18 August 2023

Submission: National Hydrogen Strategy Review

The Australian Pipelines and Gas Association (APGA) represents the owners, operators, designers, constructors and service providers of Australia's pipeline infrastructure, connecting natural and renewable gas production to demand centres in cities and other locations across Australia. Offering a wide range of services to gas users, retailers and producers, APGA members ensure the safe and reliable delivery of 28 per cent of the end-use energy consumed in Australia and are at the forefront of Australia's renewable gas industry, helping achieve net-zero as quickly and affordably as possible.

APGA welcomes the opportunity to contribute feedback to the review of the National Hydrogen Strategy.

APGA supports a net zero emission future for Australia by 2050[1]. Renewable gases represent a real, technically viable approach to lowest-cost energy decarbonisation in Australia. As set out in Gas Vision 2050[2], APGA sees renewable gases such as hydrogen and biomethane playing a critical role in decarbonising gas use for both wholesale and retail customers. APGA is the largest industry contributor to the Future Fuels CRC[3], which has over 80 research projects dedicated to leveraging the value of Australia's gas infrastructure to deliver decarbonised energy to homes, businesses, and industry throughout Australia.

The intended focus of the new National Hydrogen Strategy is specifically on the role hydrogen technology can play for Australia to meet its emissions reduction commitments. This is best achieved by understanding both the opportunity and advantage for hydrogen in Australia:

- The opportunity of simpler conversation for the majority of fossil fuel users to hydrogen, without the necessity for more costly and complex conversion to electricity use.
- The advantage of new and existing low cost, highly flexible hydrogen pipeline infrastructure, and of ample renewable electricity sources to generate hydrogen.

These opportunities and advantages extend to the use of hydrogen in the home. Household gas use decarbonisation through renewable gases can be cost-competitive with electrification. This option should be enabled to ensure that all avenues for decarbonisation

[1] APGA, *Climate Statement*, available at: https://www.apga.org.au/apga-climate-statement
[2] APGA, 2020, *Gas Vision 2050*, https://www.apga.org.au/sites/default/files/uploaded-content/website-content/gasinnovation_04.pdf
[3] Future Fuels CRC: https://www.futurefuelscrc.com/

are made available to customers, and all potential consumers of green hydrogen produced in Australia are retained.

APGA notes the opportunity for the new National Hydrogen Strategy to be strengthened by considering its recommendations:

- Retain the opportunity for residential gas customers to have the choice to decarbonise their heating demand via hydrogen blending and eventual 100% hydrogen conversion.
- Explore policies supportive of hydrogen industry development, including a Renewable Gas Target and ensuring the Hydrogen GO Scheme is fit for purpose for domestic users.
- Design a National Code of Best Practice for Hydrogen Pipelines, separate to the Code for Hydrogen Production, to maintain the safety and integrity of the industry.

These points and more are discussed in more detail in the pages that follow.

To discuss any of the above feedback further, please contact me on +61 422 057 856 or jmccollum@apga.org.au.

Yours sincerely,

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The opportunity and advantage of green hydrogen

Understanding the opportunity and the advantage of green hydrogen to decarbonise Australian homes and business needs to be at the core of the National Hydrogen Strategy. These are two somewhat different things, however. The opportunity exists due to the simplicity and cost effectiveness of converting a current fossil gas user to hydrogen, rather than electric alternatives. The advantage, meanwhile, comes from the resulting system which can support the decarbonisation of all energy consumers.

The green hydrogen opportunity

The Australian energy sector has substantial opportunity to decarbonise through renewable hydrogen uptake. Only 20 per cent of final energy consumption in Australia is consumed as electricity, with 80 per cent being consumed via some form of molecular energy vector – be it as coal, gas or liquid fuels.[4] The green hydrogen opportunity is particularly powerful for three key energy supply vectors:

- Direct gas use – 24 per cent of total final energy consumption, 11 per cent of national emissions.
- Road freight diesel – 7 per cent of total final energy consumption, 4 per cent of national emissions.
- Gas power generation – 4 per cent of total final energy consumption, 6 per cent of national emissions.

It will always be technically simpler to change from using one form of molecular energy to another, when compared to converting direct fossil fuel consumers to electricity. It is anticipated that the simplest solution will also be the cheapest overall once the cost of both appliance and energy use are taken into account. This has been demonstrated at the household level in HyHome by AGIG – a home in suburban Melbourne demonstrating 100% hydrogen appliances.[5]

All energy consumers must be allowed access to renewable hydrogen as a valid decarbonisation option. These is no valid excuse for preventing some customers from accessing this opportunity.

