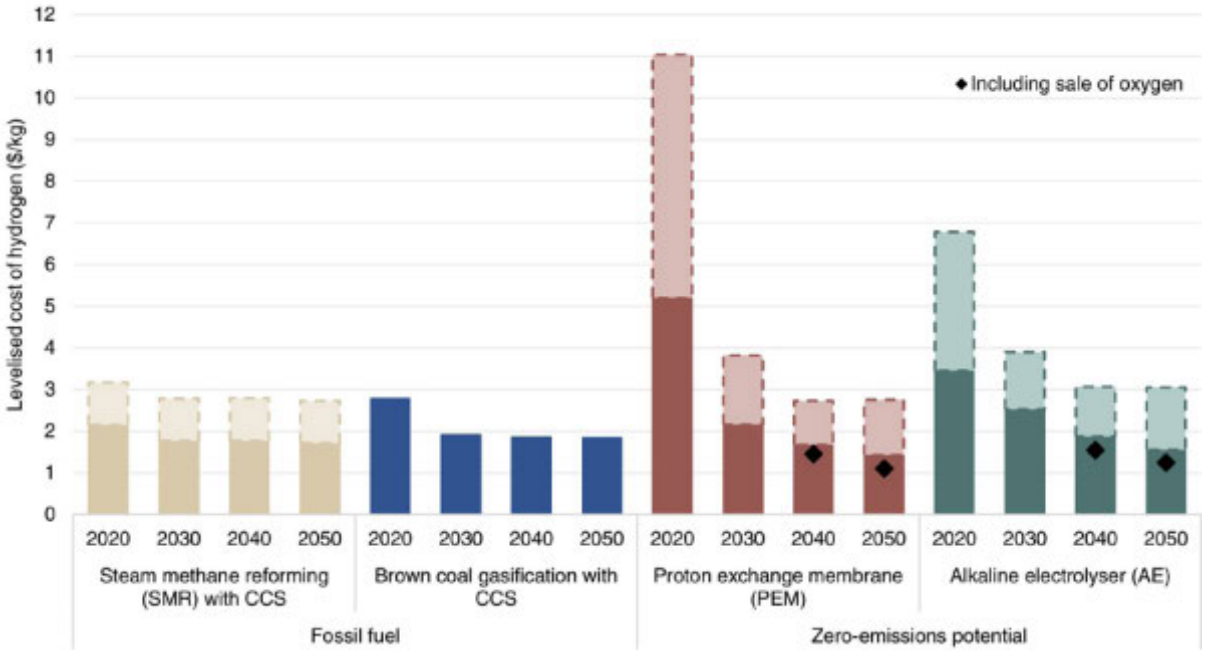
Several independent and recent studies have forecast that 'H2 under 2' is achievable by 2030 and that cost-competitive renewable hydrogen is within reach for many sectors, including blending in natural gas network. The Australian Industry Energy Transition Initiative (ETI) in June 2021 forecast sharp declines in renewable hydrogen costs (~$2/kg by 2030 under "lower-bound" assumptions and below $1.50/kg by 2050).[27]

[25] Deloitte Access Economics (Report for the ENA), *Decarbonising Australia's gas distribution networks.* See: https://www.energynetworks.com.au/assets/uploads/054496_tg_decarbonising_australias_gas_network_final.pdf

[26] See: https://www.industry.gov.au/sites/default/files/September%202020/document/first-low-emissions-technology-statement-2020.pdf

[27] See: https://energytransitionsinitiative.org/wp-content/uploads/2021/06/Phase-1-Highlights-Report-June-2021.pdf

Figure 2: Projected costs of hydrogen production routes (2020-2050)



Source: The Australian Industry Energy Transition Initiative

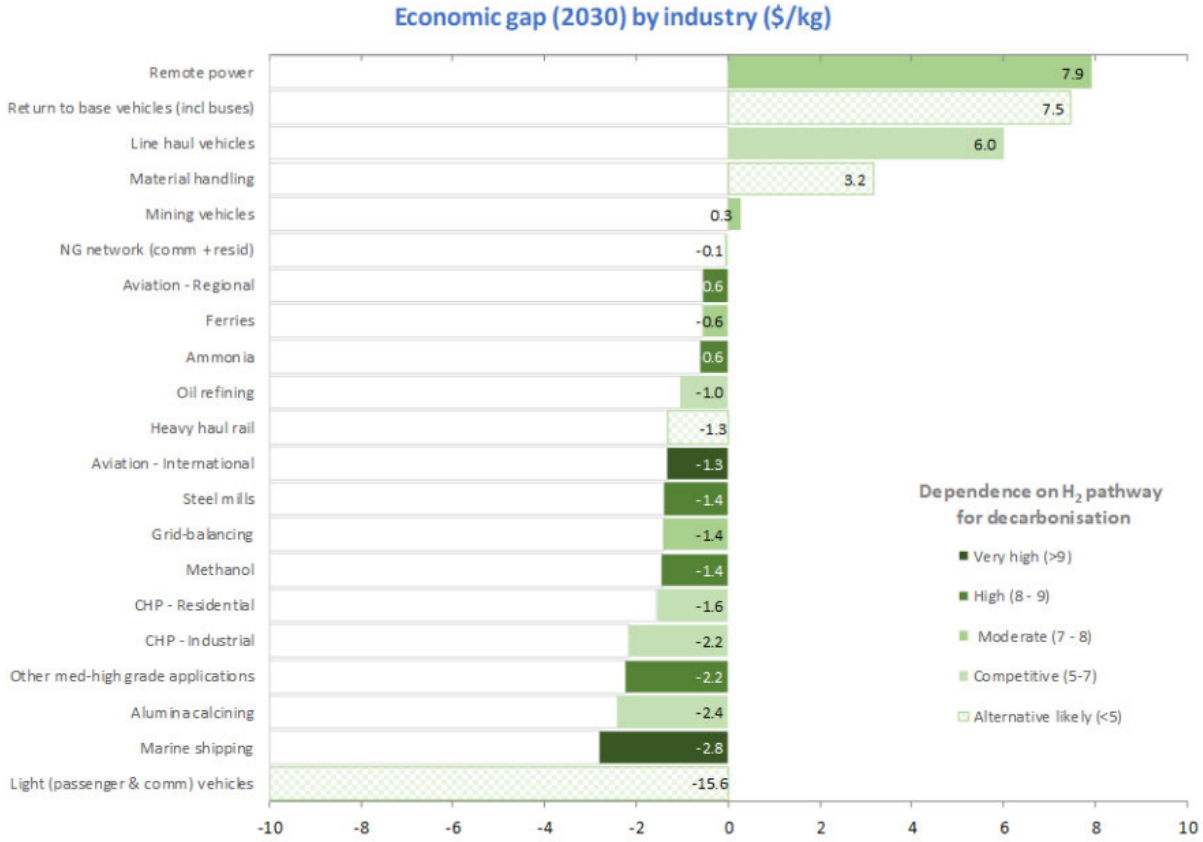
The CEFC's Australian hydrogen market study in May 2021 found similar, and that green hydrogen is already approaching cost competitiveness for heavy trucking, buses and remote power, with the potential to become commercially viable across further sectors of transportation as early as 2030.[28]

The CEFC analysis in particular forecasts that renewable hydrogen in networks will approach cost-competitive with natural gas around 2030. This is driven by three factors:

- Declining electrolyser capital costs;
- Declining renewable electricity costs; and
- Installation and operational efficiencies that can be delivered as hydrogen production is deployed in Australia.

[28] See: https://www.cefc.com.au/media/nkmljvkc/australian-hydrogen-market-study.pdf

Figure 3: Transition in sector economic competitiveness over time (2030)



Source: CEFC, Australian Hydrogen Market Study

The CEFC found that large scale development would be critical to driving down installation and commissioning costs which are driven by local factors, similar to the accelerated development experienced by Australia's large scale renewable energy sector and that displacing natural gas provides a potential transitional use to reach scale at pace. This further emphasises the need to start deploying electrolysers today where it is technically and economically efficient – particularly in networks.

6 What are the best ways to maintain social acceptability and consumer confidence?[29]

We consider the best way to maintain social acceptability and consumer confidence in renewable gas technologies is through ongoing consumer engagement as discussed in our response to Q4.

