17 February 2023

Submission: Draft 2023 Inputs, Assumptions and Scenarios Report

Priority Feedback

- AEMO continues to endorse renewable gases including hydrogen and biomethane as being critical to the most progressive IASR scenarios.
- Despite this, the IASR fails to consider established facts about hydrogen and biomethane supply chains, undermining energy consumer access to a least cost net zero energy system.
- APGA recommends AEMO immediately consider the following established facts, or undertake its own analysis in the best interests of Australian energy consumers:
  - Least cost wholesale hydrogen production is from behind the meter VRE;
  - Least cost energy transport and storage for hydrogen is via pipelines; and
  - Available biomethane volumes in Australia are greater than assumed.
- Abundant, lower cost renewable gases delivered by lower cost infrastructure can be cheaper for customers than currently proposed under IASR assumptions.

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 to the consultation on the draft 2023 Inputs, Assumptions and Scenarios Report (IASR). APGA appreciates the importance AEMO put on renewable gases in its most progressive scenarios and flags missing assumptions which could deliver even greater outcomes for Australian energy consumers.

AEMO continues to endorse the importance of renewable gases such as hydrogen and biomethane in the 2023 IASR. This is seen in the IASR's two most progressive scenarios relying upon greater uptake of hydrogen and biomethane. AEMO acknowledges for the first time that it is possible to have unlimited hydrogen uptake by existing gas distribution networks in its 1.5°C Green Energy Exports scenario.

Unfortunately, a number of IASR renewable gas assumptions are inconsistent with technoeconomic analysis and publicly available research. These assumptions sell the Australian public short by continuing to deliver a more costly electrification outcome in IASR

scenarios. These risk lead to greater than necessary public expense on electricity infrastructure and more powerlines crossing more of Australia's pristine wilderness and prime agricultural land.

APGA strongly recommends the IASR take onboard assumptions consistent with the following facts which have been communicated to AEMO by industry:

- Behind the meter variable renewable electricity (VRE) will consistently be the lowest cost source of electricity supply for hydrogen electrolysis; and
- Pipelines provide the lowest cost energy transport and storage for hydrogen.

In section 3.12.1 AEMO notes a lack of public consensus on some of the above points. Australia's peak body on pipeline infrastructure providing transparent technoeconomic analysis on the relative costs of hydrogen pipeline transport and storage is more than an opinion within a debate[1]. APGA implores AEMO undertake its own analysis rather than setting such important facts aside due to a lack of consensus between 'experts in the field' and others less versed in the technoeconomic of gaseous energy transport and storage.

APGA supports a net zero emission future for Australia by 2050[2]. Renewable gases represent a real, technically viable approach to lowest-cost energy decarbonisation in Australia. As set out in Gas Vision 2050[3], 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[4], 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 most progressive scenario – 1.5°C Green Energy Exports

The 1.5°C Green Energy Exports scenario continues to reflect the opportunities enabled by introducing renewable gases into Australia's energy mix. While the magnitude of this advantage is hampered by assumptions discussed later in this submission, this scenario, alongside the Diverse Step Change scenario, includes strong indication of a change in understanding of what is possible with renewable gas.

For the first time, AEMO acknowledges the ability to reach 100 per cent hydrogen blending in gas networks. This opens up an entire second gas use decarbonisation pathway for households, industry, and small to medium businesses. APGA analysis shows that this renewable gas pathway to gas use decarbonisation may be cost competitive with

[1] GPA Engineering, 2021, *Pipelines vs Powerlines: a technoeconomic analysis in the Australian context*, full report: 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; summary: https://www.apga.org.au/sites/default/files/uploaded-content/field_f_content_file/pipelines_vs_powerlines_-_a_summary.pdf
[2] APGA, *Climate Statement*, available at: https://www.apga.org.au/apga-climate-statement
[3] APGA, 2020, *Gas Vision 2050*, https://www.apga.org.au/sites/default/files/uploaded-content/website-content/gasinnovation_04.pdf
[4] Future Fuels CRC: https://www.futurefuelscrc.com/

electrification for gas use in the home – analysis which APGA seeks to broaden in coming months and years.[5]

The 1.8°C Diverse Step Change scenario also introduces greater levels of biomethane blending. While a step in the right direction, this still greatly underestimates the potential for biomethane to decarbonise gas use with no change to customer appliances. In 2021, ARENA published the *Australian Bioenergy Roadmap*, which identifies substantially greater volumes of biomethane (up to 500PJpa)[6] where AEMO's 7.5 per cent limit only considers in the order of 75PJpa.