By recognising the opportunity for all energy consumers to decarbonise through renewable hydrogen uptake, the market will be allowed to determine where it is an economically viable option and where it is not. The greatest threat to the green hydrogen opportunity is legislation that dictates that some energy consumers are not allowed to decarbonise through green hydrogen uptake as seen in the recent Victorian announcement banning new household energy customers from using hydrogen in the home.

APGA hopes that the National Hydrogen Strategy can overcome the politics of division relating to renewable gas use and support the right for all energy customers, including household energy customers, to access renewable hydrogen.

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[4] DCCEEW, 2022, *Australian Energy Update 2022*, https://www.energy.gov.au/publications/australian-energy-update-2022

[5] Australian Gas Infrastructure Group, 2023, *HyHome website*, https://www.australiangasnetworks.com.au/hyhome

Hydrogen's great advantage – hydrogen infrastructure

The opportunity for gas, coal and liquid fossil fuel energy customers to decarbonise through hydrogen uptake comes from the relative simplicity of substituting hydrogen in place of these fuels. The great advantage of hydrogen to decarbonise these energy customers on mass comes from lower cost and greater flexibility hydrogen pipeline infrastructure.

APGA has analysed the cost effectiveness of developing a hydrogen pipeline network capable of supplying all existing gas demand alongside road freight traversing some of Australia's major highway corridors. Hydrogen pipeline infrastructure costs were based on *Pipelines vs Powerlines: A Technoeconomic Analysis in the Australian Context* by GPA Engineering, and combined with industry expertise to determine effective hydrogen pipeline routes. Such a network is anticipated to cost substantially less than equivalent electricity infrastructure to deliver the same capacity of renewable energy transmission and storage.

Statistics for a Hydrogen Network in Australia	
Total Length	11,380 km
Total Throughput	1,380P Jpa
Total Potential Storage	1,150G Wh
CAPEX (Transport only)	$30 bn
CAPEX (+24hrs Storage)	$22 bn
CAPEX (Transport + Storage)	$52 bn
OPEX per annum	$1.5 bn
Average LCoTransport	$2.35/GJ (31c/kgH2)
Average LCoStorage	$1.29/GJd (18c/kgH2d)

Equivalent electricity transport and storage infrastructure is unable to compete with the cost effectiveness of hydrogen pipeline infrastructure. These low costs are possible due to the lower cost and greater simplicity of energy transport and storage through pipeline infrastructure. More than just cheaper for customers, this hydrogen pipeline infrastructure comes with a range of additional advantages as well – least of which being the greater social licence of installed pipeline infrastructure.

The pipeline industry looks forward to talking more about the opportunities of such a national hydrogen pipeline network in the near future.

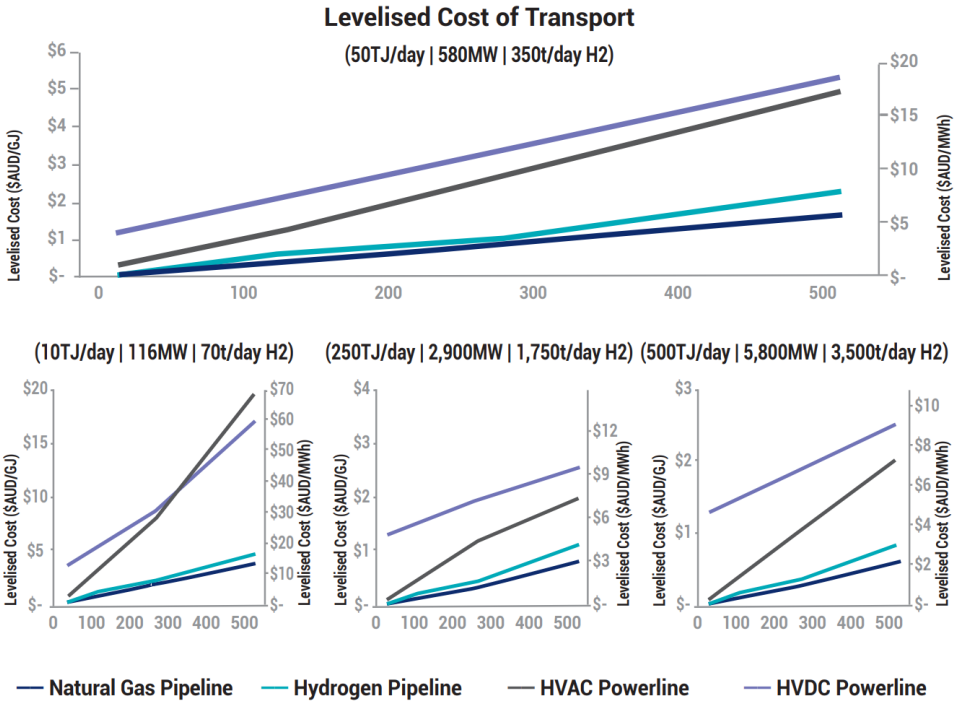
Energy transmission through pipelines is cheaper