The CSIRO's National Hydrogen Roadmap considers strategic demonstration projects to be critical, not only in assessing the viability of the technologies, but for demonstrating the safety of their operation. It notes that for larger infrastructure type projects, detailed community engagement plans are needed to assist in obtaining a social licence to operate.[30]

In maintaining social acceptability and consumer confidence, the Victorian Government should maintain flexibility and creating opportunities for consumers to choose their source of energy today and in the future. If customers like the benefits of gaseous forms of energy, it is incumbent on energy providers and governments to find solutions that meet their needs while achieving net

[29] Our response also applies to the Biogas Pathway in Attachment B.
[30] CSIRO, *National Hydrogen Roadmap*, See: https://www.csiro.au/en/work-with-us/services/consultancy-strategic-advice-services/csiro-futures/futures-reports/hydrogen-roadmap

zero emissions. This is precisely why we are making investments in renewable hydrogen and other renewable gases.

In addressing emissions in the near-term, our analysis shows that gas is currently a lower-carbon choice for our Victorian customers compared to electricity delivered via networks, as electricity in Victoria is generated primarily by brown coal. While this comparison with natural gas will change over time, gas distribution networks provide a lower carbon option today and viable pathway to net zero emissions that should remain open. This is discussed further in Attachment D.

Research across AGIG operations to understand our customers and the communities where we operate has led to several important insights summarised below:

- Customers like using gas in their homes, and it is often a preferred fuel for cooking and heating;
- Customers value the reliability of gas and satisfaction levels are very high (>80% over the last 12 months), with many customers having never experienced an outage;
- Environmental sustainability is becoming increasingly important to customers and communities, with the following findings from AGIG's Voice of the Customer research:
    - ~50% of AGIG's national gas consumers rate environmental considerations as extremely important (an uplift of 5% over the last 12 months);
    - AGIG gas customer's in regional NSW and Victoria score 'Cleaner for the Environment' at an 8.6-out-of-10 in terms of level of importance.
- Customers demonstrate an increased willingness-to-pay for better environmental outcomes, for example in AGIG's recent South Australian program:
    - One-in-four customers rated environmental sustainability as their number one priority, ahead of price and reliability;
    - 87% of customers considered it very important or extremely important for AGIG to consider ways to lower carbon emissions; and
    - 84% of customers supported AGIG further investing in carbon reduction initiatives at a cost to customers.

Further, extensive engagement activities across Victoria are planned throughout 2021 and 2022 as part of our Access Arrangement reviews already underway and in developing HyP Murray Valley.

7 What are the inter-dependencies and trade-offs with other pathways (are pathways complementary or alternatives)?[31]

AGIG recognises that if Victoria is to meet the emission reductions, we need to focus on the large-scale decarbonisation of the entire energy supply chain, including electricity, gas and transport. We recognise that each of the identified pathways represents opportunities to decarbonise gas use and consider the pathways to be complementary rather than alternatives.

As discussed in Q2 above, there are many co-benefits between renewable electricity and hydrogen production. The more renewable energy we generate, the greater potential to produce renewable hydrogen. We consider that focusing on electrification alone as a means of decarbonising is likely to be very costly as has been recognised by Frontier Economics and the Grattan Institute. This is discussed further in our response in Attachment D.

[31] Our response also applies to the Biogas Pathway in Attachment B.

8 What are the key uncertainties and potential for unintended consequences? what is the government's role in reducing these uncertainties?[32]

We commend the Victorian Government in exploring a range of pathways for the gas sector to reach net zero emissions and seeking to accelerate all opportunities to decarbonise gas supply.

We recognise that the pathway taken to achieve net zero emissions in the medium to long term remains uncertain and that there are downside risks as a result of the energy transition, as alternatives to renewable gas are also available and often prioritised by government policy at the State and local level.

In addition to the uncertainties identified in the Gas Roadmap consultation paper, we consider a key uncertainty that should be recognised is the nature of evolving competition in the energy sector in the future that may result in is a very different competitive environment. We should look for opportunities to enhance this competition which provides benefits to customers and the economy as a whole.

In reducing these uncertainties, governments, networks and other stakeholders should allow time to fully examine the viability of the proposed pathways for achieving net zero emissions. This will reduce the risk of making pivotal decisions too early, increasing costs for customers unnecessarily. Decisions made today will have implications across both gas and electricity networks and for customers and may create path dependency, locking in higher cost solutions.

Gas is a fuel of choice today and we can see the potential for more competition in the future as renewable energy becomes less expensive. These cost reductions benefit electricity consumers and hydrogen consumers. However, our customers choose to connect to the gas network because of benefits it delivers like affordability, reliability, comfort and convenience.

Therefore it is incumbent on energy providers and governments to find solutions that meet their needs while achieving net zero emissions. This is precisely why we are making investments in renewable hydrogen and other renewable gases. The key focus for the Victorian Government should be on maintaining flexibility and creating opportunities for consumers to choose their source of energy today and in the future while achieving net zero emissions without prematurely locking-in a definite outcome.

Addressing uncertainty about this role requires a clear framework to translate information about the future into action today in a manner that is transparent, understood and supported by our customers and stakeholders. This issue is under active consideration as part of the next five-year regulatory pricing reset for Victoria's gas distribution network (called an Access Arrangement, AA, review). All three of Victoria's gas distribution networks have recently begun engagement as part of the next AA review.

The future of gas will be a major focus of our engagement program as part of the AA review and we have established a Future of Gas Co-design group. This group will co-design potential future scenarios (2030-2050) for the energy sector and consider how we as gas network businesses should respond in a regulated environment. Our engagement on the future of gas will be designed to complement but not duplicate projects being undertaken by the Victorian Government and other groups in the industry.

[32] Our response also applies to the Biogas Pathway in Attachment B.

Attachment B: Biogas Pathway

1 What are the key benefits, risks, and potential impacts on various end-users, on energy affordability, safety, security, reliability and equity?

Biogas presents many similar opportunities to renewable hydrogen. The key issue to address will be the availability and proximity of feedstocks at sufficient scale and we encourage the Victorian Government to conduct further analysis of this question. Victoria in encouraging the decarbonisation of natural gas use, should remain open to a role to be played by biomethane, as well as renewable hydrogen.

As outlined in the *Biogas opportunities for Australia Report*, biogas presents many benefits and opportunities for Australia.[1] In particular, biogas transformed into biomethane is a renewable gas that can be quickly deployed using existing gas distributions networks, without modifying gas pipelines or appliances. It can be used in homes for cooking, heating and hot-water, or as a fuel for gas vehicles. It can be injected into the gas grid or used directly on-site. This is an opportunity for the gas and transport sectors to further assist the energy transition.

Biomethane also offers a number of market advantages over and above those available for the onsite use of biogas for electricity generation. Gas distribution networks and pipelines represent large potential storage sites, where producers can store or use biomethane in response to the peaks and troughs of gas and electricity prices.

This same factor would enable the smooth production profile of biogas to be maintained, despite more variable onsite electricity demand, potentially removing the need for flaring. Furthermore, the network provides an opportunity to distribute biomethane to vehicle refuelling stations across dense networks in many parts of Australia, providing a framework for transport usage.

All of the policy and regulatory recommendations in this submission are relevant for and should incorporate biogas/biomethane.

2 What is the scale of the opportunities and potential to accelerate uptake?

Bioenergy Australia notes significant biomethane (as opposed to biogas for onsite electricity generation) is already produced in other markets and suggest the Australia's biogas production potential is around 371PJ, or 9 per cent of Australia's total annual energy consumption. [2]

We consider biogas can represents part of a viable pathway to decarbonise gas use in Victoria. While not currently deployed in Victoria, injecting biomethane means that residential end-users can continue getting the same benefits they receive from natural gas today – affordability, safety, reliability, security of supply and equity, but with the carbon neutral benefits of biomethane.

End-users will not be required to change out existing household appliances so there will be minimal impacts and disruptions during the transition to net zero emissions. For our industrial customers in hard to abate sectors, biomethane can be used wherever natural gas is used today and replace methane as an industrial feedstock.

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[1] ENEA Consulting (For Bioenergy Australia), *Biogas opportunities for* Australia. See: https://www.enea-consulting.com/en/publication/biogas-opportunities-for-australia/#:~:text=The%20biogas%20resources%20in%20Australia,5%20to%205.0%20billion.

[2] ENEA Consulting (For Bioenergy Australia), *Biogas opportunities for* Australia

We recognise the potential limitations to the availability of sustainable biomass resources to meet Victorian domestic needs. As identified in the Gas Roadmap consultation paper, it may require biomass resources greater than currently available from existing pig waste, in the form of new plant crops, which would place pressure on existing land uses and water availability. Deloitte found that Victoria's lower biogas resource and higher gas consumption mean only around a quarter of gas demand could be met with current biogas feedstock resources.[3]

Notwithstanding this, we consider there to be a role for biomethane, in combination with other renewables gas like hydrogen in Victoria's future energy supply mix in achieving net zero emissions. We would support further work to analyse the level of decarbonisation of gas that could be achieved through the biogas pathway, including the availability and location of sustainable biomass that could be diverted to produce biomethane for injection into the gas grid.