Despite these positive steps towards endorsing renewable gases, the high rates of electrification in the 1.5°C Green Energy Export and 1.8°C Diverse Step Change scenarios are indicative of the risk of not adequately considering adjacent assumptions in IASR modelling. Artificially high electricity for electrification costs and the absence of hydrogen pipelines for energy transport and storage undermine the ability to consider the true cost of renewable gases within AEMO modelling.

APGA hopes to see AEMO continue to move towards providing ever greater endorsement for renewable gas helping to deliver lower cost whole-of-energy-system decarbonisation for Australian energy consumers. One way this could be achieved is through serious consideration of aligning assumptions behind the facts in the next IASR.

Least cost wholesale hydrogen production is from behind the meter VRE

However, AEMO assumes electricity used in electrolysis is delivered via electricity infrastructure.

The lowest cost green hydrogen production will come from the lowest cost electricity. The most consistent source of low cost electricity is wind and solar PV. Importantly, substantial cost is added to this least cost generation as soon as it enters electricity transmission systems. This is why CSIRO projects energy prices to rise with successively higher VRE penetration.[7]

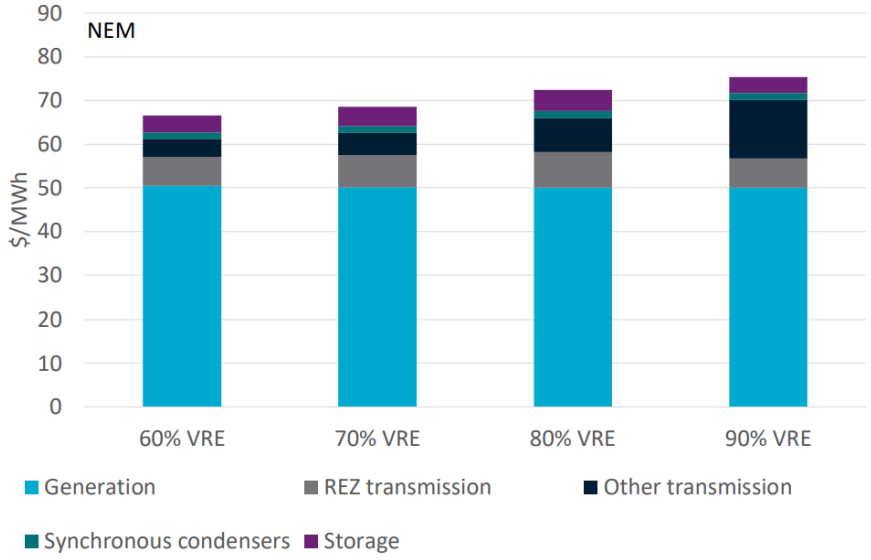
Feeding behind the meter wind and solar directly into electrolysis can consistently avoid these additional costs delivering a lower cost of hydrogen production. This is the pathway being pursued by the majority of hydrogen export projects, in part due to the lower production cost, and in part due to the lower cost of energy transport and storage via hydrogen pipeline (discussed in the next section). One study from the Australian National

[5] APGA, 2022, Supply chain analysis methodology for Total Customer Cost, full report: https://www.apga.org.au/sites/default/files/uploaded-content/website-content/supply_chain_analysis_methodology_for_total_customer_cost_-_final_1.pdf; summary: https://www.apga.org.au/sites/default/files/uploaded-content/website-content/supplychainv5.pdf
[6] ARENA, 2021, *Australian Bioenergy Roadmap*, https://arena.gov.au/assets/2021/11/australia-bioenergy-roadmap-report.pdf
[7] CSIRO, 2022, GenCost 2021-22 Final Report, https://publications.csiro.au/publications/publication/PIcsiro:EP2022-2576

University projects hydrogen production may reach as low as $1.89AUD by 2030 when behind the meter VRE is considered.[8]

Testament to this fact is Figure 5-2 from CSIRO's 2021-22 GenCost report (also replicated within the Draft 2022-23 GenCost report). This demonstrates the relative cost of VRE generation as a proportion of net zero electricity cost in the NEM. In data for a 90 per cent VRE NEM these additional costs amount to an additional 50 per cent of VRE generation cost (Fig. 1). Given the choice, green hydrogen producers will be able to produce lower cost hydrogen from the VRE alone compared to hydrogen produced from the same VRE delivered via electricity transmission infrastructure.