In the *Pipelines vs Powerlines* study, GPA Engineering also considered a range of scenarios for transporting energy over a range of distances and quantities. It confirmed that transmission pipelines consistently cost less to deliver the same quantity of energy across the same distance when compared to electricity transmission powerlines. Importantly, this relationship holds true for both natural gas transmission and for hydrogen transmission.

Not only do pipelines cost less, this difference is significant and grows with distance. This is important to consider when weighing energy transport options between planned renewable energy generation zones and population centres.

An example of this relationship can be seen in Figure 1, outlining the cost of energy transport for those scenarios.

Figure 1: Levelised cost of energy transport via pipelines and powerlines



Source: GPA Engineering, 2022, *Pipelines vs Powerlines: A Technoeconomic Analysis in the Australian Context*

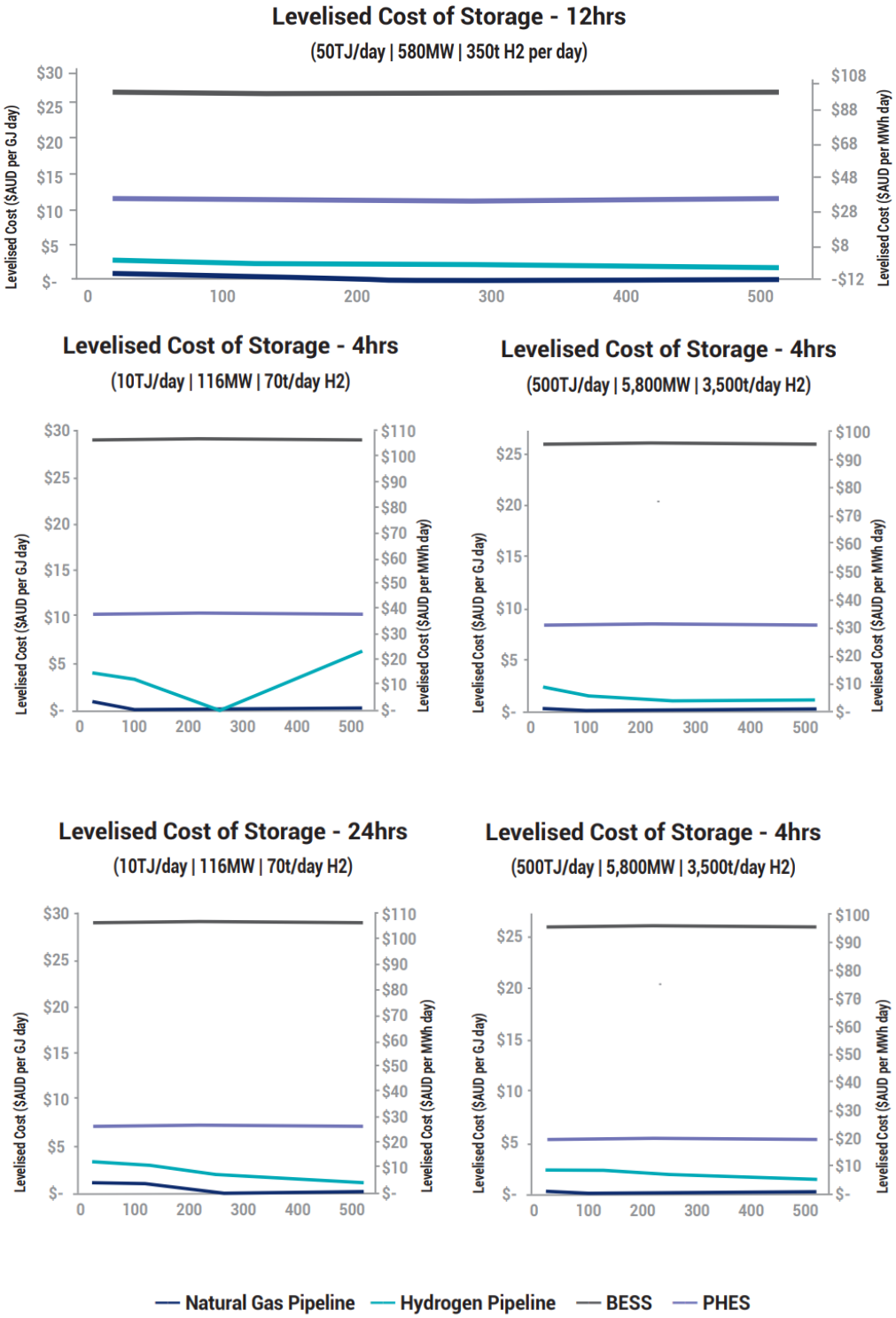
Energy storage in pipelines is cheaper

As a function of their engineering, gas transmission pipelines typically provide several hours worth of energy storage, free or at low cost. Noting this significant existing storage capacity in pipelines, GPA Engineering also considered whether this could be true in the future with hydrogen pipelines, compared to existing battery storage (BESS) and pumped hydro (PHES) options.

When considering all factors including construction cost, the *Pipelines vs Powerlines* study found that energy storage in natural gas pipelines can be hundreds of times cheaper than energy storage in BESS or PHES across a range of scenarios over 500km (Figure 2). Importantly this is still true for energy storage in hydrogen pipelines, which can be 2 to 36 times cheaper, excluding the instances in which it is essentially free.[6]

[6] GPA Engineering, 2022, *Pipelines vs Powerlines: A Technoeconomic Analysis in the Australian Context* available at https://www.apga.org.au/sites/default/files/uploaded-content/field_f_content_file/pipelines_vs_powerlines_-_a_technoeconomic_analysis_in_the_australian_context.pdf; APGA, 2022, *Pipelines vs Powerlines: A Summary*. https://www.apga.org.au/sites/default/files/uploaded-content/field_f_content_file/pipelines_vs_powerlines_-_a_summary.pdf

Figure 2: Levelised cost of energy storage via pipeline linepack, BESS and PHES



Source*:* GPA Engineering, 2022, *Pipelines vs Powerlines: A Techno*economic *Analysis in the Australian Context*

Additional benefits of hydrogen pipeline infrastructure