3 What are the key technical, regulatory and economic barriers?

As stated in the Roadmap consultation paper, injecting biomethane into the reticulated gas network presents no technical issues. While there are currently no biomethane plants yet operating in Victoria, the technology is well proven overseas.

There are number of regulatory and economic barriers that need to be addressed to achieve the rapid and widespread deployment of biogas in Australia and in Victoria. This includes more favorable policy incentives to deploy biomethane for use in gas networks and other applications. These issues are largely the same as those for renewable hydrogen (refer to Attachment A).

Specific for biomethane, we note that the waste management sector is a complex sector with dispersed supply chains and stakeholders, and often conflicting policy goals. Because biomethane injection is unproven in the Australian context, it is difficult to provide assurance that a long-term feedstock is available and revenue stream is able to be generated. Furthermore, there is a need to incentivise the diversion of organic waste from landfill so that it can be used for biomethane injection.

We welcome Victoria's waste sector emissions reduction pledge which recognises the significant opportunities for additional emissions reductions in this sector, including through diverting organic waste from landfill to 'waste-to-energy' facilities.[4] We consider that strengthening incentives to divert organic waste from landfill to produce biomethane is important to build scale.

At the Federal level, the opportunities for bioenergy are increasingly gaining recognition. The Federal Government (through ARENA) is developing the Bioenergy Roadmap (expected to be released in 2021) to identify the role that the bioenergy sector can play in Australia's energy transition and in helping Australia further reduce our emissions.[5] Like the National Hydrogen Strategy, this will help inform investment and policy decisions in the bioenergy sector in Australia.

We would support further work by the Victorian Government to explore opportunities and to accelerate investment in biomethane in Victoria, which may include developing a bioenergy industry development plan for Victoria, setting out a clear pathway to developing the Victorian

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[3] Deloitte Access Economics, *Decarbonising Australia's gas distribution networks*. See: https://www2.deloitte.com/au/en/pages/economics/articles/decarbonising-australias-gas-distribution-networks.html

[4] Victorian Government, *Waste sector emissions reduction* pledge. See: https://www.climatechange.vic.gov.au/victorian-government-action-on-climate-change/Waste-sector-pledge-accessible.pdf

[5] ARENA, See: https://arena.gov.au/knowledge-innovation/bioenergy-roadmap/

bioenergy sector. This action has been identified in Sustainability Victoria's New Energy Technology Sector Strategy.[4]

The Clean Energy Regulator is also developing a new biomethane method so eligible biomethane projects can be credited for emissions reductions and receive Australian carbon credit units (ACCUs).[6] This is a step in the right direction as existing policies have favored the use of biogas for electricity generation, by enabling the use of bioenergy resources for onsite electricity generation to generate value (e.g. tradeable permits, or a certified product for customers), rather than valuing the almost identical emissions reductions when achieved by injecting biomethane into a gas network or pipeline, where the gas is combusted downstream.

We note that current drafts of the method excludes agricultural waste as a feedstock, [7] which represents a significant opportunity missed to incentivise growth in the sector as agricultural waste represents around 94 per cent of the available biogas resource in Australia.[8]

4 What are the roles to be played by government, industry and how will consumers preferences be accounted for in the transition?

See our response to the Hydrogen Pathway in Attachment A.

5 What are the likely timings of technical maturity and economic viability?

As discussed above, injecting biomethane into the gas distribution network is not expected to present technical issues.

The commercial viability of replacing natural gas with biogas and biomethane will depend largely on the availability and location of biomass (organic waste), and the cost of digestion and biomethane purification facilities.

6 What are the best ways to maintain social acceptability and consumer confidence?

See our response to the Hydrogen Pathway in Attachment A.

7 What are the inter-dependencies and trade-offs with other pathways (are pathways complementary or alternatives)?

See our response to the Hydrogen Pathway in Attachment A.

8 What are the key uncertainties and potential for unintended consequences? what is the government's role in reducing these uncertainties?

The commercial viability of replacing natural gas with biogas and biomethane will depend largely on the availability and location of biomass (organic waste), and the cost of digestion and biomethane purification facilities.

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[6] DISER. See: https://www.industry.gov.au/regulations-and-standards/methods-for-the-emissions-reduction-fund

[7] Bioenergy Australia. See: https://cdn.revolutionise.com.au/cups/bioenergy/files/mqo5evfvyfqc0phx.pdf

[8] Deloitte Access Economics, *Decarbonising Australia's Gas Distribution Network*.

Attachment C: Reducing fugitive emissions

1 What are the opportunities and barriers to further reductions in fugitive emissions?

Unaccounted for gas (UAFG) is the difference between metered gas entering and exiting the distribution network that may arise as a result of fugitive emissions (leaks from the network), metering inaccuracies and/or gas theft. Leaks from the network is one of the largest source of direct greenhouse gas emissions from operating our Victorian distribution networks.

Reducing UAFG emissions or fugitive emissions can serve as a stepping stone to developing low and zero carbon options for the wider network, helping to create options for the future of the network, which we support.

On our network, fugitive emissions are primarily caused by gas leakages from aging cast iron and unprotected steel mains which are our oldest mains and have a history of fracture and failure in gas distribution networks in Australia and overseas.

We reduce fugitive emissions through our Mains Replacement Program (MRP), which is one of the important activities we undertake to ensure public safety. This mains replacement work also has the added benefit of making our gas distribution networks 'hydrogen ready', but will have to occur in any case for safety and operational reasons.

A summary of our progress in replacing cast iron or uncoated steel mains (therefore 'hydrogen ready)' are found in Tables 2 and 3 of this document. On current plans, expected completion of low-pressure mains replacement for the Australian Gas Networks (AGN) is 2022. The AER projects the Multinet Gas Networks (MGN) MRP to be complete in 2037, although based on current progress we expect the program to be complete in 2032. Further detail is found in Table 3.

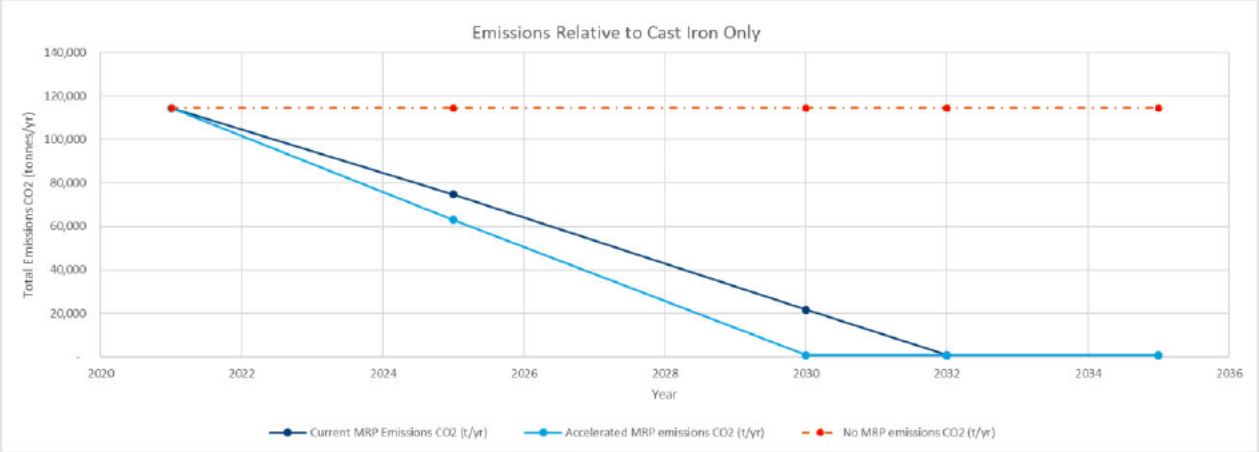
We are currently undertaking detailed review of our MRP for the next five years (July 2023 to June 2028) as part of developing our plans for the next five year regulatory pricing reset (called an Access Arrangement (AA) review). Our MRP proposal will be considered by the Australian Energy Regulator as part of our broader capital expenditure program. Our plans will be informed by an extensive engagement program as part of our AA review to ensure it is capable of being accepted by our customers and stakeholders.

There are opportunities to further reduce fugitive emissions by accelerating our MGN Mains Replacement Program for completion before 2030 and we are currently reviewing this as part of our plans for the next AA period.