Figure 1. Levelised costs of achieving 60%, 70%, 80% and 90% annual variable renewable energy shares in NEM in 2030



Source: CSIRO, 2022, *GenCost 2021-22 Final Report*, Figure 5-2, p. 56[9]

The exception to this fact is electrolysis from electricity sourced from excess generation soak. Locating electrolysers at key nodes within the NEM and electricity distribution networks which experience excess VRE generation can provide access to market electricity prices lower than that of behind the meter VRE. However, access to this low cost electricity is inconsistent at best, and risks exposure to high NEM prices at worst. Considering excess generation soak alone would artificially constrain volumes of low-cost hydrogen production. While volumes of excess generation are large from the perspective of electricity systems, they represent a relatively small hydrogen production opportunity compared to the potential

[8] Longden T, Jotzo F, Prasad M, Andrews R, 2020, *Green hydrogen production costs in Australia: implications of renewable energy and electrolyser costs*, Centre for Climate Change and Policy Working Paper 20-07, https://ccep.crawford.anu.edu.au/sites/default/files/publication/ccep_crawford_anu_edu_au/2020-09/ccep20-07_longden-jotzo-prasad-andrews_h2_costs.pdf

[9] CSIRO, 2022, *GenCost 2021-22 Final Report*.

size of the domestic hydrogen customer base (i.e. the 994PJ of domestic energy consumed as gas today).[10]

If the IASR does not consider this lower hydrogen production cost alternative within its modelling, the relative cost of alternatives will appear less in comparison. Similarly, if available biomethane volumes are artificially capped, alternatives will appear more achievable in comparison as well. The link between high price and low quantity assumptions can be logically linked to artificially high electrification within AEMO's scenarios, implying greater investment in costlier electricity infrastructure is required.

The explanation that AEMO provides for assuming that electrolysis will take place at the consumer is: "*at this stage AEMO is not proposing to increase the complexity of the model's derivation to incorporate the alternative configuration*." This fails the customer in not considering more cost-effective hydrogen production alternatives. Despite the added complexity, not considering this in the IASR builds in greater customer cost and is out of step with developing national and international practice.

Least cost energy transport and storage for hydrogen is via pipeline

However, AEMO assumes all energy transport and storage via powerlines and forms of electricity storage.

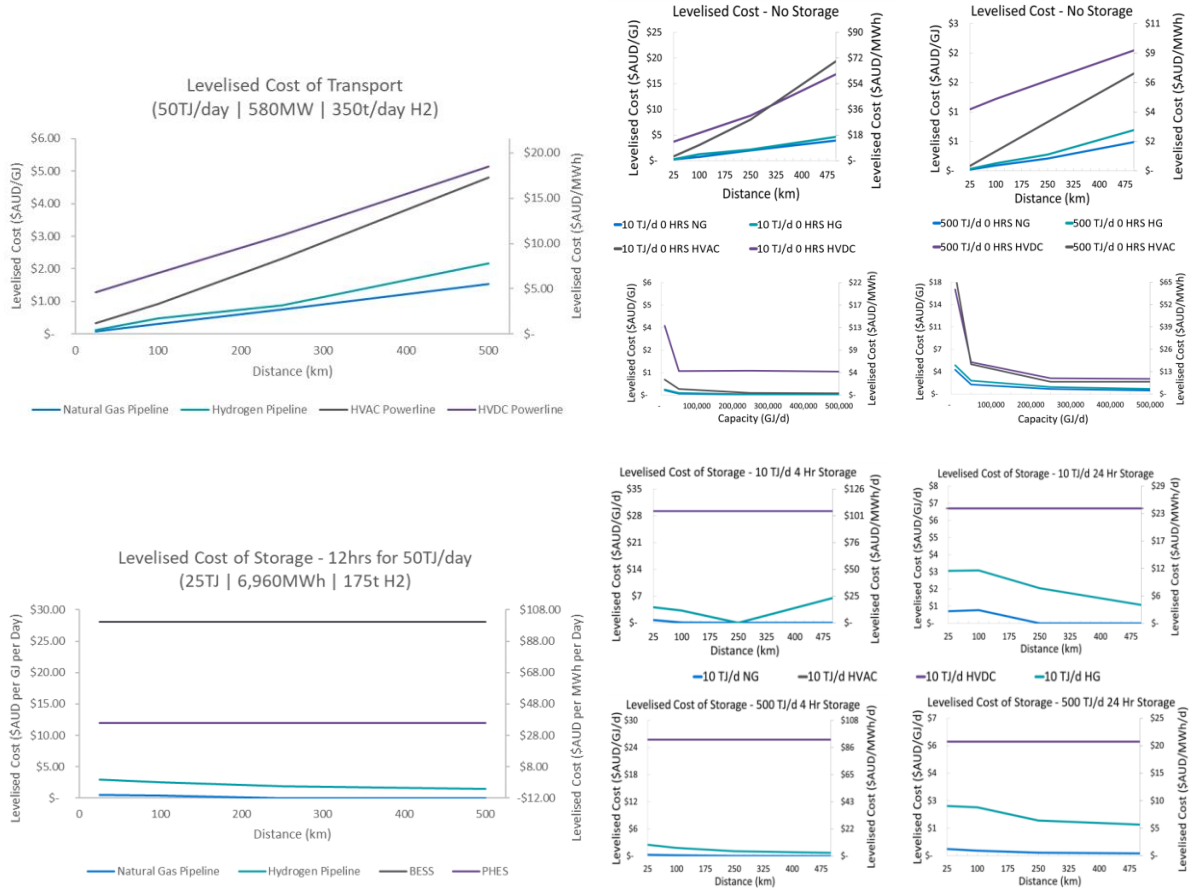
Like-for-like technoeconomic analysis from GPA Engineering has demonstrated that energy transport and storage via pipeline is lower cost than HVAC or HVDC powerlines, and other forms of electricity storage, across a case map of 256 scenarios.[11] AEMO have been provided this modelling by the pipeline industry, which indicates that consideration of hydrogen pipeline transport and storage could have a material cost reduction impact upon Australian energy customers. However, the only reference to this in the IASR is in Section 3.12.1 which notes a *lack of consensus* on the topic.