The additional benefits of hydrogen pipeline infrastructure make them quicker and easier to deploy than other energy transport and storage alternatives. With negligible visual, land use and safety impacts, it is unsurprising that pipeline infrastructure tends to have greater social licence in the communities through which they operate today. There is no doubt that

hydrogen pipeline infrastructure will benefit from the same relatively high levels of social acceptance as gas pipeline infrastructure today.

Beyond visual and land use amenity, pipeline infrastructure has a substantially lower loss of supply risk, alongside substantially lower bushfire risk. Energy pipelines can even continue to operate as a bushfire passes above them. These facts combine to support a more resilient renewable energy system which ensures customers are more likely to be able to access energy in times of crisis.

Pipelines are also easier to build and invest in. The contract carriage form of market under which pipeline infrastructure operates mean they are much faster and simpler to put in the ground than comparable electricity infrastructure. Pipelines can reach Final Investment Decision (FID) quickly, as a wholesale energy customer or energy retailer contract for pipeline services is all that is required to underwrite the investment. Once FID is reached, pipelines are typically quick to construct, with recent pipelines being constructed within 12 to 24-month timeframes.

Future research

The hydrogen infrastructure story doesn't stop here. Industry is undertaking considerable research to consider how future hydrogen infrastructure could contribute even more to Australia's decarbonisation journey. This includes but is not limited to research into:

- How the NEM could be firmed using dispatchable hydrogen gas power generation while avoiding the social licence issues of high voltage powerlines and constrained battery supply chains.
- How a future hydrogen supply chain could be developed to maximise hydrogen delivery to existing demand centres from production in Renewable Energy Zones.
- Per-sector decarbonisation costs considering both appliance and energy costs combined.
- Macroeconomic analysis of the Australian economy under a variety of gas use decarbonisation pathways.
- The most effective ways to reduce methane, fugitive and gas combustion emissions from the pipeline supply chain.

We look forward to informing the Department on the outcomes of this research once completed.

Preserving all opportunities for domestic hydrogen use

The 2019 National Hydrogen Strategy identified integration of hydrogen gas into existing gas networks as a key necessary driver for a domestic hydrogen industry to flourish. This remains true today, as do the conditions that make it true.