Based on preliminary analysis, the MGN MRP could reduce annual emissions associated with MGN cast iron mains from 114,505 tonnes of CO_2-e to 735 tonnes on completion (note there are additional fugitive emissions not associated with cast iron mains that will remain unchanged). Relative to a base case with no MRP, the MGN MRP could achieve a cumulative emissions reduction between now and 2032 of 633,820 tonnes of CO_2-e. Accelerating the program for completion before 2030 could save a further 115,240 tonnes of CO_2-e between now and 2032. These figures are based on National Greenhouse and Energy Reporting methodologies for fugitive emissions for distribution network which differs from the quantity of UAFG used within Victoria's Declared Wholesale Gas Market.

Accelerated MRP to achieve these emissions reductions will require an increase in capital expenditure over the next AA period, which will likely see an increase in customer bills relative to a case where the program remains as currently planned.

Figure 1: Estimated fugitive emissions reductions as a result of cast iron MRP for MGN



Source: AGIG analysis

Table 1: Estimated fugitive emissions reductions comparing current MRP, accelerated MRP and no MRP for MGN

Year	Current MRP Emissions CO2 (t/yr)	Emissions Relative to Cast Iron Only Accelerated MRP emissions CO2 (t/yr)	No MRP emissions CO2 (t/yr)
2021	114,505	114,505	114,505
2025	74,656	62,986	114,505
2030	21,736	735	114,505
2032	735	735	114,505
2035	735	735	114,505

Australian Gas Infrastructure Group

Summary of AGIG's Victorian Mains Replacement Program

Table 2: AGIG (sub or regional) distribution networks with no cast iron or uncoated steel mains – Vic Outer Melbourne

Victoria – Outer Melbourne		
Epping	Berwick	Mornington Peninsula and towns
Healesville	Clyde	Narre Warren
Mernda	Cranbourne	Officer
Whittlesea	Hampton Park	Pakenham
Donnybrook	Lyndhurst	Yarra Glen
Upper Yarra Valley Network (Woori Yallock to Warburton)	Gembrook	

Table 3: AGIG (sub or regional) distribution networks with no cast iron or uncoated steel mains – Vic Regional

Victoria – Regional		
Bairnsdale	Kyabram	Tatura
Benalla	Longwarry	Tongala
Beveridge	Maffra	Trafalgar
Broadford	Merrigum	Traralgon
Chiltern	Mildura	Wallan
Churchill	Moe	Wandong Heathcote Junction
Cobram	Morwell	Wangaratta
Darnum	Rosedale	Wangaratta East
Drouin	Rutherglen	Warragul
Echuca	Sale	Wodonga
Euroa	Seymour	Yarragon
Kilmore	Shepparton	Yarrawonga

Koonoomoo	Tallarook	Lang Lang
Korumburra Wonthaggi	Leongatha	Inverloch

Table 4: Expected completion of low-pressure mains replacement

Network	Starting Year	Low-pressure mains to be replaced at start of programme (km)	Low-pressure mains replaced to date (km)	% replaced to date	Anticipated completion year
Australian Gas Networks – Melbourne and inner suburbs	2011	1,149	916	80%	2022
Multinet Gas Network - Melbourne inner eastern suburbs	2003	3,196	1,522	47%	2032

Attachment D: Gas industry transition issues and challenges

Key issue 1: Maintaining electricity reliability with new sources of demand

1 What policies are needed to ensure that the electricity network can reliably serve new sources of demand from electrification of gas demand, hydrogen production and electric vehicles?

As recognised by the Victorian Government, new sources of demand from electrification of gas demand, hydrogen production and electric vehicles will likely test the capacity of the electricity networks to accommodate the increase in new sources of demand.

In Victoria, households use more gas for cooking, space heating and hot water than anywhere else in Australia. Winter demand is roughly three times higher than summer, primarily due to heating. The Grattan Institute recognises the challenge that electrification of household and commercial gas load in Victoria would increase electricity demand more in winter than at other times of the year, exacerbating the winter challenge for the National Electricity Market (NEM).[1]

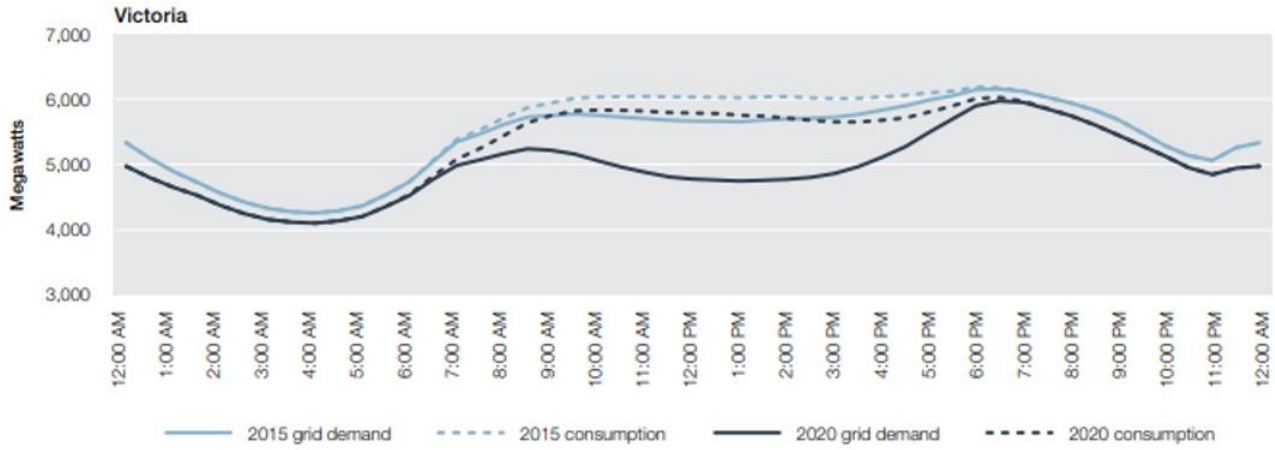
Further, patterns of electricity demand are changing, and the Australian Energy Regulator notes that while solar generation is helping to meet energy demand, timing issues limit the extent of this assistance.[2] Rooftop solar PV generation is having a more profound impact on the level and timing of minimum demand for grid supplied electricity. Historically, demand reached its low point in the middle of the night, when most people are sleeping. But the growth in solar PV output in the middle of the day is lowering daytime grid demand, and minimum grid demand increasingly occurs and peaks later in the day.

As shown in Figure 1 below, Victoria's grid demand has increasingly shifted into the evening where gas demand is generally at its highest. When combined with electricity demand this further highlights the challenge of large scale electrification of gas which would have significant implications on the NEM.

[1] Grattan Institute, *Go for net zero.* See: https://grattan.edu.au/wp-content/uploads/2021/04/Go-for-net-zero-Grattan-Report.pdf

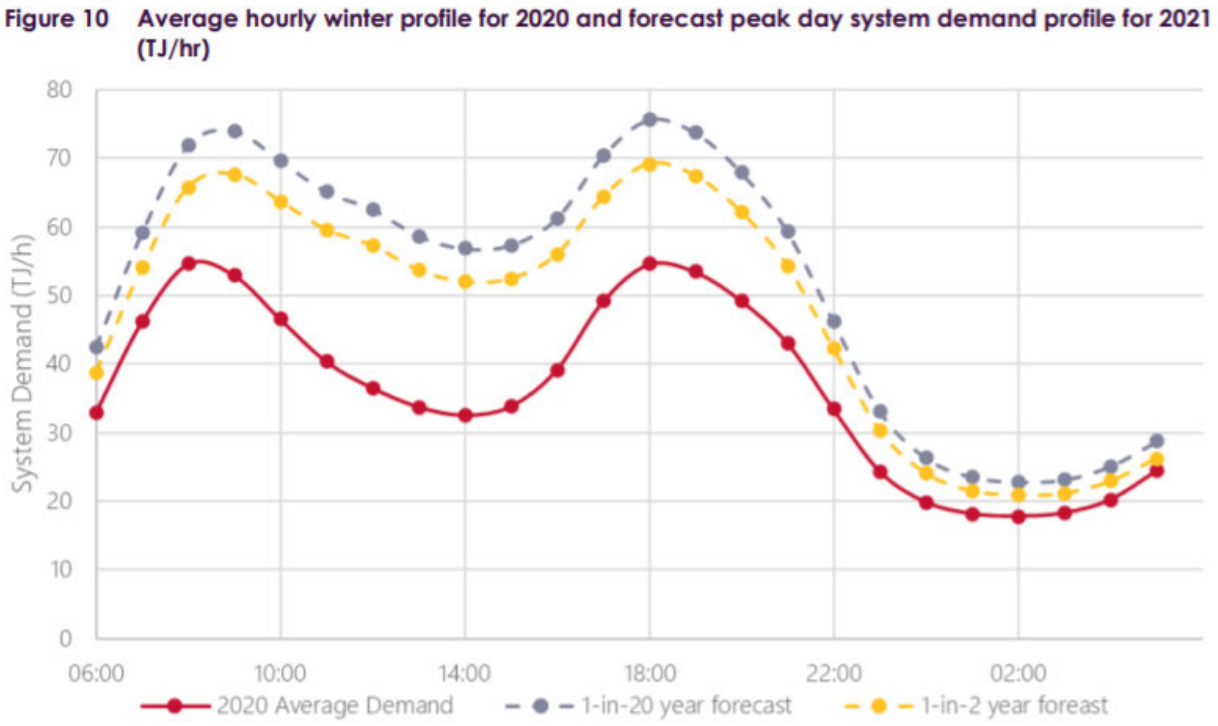
[2] Australian Energy Regulator, *State of the Energy Market 2021.* See: *https://www.aer.gov.au/system/files/State%20of%20the%20energy%20market%202021%20-%20Chapter%201%20-%20The%20electricity%20market%20in%20transition_0.pdf*