The lower cost of energy transport and storage via hydrogen pipeline is not conjecture. Rather, this is the conclusion of engineering and economic analysis delivered by one of Australia's foremost expert engineering firms in hydrogen infrastructure – and others alongside them (Fig. 2). The report scrupulously details its modelling assumptions and outcomes in its appendices.

[10] DCCEEW, 2022, *Australian Energy Update 2022*, Table 9, https://www.energy.gov.au/sites/default/files/Australian%20Energy%20Statistics%202022%20Energy%20Update%20Report.pdf

[11] GPA Engineering, 2022, *Pipelines vs Powerlines: a technoeconomic analysis in the Australian context*, dataset: https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fwww.apga.org.au%2Fsites%2Fdefault%2Ffiles%2Fuploaded-content%2Ffield_f_content_file%2Fappendix_3a_and_3b_results_summary.xlsx&wdOrigin=BROWSELINK

Figure. 2: Levelised cost of energy transport – pipelines vs powerlines



Source: GPA Engineering, 2022, *Pipelines vs Powerlines*[12]

The value of low cost hydrogen storage in particular is recognised by Federal Minister for Climate Change and Energy, the Hon Chris Bowen MP. Discussing energy storage in a 14 February 2023 interview with ABC Adelaide, Minster Bowen noted:

"Batteries are great for the short term - few hours, but hydrogen holds a lot of potential to store it for a lot longer than that."

Currently, gas infrastructure transports more energy than electricity infrastructure, and provides around 2.3TWh of energy storage capacity – equivalent to 4.5 days of NEM energy demand.[12] By comparison, the Snowy Hydro 2.0 project will contribute a maximum of 0.35TWh. GPA Engineering's research found that energy storage in hydrogen pipelines would cost up to 37 times less than battery energy storage systems and up to 10 times less than pumped hydro energy storage. This is in addition to the 65TWh worth of underground gas storage available today.

Importantly, AEMO has always had the option of undertaking this analysis themselves. Even provided all necessary information via the GPA Engineering report, AEMO has again decided to not consider this alternative.

[12] GPA Engineering, 2022, *Pipelines vs Powerlines: a technoeconomic analysis in the Australian context*.

It is beholden upon AEMO to do the work necessary to understand infrastructure alternatives where there is a genuine indication that it could have a material impact on customer cost. AEMO has done so for renewable electricity, batteries, and Distributed Energy Resources. Now is the time for AEMO to do the work on energy transport and storage via hydrogen pipelines.

To discuss any of the above feedback further, please contact APGA National Policy Manager, Jordan McCollum, on +61 422 057 856 or jmccollum@apga.org.au.

Yours Sincerely,

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