Enabling the decarbonisation of household gas use through renewable gases is just as, if not more important than pursuing this decarbonisation through electrification alone. Household decarbonisation through renewable gases can be cost competitive with wholesale electrification, both for individuals and at a community level. Preserving this option preserves consumer choice and applies competitive pressure on electricity prices.

The shift in the consultation paper away from this cost competitive gas use decarbonisation option is disappointing and will not serve the interests of existing gas customers. It will remove one of few cost competitive gas use decarbonisation options and remove an immediate source of hydrogen demand. Blending hydrogen into existing gas pipelines can immediately help solve the chicken and egg problem of hydrogen project development.

The emphasis on household hydrogen use is even more necessary today than it was at the time of the 2019 National Hydrogen Strategy. The challenges of household electrification are well documented, both in appliance cost and security of supply from an electricity grid increasingly dominated by variable renewable electricity generation. Having an additional option can only serve household customers better than preventing them from accessing hydrogen as a decarbonisation option.

Some jurisdictions have elected to prioritise electrification, but this does not change the reality that renewable gas can cost-effectively support the decarbonisation of household gas use. And while some jurisdictions, on an ideological rather than fact basis, are investigating restricting new residential gas connections this still leaves many residential gas consumers willing and able to decarbonise and maintain their existing gas connections.

Household renewable gas use will be cost-competitive with electrification

It is regularly asserted that for households and some commercial users, renewable electricity is 'cheaper' than reliance on fossil fuel energy, especially in terms of heating systems. Generally this relies on the cost effectiveness or efficiency of individual components of energy supply chains, and fails to take into account the total cost of those supply chains to the customer.

To explore this, APGA undertook the *Supply chain analysis methodology for Total Customer Cost* study[7] to examine the costs of the energy supply chains which provide heat to household consumers. This study considered all aspects upstream of the purpose for which a customer is using energy – including the cost of the appliance, the cost of the energy used, and the efficiency of the appliance using this energy, using a freestanding home in Victoria as the case study.

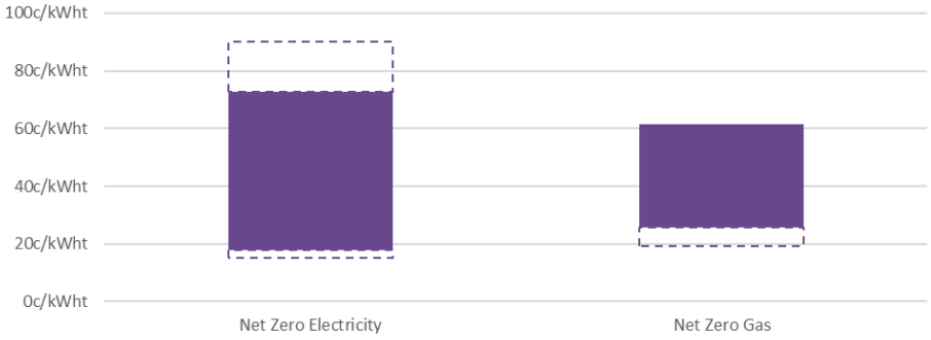
Contrary to the prevailing assertion that electrification is superior in cost to gas use decarbonisation in the home, the study found that transitioning to net zero gas will be cost competitive with electrification. This is despite electric heat pump appliances having vastly greater energy efficiency. This means that gas use decarbonisation for these customers is cost competitive whether achieved via renewable gas or renewable electricity uptake.

Figure 3 displays study results for customer cost of zero emission heat in the home for freestanding homes in Victoria which currently using gas for heat, founded upon 2020-21 financial year price data. The solid bars display the ranges of total customer cost of heat,

[7] APGA, 2022, *Supply chain analysis methodology for total customer cost*, https://www.apga.org.au/sites/default/files/uploaded-content/website-content/supply_chain_analysis_methodology_for_total_customer_cost_-_final.pdf
Study summary:
https://www.apga.org.au/sites/default/files/uploaded-content/website-content/supplychainv5.pdf

including retail energy and appliance costs in a net zero energy future, and include sensitivities (dotted bars).

Figure 3: Customer cost of heat in the home, using FY2020-21 data, for a freestanding house in Victoria.



Source: APGA, 2022, *Supply chain analysis methodology for total customer cost*

As demonstrated in Figure 3, retail net zero gas is cost-competitive with (and can be cheaper than) retail net zero electricity for heating free standing homes in Victoria which use gas appliances today.