Figure 1: Victoria Electricity duck curve, average native demand by time of day for 2015 and 2020



Source: AER, State of the Energy Market 2021

Figure 2: Victoria Gas system average hourly winter profile and forecast



Source: AEMO, 2021 Victorian Gas Planning Report

New sources of demand from the uptake of electric vehicles (EV) could pose additional challenges to the grid. AEMO noted that the uptake of electric vehicles (EV) in Australia is projected to accelerate rapidly in coming years, with two million EVs expected on Australian

roads by the mid-2030s. By this time the EV consumption of electricity from the national grid is forecast to grow at more than 1TWh/year – with significant implications for the NEM.[3]

The Grattan Institute observes that uncoordinated, widespread charging could exacerbate peak demand in the evening. However, it noted this problem could be managed by encouraging drivers to charge their vehicles when electricity is abundant, such as during the middle of the day, or allowing electricity suppliers to coordinate the charging of electric vehicles.[4]

In terms of electricity demand from hydrogen production, we consider that renewable hydrogen could provide substantial flexible demand for electricity. The Grattan Institute considers that in theory, this sector could take advantage of electricity supply when it is abundant – such as on sunny days – and turn down or even switch off when renewable energy is scarce. This would help to firm the NEM and address the winter challenge.[5] Further detail can be found in Attachment A – Hydrogen Pathway.

Over-emphasising electrification in policy decisions as the only pathway to achieving decarbonisation, risks increasing emissions in the near term, and increasing economy-wide costs in the longer-term.

The Grattan Institute also found that "Victoria's large household winter gas heating load means that switching small-user gas loads would have significant effects on its electricity system" and that switching to electricity would increase emissions over the next decade.[6] Further The Grattan Institute explicitly note:

> "*In Victoria, encouraging households to use electricity rather than gas will generally increase emissions over the coming decade."*[7]
>
> *It is not possible today to make definitive judgements about whether or when to electrify gas loads, or move to low-emissions gas substitutes. The factors that will determine the best approach for consumers are too uncertain and, in any case, will vary significantly between places and over time".*[8]

Frontier Economics found that in Victoria using renewable hydrogen is significantly cheaper than electrification to replace existing uses of natural gas (excluding power generation) because "there are significant additional electricity network costs" associated with electrification.[9]

These results show that the net cost of replacing natural gas with renewable hydrogen blended into distribution networks is significantly cheaper than electrification because of electricity network augmentation and storage requirements.

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[3] AEMO, https://aemo.com.au/en/newsroom/news-updates/report-highlights-data-needs-for-a-smooth-transition-to-evs

[4] Grattan Institute, *Go for net zero*.

[5] Grattan Institute, *Go for net zero*.

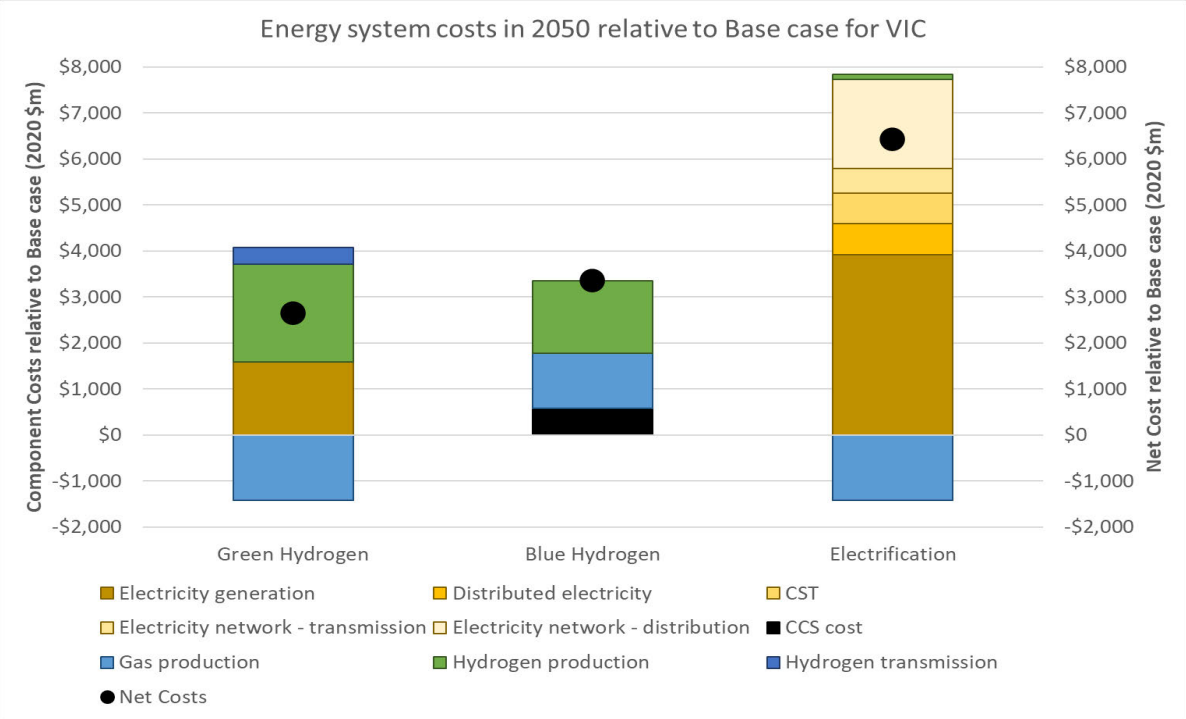
[6] Grattan Institute, *Go for net zero*.

[7] Grattan Institute, *Go for net zero*.

[8] Grattan Institute, *Go for net zero*.

[9] Frontier Economics, *The Benefits of Gas Infrastructure to decarbonise Australia*. See: https://www.energynetworks.com.au/resources/reports/2020-reports-and-publications/the-benefits-of-gas-infrastructure-to-decarbonise-australia-frontier-economics/

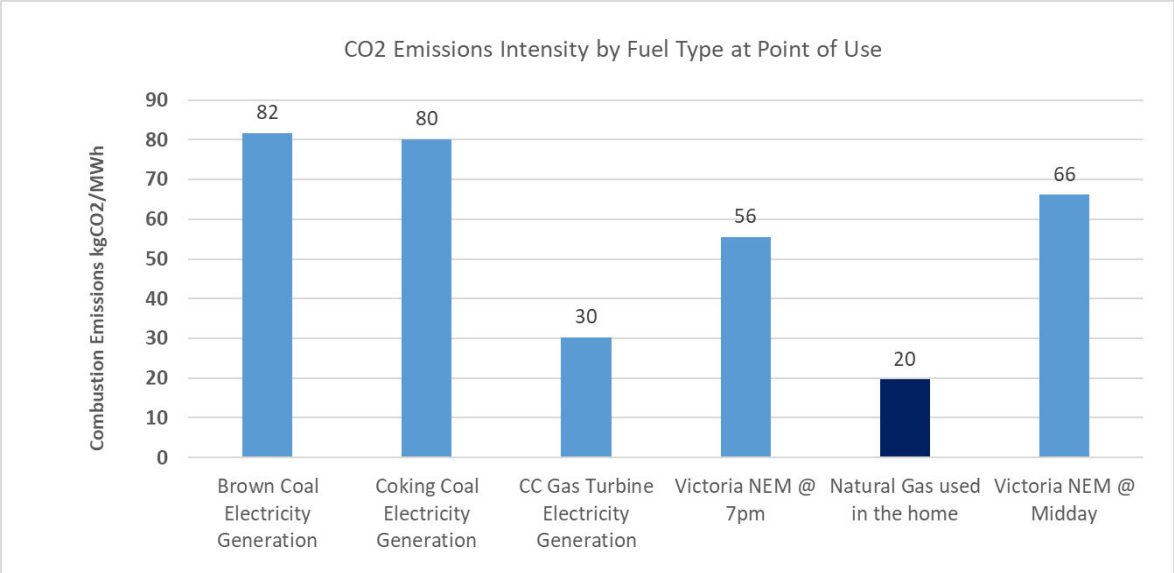
Figure 3: Energy System costs in 2050 relative to base case



Source: Frontier Economics

In addition to these long-term costs, AGIG analysis further underlines the point made by the Grattan Institute that in the near term switching from a gas appliance to an electric appliance with grid-electricity is also likely to increase emissions. This is likely to remain the case for some time even as the proportion of renewable electricity increases, as gas consumption peaks during winter and in the morning and evening when electric appliances would continue to draw fossil fuel electricity energy from the grid.

Figure 4: CO2 Emissions Intensity by Fuel Type at Point of Use in Victoria



Source: AGIG analysis

Looking forward to our next AA period (2023-2028), AGN and MGN combined expect to connect approximately 20,000 customers per year in Victoria, or 100,000 for the full period. Relative to grid sourced electricity this would avoid approximately 418,000 tonnes of CO_2-e emissions over the five year period, and would save approximately $264/$440 (AGN/MGN) per residential customer per year.[10]

Table 1: New gas connections – potential avoided emissions 2023-2027

New Connections	2023	2024	2025	2026	2027
Forecast average annual new residential connections	19,700	19,700	19,700	19,700	19,700
Emissions avoided per residence remaining on gas relative to grid sourced electricity (t CO2-e)	4.70	4.47	4.25	4.02	3.80
Total emissions avoided (t CO2-e)	92,491.50	88,059.00	83,626.50	79,194.00	74,761.50
Saving over five year AA period (t CO2-e)			418,132.50		

Source: AGIG analysis

By remaining connected to the gas network, the 1.4 million customers connected to the AGN and MGN networks can avoid approximately 29 million tonnes of CO2-e over the 2023-2028 period relative to grid sourced electricity.

[10] Forecast connection growth is a preliminary estimate that is being further refined as part of the AGN and MGN AA processes. We will present a more detailed forecast as part of our submission to the AER in July 2022. Emissions savings are based on appliance end use consumption and national Greenhouse and Energy Reporting emissions factors, assuming a decreasing emissions intensity of the Victorian grid as renewable electricity generation increases.

Table 2: Existing gas connections – potential avoided emissions 2023-2027

Existing Connections	2023	2024	2025	2026	2027
Existing residential connections	1,377,667	1,377,667	1,377,667	1,377,667	1,377,667
Emissions avoided per residence remaining on gas relative to grid sourced electricity (t CO2-e)	4.70	4.47	4.25	4.02	3.80
Total emissions avoided (t CO2-e)	6,468,146.57	6,158,171.49	5,848,196.42	5,538,221.34	5,228,246.27
Saving over five year AA period (t CO2-e)			29,240,982.08		

Source: AGIG analysis

Therefore in Victoria, there is a particularly strong case for policy and regulatory change to encourage the development of renewable hydrogen and its use in gas distribution networks.

Given this evidence on the system wide costs and additional emissions associated with electrification, heavy-handed measures like preventing new gas connections and associated infrastructure should be not form part of the roadmap. Stopping network growth will increase both gas and electricity bills for individual customers with long-lasting ramifications – other states and territories are feeling the effects of this sort of heavy-handed policy approach. In new estates it would also preclude those customers from accessing renewable hydrogen in the future, adding significant opportunity costs.

As acknowledged by the Victorian Government, extensive electrification may require significant investment in electricity generation, storage and network assets to maintain reliability. These investments particularly in renewable generation need to be carefully planned in the context of the Energy Security Board's Post 2025 NEM design to make it fit for purpose.[11]

For Victoria in particular, DELWP observes that in Victoria, recent increases in renewable energy capacity in some technically weaker areas of Victoria's electricity network have created technical challenges for AEMO's operation of the Victorian network. These challenges have affected Victorian renewable energy projects (including through output constraints and

[11] Energy Security Board: https://esb-post2025-market-design.aemc.gov.au/

commissioning delays) and have contributed to a slowing in the volume of Victorian renewable energy projects achieving financial close over the past year.[12]

With the confirmed exit of the Yallourn Power Station, AEMO has revised its ESOO forecast advising that this would result in an increase in forecast unserved energy (USE) for Victoria above the reliability standard in Victoria from 2028-29 unless there is further commitment of dispatchable capacity.[13]

2 What is the role for gas-fired power generation and hydrogen in maintaining electricity reliability?

A Frontier Economics Report for the Australian Pipelines and Gas Association shows that gas powered generation can play a significant role in a net-zero future by unlocking extremely high levels of renewable generation at low cost, while ensuring a secure and reliable system. Its modelling reveals that total resource costs are reduced by as much as 36 per cent when gas-powered generation is used to support a renewable electricity system.[14]

In terms of the role of hydrogen in maintaining electricity reliability the key role is in sector coupling. The Clean Energy Finance Corporation's (CEFC) Hydrogen Market Study Report[15] observed that there is opportunity for hydrogen-based systems to provide excess power capture and power storage (akin to a battery) to enable grid balancing. This involves storing renewable electricity as hydrogen when there is excess power causing lower prices and regenerating as power when there is a supply shortfall resulting in higher spot prices. Fuel cell technology offers the prospect of more efficient peaking generation with hydrogen compared with natural gas open cycle turbines. The CEFC forecasts that grid balancing application will progressively become more favourable across the time horizon but is not expected to reach parity with natural gas peaking before 2050.

For remote power applications, the CEFC found that hydrogen production, storage and return to electricity has the potential to provide a more cost-effective remote power solution for towns or industrial sites, than more conventional diesel and solar with battery solutions.

Key issue 2: Transitioning to more sustainable gaseous fuels with minimal disruption to end-users

3 What are the key technical challenges in converting existing gas networks to accommodate more sustainable gaseous fuels?

Blending higher percentages of hydrogen into the gas distribution networks is likely to require adjustments to household gas appliances, gas metering equipment and possibly some pipefitting. In finding solutions to address these technical challenges, we are working closely with governments, industry and research organisations on key areas including delivering renewable gas blending projects and undertaking feasibility studies. Further details are found in Attachment A – Hydrogen Pathway).

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[12] DELWP, *Victorian Renewable Energy Target 2019-20 Progress Report*. See: https://www.energy.vic.gov.au/__data/assets/pdf_file/0026/506825/VRET_2019-20_Progress_Report.pdf

[13] AEMO, https://aemo.com.au/en/newsroom/media-release/aemo-updates-2020-esoo

[14] APGA, *Potential for Gas-Powered Generation to support renewables*. See: https://www.apga.org.au/sites/default/files/uploaded-content/field_f_content_file/210219_potential_for_gpg_to_support_renewables_-_final_report.pdf

[15] CEFC, *Australian Hydrogen Market Study*. See: https://www.cefc.com.au/media/nhnhwlxu/australian-hydrogen-market-study.pdf

From a networks perspective, our Victorian gas distribution networks will be hydrogen ready and can be fully optimised by 2032 when our mains replacement program is complete (significant parts of the networks are already in this position). There is significant potential for this program to be accelerated for completion before 2030 – bringing forward the date for hydrogen readiness and increased emissions savings. Further details are found in Attachment C – Reducing Fugitive Emissions.

4 What are the potential costs and opportunities in switching to more sustainable gaseous fuels for consumers?

In switching to more sustainable gaseous fuels, consumers that like gas, can continue to receive the same benefits from gas today – for cooking and heating and hot water, but with the zero emissions benefit of renewable gases. However there are likely to be costs to customers in switching to more sustainable gaseous fuels and also through electrification.

We note that while renewable hydrogen is currently more expensive than natural gas, independent modeling suggest that hydrogen costs are likely to decline rapidly and in many areas including network blending begin approaching competitiveness with natural gas by 2030 (consistent with the Federal Government targets of H2 under $2kg per kg). Further details are found in Attachment A – Hydrogen Pathway).