A domestic hydrogen industry needs strong national leadership

APGA acknowledges that advocating for hydrogen use in the home is currently under debate, relative to other commercial and industrial uses. There are many competing interests in this space, and not everyone involved in the hydrogen industry is on the same page. This reflects a need for strong and decisive national leadership and a realised, evidence-based vision of the future hydrogen industry in Australia.

It is important to preserve opportunities which may lead to better decarbonisation outcomes for all Australians. This includes the opportunities and advantages of green hydrogen in all relevant uses, including in the home.

In gathering evidence, APGA advises caution when considering the existing advice on cost assumptions for hydrogen. The Grattan Institute research referred to in the consultation paper considers the cost of green hydrogen to be very high relative to both natural gas and electricity today. It achieves this by referencing cost assumptions from the CSIRO – which assumes electricity used to produce green hydrogen is sourced exclusively from the NEM.

For the avoidance of doubt, producing green hydrogen through use of NEM electricity *would* be very expensive – compared to sourcing this energy directly from renewable generators. Some jurisdictions such as South Australia are already proceeding on that basis and co-locating hydrogen electrolysers in situ with renewable energy generation.

APGA suggests commissioning a new examination of hydrogen cost assumptions that takes into account all renewable energy source scenarios.

Recommendations relating to the Draft National Hydrogen Strategy 2.0

Retain focus on household gas decarbonisation

It is critical that all avenues for decarbonisation are explored in the National Hydrogen Strategy. Renewable gases, including green hydrogen, are a viable, cost-efficient option for gas use decarbonisation, for households as well as commercial and industrial users.

APGA strongly recommends that the National Hydrogen Review revert its proposal to reconsider the role of hydrogen in residential space and water heating in the new National Hydrogen Strategy.

Explore supportive policy options for hydrogen

Renewable Gas Target

The consultation paper notes that specific hydrogen targets were not considered necessary in the 2019 National Hydrogen Strategy. Since that document was published, however other countries have introduced specific targets to boost demand.

APGA proposes that the National Hydrogen Review should consider including a National Renewable Gas Target in the new National Hydrogen Strategy. A Renewable Gas Target designed in much the same way as the Renewable Energy Target would provide significant market incentives, both for the hydrogen industry and for biomethane. While this RGT would likely need to encompass some production dedicated for export, it is important that domestic use of gas is prioritised.

This Renewable Gas Target would need to be based on a renewable gas certification scheme, similar to the Large Generation Certification scheme on a per gigajoule of zero emissions gas basis.

Product Guarantee of Origin Certificates

The hydrogen Guarantee of Origin certification scheme currently being designed by the Federal Government achieves some but not all aspects necessary to support a Renewable Gas Target. As we noted in our submission to the last round of consultation on the scheme, the current design

- seeks to prioritise export profits over needs of domestic energy customers
- prioritises renewable electricity over renewable gas
- is inconsistent with majority of hydrogen certificate designs internationally, and
- is currently incompatible with the Safeguard Mechanism Reforms, which will disincentivise investment.[8]

APGA proposes that the National Hydrogen Strategy requires a hydrogen certification scheme which is fit for purpose.

[8] APGA, 2023, *Submission: Australia's Guarantee of Origin Scheme*, https://www.apga.org.au/sites/default/files/uploaded-content/field_f_content_file/230203_apga_submission_-_guarantee_of_origin_scheme.pdf

Hydrogen reservation policies

The 2019 National Hydrogen Strategy indicated that domestic reservation policies for hydrogen may be considered at some point in the future, likely to be designed on the lines of what currently operates for natural gas in Western Australia. APGA does not have an opinion on whether a domestic gas reservation policy would support a domestic hydrogen industry, though acknowledges the option may be appealing to preclude future gas supply issues. We do observe, however, that policies that incentivise a market to produce sufficient supply renders reservation policies unnecessary.

National Code of Best Practice for Hydrogen Pipelines

As noted in the consultation paper, the Commonwealth, states and territories are presently developing a range of National Hydrogen Codes of Best Practice, including a National Code of Best Practice for Hydrogen Production. We understand that hydrogen pipelines are intended to be included in the scope of this code.

Policy settings around the codes of best practice must be done in a way that reflects industry understanding. APGA strongly advises against including hydrogen pipelines in the scope of the Code for Hydrogen Production, as it may introduce safety risks. It also does not reflect current codes of practice for the production and transportation of natural gas, which are subject to separate codes.