Key issue 3: Maintaining the reliability, affordability and safety of gas supply

5 What are the affordability, reliability and safety considerations related to gas supply and gas infrastructure, both in the short term and during a long-term transition to a decarbonised gas sector?

We agree with the Victorian Government's position that given the reliance on gas in Victoria, gas will continue to play a role in meeting Victoria's energy needs for years to come. Until such time as renewable and zero emissions alternatives become available at scale and are embraced by the market, it is important to maintain a reliable supply of affordable gas through policy decisions. We note that energy affordability remains the most important issue for all Australians in Energy Consumer Australia's latest sentiment survey in June 2021.[16]

In all potential pathways, AGN and MGN will continue to incur capital and operating expenditure to maintain the safety and reliability of the network, as customers will continue to rely on the network for decades to come.

6 What policies are needed to ensure that the gas system continues to operate reliably and safely and remain affordable for end-users during this transition?

The safety and reliability of our networks is not negotiable. Customers will continue to use the network for decades in all scenarios, and therefore we will continue to invest and incur costs. It is important that government recognise the co-benefits of these investments in a renewable gas future. These unavoidable costs benefit natural gas consumers today and renewable gas consumers in the future ensuring that the gas system continues to operate reliably and safely while remaining affordable for end-users during this transition.

As network businesses in Victoria distributing gas to over 1.4 million customers, we play a critical role in ensuring the gas distribution network operates reliably and safely for customers. This will remain a key priority for AGIG during a transition to a decarbonised gas sector both in the short term and long term and will continue to meet all safety, licencing and reliability requirements. In terms of affordability, we know price is important to our customers, and we

[16] Energy Consumer Australia, *Sentiment Survey – June 2021.* See: https://ecss.energyconsumersaustralia.com.au/sentiment-survey-june-2021/featured-content/

continuously focus on providing affordable energy solutions. Cost savings have always been one of the main reasons customers use natural gas for cooking, hot water and heating.

As part of the next five-year regulatory pricing reset for Victoria's gas distribution networks (called an Access Arrangement, AA, review), we are developing plans which outlines the activities and investments we propose to undertake for the next AA period (2023 to 2028) and the resulting price change for our customers. We will be preparing our operating and capital expenditure program proposals which will deliver for customer on safety, reliability and affordability. Our proposals will be informed by an extensive engagement program as part of our AA review to ensure it is capable of being acceptance by our customers and stakeholders.

Policies which preclude the potential for renewable gases (including preventing new connections and associated infrastructure) will increase costs on customers remaining on the network. Yet the network will continue to incur unavoidable costs to remain reliable and safe. This has potentially significant implications for the affordability of energy generally; by genuinely keeping options open we can avoid imposing excess costs on those with the lowest capacity to change (hard-to-abate sectors, and customers in vulnerable circumstances).

Key issue 4: Supporting Victoria's workforce, industry and the institutions that support them

7 What workforce skills and industry capabilities are required to transition to new and emerging energy sources?

Renewable hydrogen represents a significant opportunity to create new jobs and to reskill the existing plumbing and gas-fitting workforce. It also presents a significant opportunity to maintain gas appliance manufacturing in Victoria; by mandating that all gas appliances should be 'hydrogen ready' by 2025, Government can send a signal to industry to begin developing and manufacturing these appliances.

A large-scale hydrogen production, transport and export industry, will require a mix of new roles - necessitated by the introduction of new technologies, and traditional roles that have been a part of the LNG/CSG industries. These job roles can be categorised as:[17]

- Existing trades and disciplines which can be adapted/specialised for the hydrogen sector such as pipeline technicians
- Related capabilities such as WH&S, project management, financial analysis; and
- New roles such as fuel cell technicians.

8 How can government, industry and unions best work together, including through the Victorian TAFE and Training system, to help to build these skills and capabilities, and support existing workers through the transition?

We consider collaboration between government, industry and unions are critical to help build skills and capabilities, and support existing workers through the transition. In doing this, we support the identified activities underway as part of *Outcome 3: Workforce skills and capabilities can pivot to an emerging hydrogen industry* of the Victorian Renewable Hydrogen Industry Development Plan.[18]

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[17] Energy Skills Queensland, *Interim Research Report Hydrogen Industry*. See: https://energyskillsqld.com.au/wp-content/uploads/2020/10/Interim-Research-Report-Hydrogen-Industry.pdf

[18] DELWP, *Victorian Renewable Hydrogen Industry Development Plan*. See: https://www.energy.vic.gov.au/__data/assets/pdf_file/0021/513345/Victorian-Renewable-Hydrogen-Industry-Development-Plan.pdf

9 How do we maximise local job opportunities, including for industry training centres such as that operated by the Plumbing Industry Climate Action Centre, to prepare workers for the future?

We strongly support the use of industry training centres including the Plumbing Industry Climate Action Centre (PICAC) to maximise local job opportunities. Organisations like PICAC demonstrate the commitment of the workforce and the training community to achieving net-zero emissions while leveraging Victoria's existing skilled workforce. In particular, this includes the large existing plumbing and gas-fitting workforce skilled in working with natural gas and provide upskilling to expand their skillset.

Key issue 5: Managing uncertainty in the transition

10 What key uncertainties should the Roadmap take into account, and what is the government's role in reducing these uncertainties?

We recognise that the pathway taken to achieve net zero emissions in the medium to long term remains uncertain and that there are downside risks as a result of the energy transition, as alternatives to renewable gas are also available and often prioritised by government policy at the State and local level.

In the context of uncertainty governments, networks and other stakeholders should allow time to fully examine the viability of renewable hydrogen and other options for achieving net zero emissions. This will reduce the risk of making pivotal decisions too early, increasing costs for customers unnecessarily. Decisions made today will have implications across both gas and electricity networks and for customers and may create path dependency, locking in higher cost solutions. For further detail see Attachment 1 – Hydrogen Pathway.

In addition to the uncertainties identified in the Gas Roadmap consultation paper, we consider a key uncertainty that should be recognised is the nature of evolving competition in the energy sector in the future that may result in is a very different competitive environment. We should look for opportunities to enhance competition and customer choice as it provides benefits to customers and the economy as a whole.

Key issue 6: Transitioning the Victorian economy efficiently and equitably

We support the need to transition the Victorian economy efficiently and equitably. This requires considering issues from both an individual consumer perspective and from an economy-wide perspective. As demonstrated above and in Attachment A, there is an increasingly strong case that renewable hydrogen represents a more cost-effective approach to decarbonising natural gas usage than alternative pathways. We also recognise that incentive mechanisms to assist households with the transition are needed and should be genuinely technology neutral.

We note that like renewable electricity, the benefits of renewable gases flow widely across the community and therefore the costs should be shared across the community.

11 How can we ensure that the costs of transition to lower emissions energy sources are borne equitably?

Like renewable electricity, the primary benefit of renewable gases are its potential to achieve the emission targets at a lower cost to the economy as a whole. These benefits flow widely across the community and achieving these benefits requires an approach which recognises the economy wide benefits of renewable and combines incentives, support and regulation. By introducing an incentive mechanism, like a Contract for Difference, Government can ensure that the costs of transition to lower emissions energy sources are borne equitably.

Renewable electricity provides a useful case study. The additional costs of renewable electricity have been shared across the community in a variety of ways. The costs of the Victorian Renewable Energy Target and government procurement of renewable electricity are drawn from general revenue. Meanwhile, the costs of the Commonwealth Renewable Energy Target are spread across all consumer bills. We recommend a similar approach be taken for renewable hydrogen and other renewable gases, until the costs decline to more competitive levels, as expected by independent forecasts discuss in other parts of this submission.

This is discussed further in Attachment A – Hydrogen Pathway.

12 How can we help low-income and vulnerable households manage any upfront costs in changing energy sources?

We consider that government support is crucial in helping low-income and vulnerable households to manage any upfront costs in changing energy sources. This sentiment is supported by the Australian Council of Social Services' survey which revealed that over 90 per cent of voters think that it is important or very important that governments help reduce households' and businesses' energy bills.[19] In the long-term the need for such support will be minimised if we remain open to various pathways to achieving net-zero emissions and encourage a competitive energy market where customers can choose amongst different fuels.

13 What are the barriers for households in improving the efficiency of their use of gas for heating, cooking and hot water and/or switching to solar/pump hot water in existing homes?

As identified by Australian Council of Social Services, the key barriers for households in improving energy efficiency relates to:[20]

- Capital - people on low incomes are less able to benefit from new efficiencies as they have less capacity to pay;
- Landlord-tenant split incentive – preventing renters from installing energy efficient products; and
- Information barriers – that prevent households from understanding the options available to them to increase energy efficiency.

Policy should focus on these barriers in a technology neutral way.

14 What are the opportunities for the Victorian Energy Upgrades program to incentivise efficient gas use, thermal upgrades of buildings (e.g. insulation) and electrification?

As part of the Essential Services Commission Victoria's *Getting to fair – draft strategy*, a number of possible initiatives were identified to improve the Victorian Energy Upgrade (VEU) program such as by developing more diverse consumer facing materials, increased direct engagement with consumers and expanded the VEU program to better reflect the needs of

[19] Australian Council of Social Service, *EEC Survey*. See: https://www.acoss.org.au/wp-content/uploads/2018/04/EEC-Survey-online-FINAL-.pdf

[20] Australian Council of Social Service, *Energy Efficiency & People on low incomes*. See: https://www.acoss.org.au/images/uploads/ACOSS_ENERGY_EFFICIENCY_PAPER_FINAL.pdf

consumers.[21] We support these potential initiatives to improve energy efficiency opportunities available to customers in vulnerable circumstances, including more efficient gas use.

While not currently demonstrated in a domestic context, hydrogen-ready boilers could be added as an activity under the VEU to incentivise efficient gas use for consumers that would prefer to continue using gas rather than switch to an electric alternative. Hydrogen-ready boilers are discussed in Attachment A.

15 What issues and elements do you see as most important to improve the energy and emissions performance of new homes?

We note that any measures to improve the energy and emissions performance of new homes such as the introduction of a new 7-star energy efficiency standard should recognise the potential role that renewable gases can play in meet energy efficiency requirements.

AGIG is targeting 100 per cent renewable gas available for new subdivisions and/or apartments and commercial buildings from 2025. We are working with property, land and housing developers to achieve this goal. It is vital that ratings schemes recognise the potential for zero (and net-zero) emissions gas appliances to be used in homes in the very near future.

Further detail on our Low Carbon Strategy is found in Attachment E.

16 Do the range of outcomes measures identified above adequately cover key considerations for assessing the costs and benefits of options and strategies to decarbonise the use of gas in Victoria?

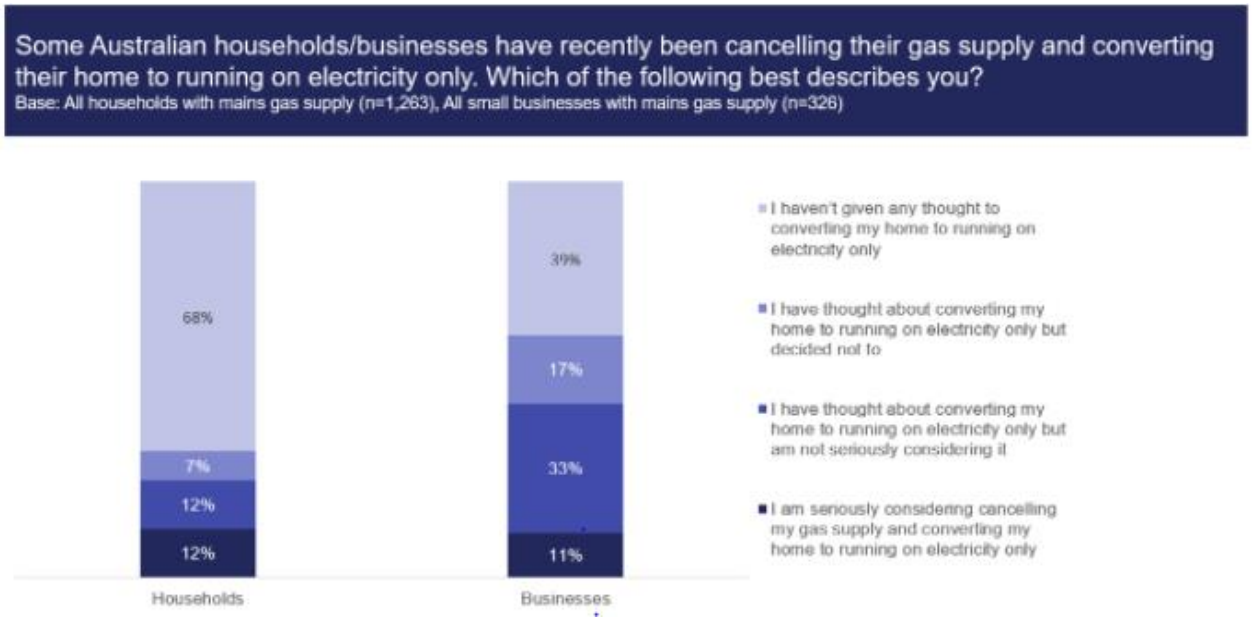
In addition to the range of outcomes measure identified by the Victorian Government, we consider that customer choice should also be a key consideration as part of the social licence outcomes measure. In Victoria customers are free to choose their source of energy today and should have this choice in the future. If customers like the benefits of gaseous forms of energy, it is incumbent on energy providers and governments to find solutions that meet their needs while achieving net zero emissions.

A recent Energy Consumer Australia survey revealed that only 11 to 12 per cent of households and businesses are seriously considering electrification.[22] These results align with research conducted with AGIG's customers to understand our customers and the communities where we operate. This is discussed further in Attachment A – Hydrogen Pathway.

[21] Essential Services Commission Victoria, *Getting to fair: draft strategy*. See: *https://www.esc.vic.gov.au/sites/default/files/documents/Getting%20to%20fair%20-%20Draft%20decision%20paper%2020210507%20.pdf*

[22] Energy Consumer Australia, *Sentiment Survey – June 2021*.

Figure 6: Energy Consumer Australia survey results on switching from gas



Source: Energy Consumer Australia

Attachment E: About AGIG and our Low Carbon Strategy

Australian Gas Infrastructure Group (AGIG) is the largest gas distribution business in Australia, serving more than 2 million customers through our networks in Victoria, Queensland, South Australia and several regional networks in New South Wales and the Northern Territory.

In Victoria, we reliably distribute gas to over 1.4 million customers through over 21,000km of distribution network. Australian Gas Networks (VIC & Albury) and Multinet Gas Networks serve much of Victoria including the Melbourne CBD, the northern, eastern and south-eastern suburbs, and much of eastern and central Victoria extending north to Wodonga and east to Bairnsdale.

At AGIG, we are committed to sustainable gas delivery today, and tomorrow. In 2017 we worked with Australia's five peak gas bodies to develop Gas Vision 2050 – a pathway to achieve near zero emissions in our gas sector.

We have developed a Low Carbon Strategy, which targets 10% renewable gas in networks by no later than 2030, delivering 100% renewable gas developments from 2025, with full decarbonisation of our networks by 2040 as a stretch target, no later than 2050. Our low carbon strategy is consistent with Gas Vision 2050, as well as Australian state and territory net zero ambitions, including Victoria.

We are now delivering on our strategy by deploying renewable gas projects. Our projects include:

- Hydrogen Park Murray Valley (HyP Murray Valley) proposal – A 10MW elctrolyser to produce renewable hydrogen for blending with natural gas (up to 10%) and supply the twin cities of Wodonga (Victoria) and Albury (NSW), with the potential to supply industry and transport sectors. We have been awarded funding by ARENA and are now targeting Financial Investment Decision in 2022 and first production in 2023.
- Hydrogen Park South Australia (HyP SA) – A 1.25MW electrolyser to produce renewable hydrogen for blending with natural gas (up to 5%) and supply to more than 700 existing homes and businesses in metropolitan Adelaide. HyP SA is now operational and the first renewable hydrogen production facility in Australia
- Hydrogen Park Gladstone (HyP Gladstone) – A 175kW electrolyser to produce renewable hydrogen for blending with natural gas (up to 10%) and supply to the entire network of Gladstone, including industry. First production is expected in 2022.
- The Australian Hydrogen Centre (AHC) – A virtual centre delivering feasibility studies for 10% and 100% blending of renewable hydrogen into towns and cities in South Australia and Victoria.

We are delivering these projects in partnerships with Governments across Australia. In Victoria, we are delivering the work program of the Australian Hydrogen Centre in partnership and developing the HyP Murray Valley collaboratively in consultation with the Department of Environment, Land, Water and Planning (DELWP) and aligns with the DELWP's Victorian Hydrogen Investment Program.