Too much happy gas?

Submission to Jemena Gas licence for hydrogen blending

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About the Public Interest Advocacy Centre

The Public Interest Advocacy Centre (PIAC) is an independent, non-profit legal centre based in Sydney.

Established in 1982, PIAC tackles barriers to justice and fairness experienced by people who are vulnerable or facing disadvantage. We ensure basic rights are enjoyed across the community through legal assistance and strategic litigation, public policy development, communication and training.

Energy and Water Consumers' Advocacy Program

The Energy and Water Consumers' Advocacy Program (EWCAP) represents the interests of low-income and other residential consumers of electricity, gas and water in New South Wales. The program develops policy and advocates in the interests of low-income and other residential consumers in the NSW energy and water markets. PIAC receives input from a community-based reference group whose members include:

- NSW Council of Social Service;
- Combined Pensioners and Superannuants Association of NSW;
- Ethnic Communities Council NSW;
- Salvation Army;
- Physical Disability Council NSW;
- St Vincent de Paul NSW;
- Good Shepherd Microfinance;
- Affiliated Residential Park Residents Association NSW;
- Tenants Union;
- Solar Citizens; and
- The Sydney Alliance.

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The Public Interest Advocacy Centre office is located on the land of the Gadigal of the Eora Nation.

The role of hydrogen

As a potential carrier of low- or zero carbon energy, hydrogen is likely to fill niche roles in transport and export markets. However, the idea hydrogen in gas networks could become economically or technically viable is predicated on unrealistic assumptions about cost improvements in hydrogen production, reticulation and storage.

In the unlikely event of breakthroughs in all those areas, there remains little merit in blending hydrogen into the natural gas network, and no merit for consumers.

Recent analysis by E3G found that, due to a range of production factors “sustainable hydrogen will only be available in limited quantities” and it should be targeted for use as a “decarbonisation option in processes for which electrification and other solutions such as material and energy efficiency improvements are not available.” Blending hydrogen into existing natural gas networks “runs counter to an efficient allocation of scarce hydrogen resources.”[1]

Proposed hydrogen blending is an understandable but problematic attempt by gas networks to maintain their relevance in the face of electrification and decarbonisation. It is not in the interests of consumers and PIAC is opposed to consumers being required to pay for or bear the risk for such projects.

Hydrogen blending in networks is never likely to be cost-effective or sustainable

The plan to transition to hydrogen that underly Jemena’s Western Sydney Green Gas Project proposal are divorced from the intent of providing more affordable or sustainable energy. Plans and analyses that support blending hydrogen in the gas network externalise or ignore many significant costs involved in converting to a pure hydrogen or even blended supply.

Even the International Energy Agency’s (IEA) very optimistic appraisal of hydrogen uptake acknowledges the significant and perhaps insurmountable barriers to its cost effective use in gas networks.[2] While the cost of electricity to create hydrogen may come down with high penetrations of zero-fuel cost generation, the cost of electricity is only one of many factors in determining the total cost to create, transport and ultimately use hydrogen as a fuel.

In particular PIAC highlights that:

- The intermittency of renewable generation means that any hydrogen converter powered by it may have low utilisation or require fossil fuel generation back up. Low utilisation negates any purported cost efficiencies, and using fossil fuels defeats the purpose of using hydrogen for emissions reduction. These problems are further exacerbated if the hydrogen converter is relying, in whole or part, on ‘surplus’ renewable generation.

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1 E3G, *Hydrogen Factsheet: Blending*, April 2021. https://www.e3g.org/publications/hydrogen-factsheet-series/

2 International Energy Agency (IEA), *The Future of Hydrogen*, June 2019.

- The process and equipment needed for conversion from electricity to hydrogen remains prohibitively expensive despite decades of development.

- The energy density of hydrogen is significantly less than that of natural gas. As the IEA notes it is "around a third of that of natural gas and so a blend reduces the energy content of the delivered gas: a 3% hydrogen blend in a natural gas transmission pipeline would reduce the energy that the pipeline transports by around 2% (Haeseldonckx and D'haeseleer, 2007). End users would need to use greater gas volumes to meet a given energy need. Similarly, industrial sectors that rely on the carbon contained in natural gas (e.g. for treating metal) would have to use greater volumes of gas."[3]

- The distribution, transportation and storage of hydrogen (including any conversion upgrade, replacement or brand-new builds required to insert hydrogen into the gas network) all add costs.

- End-use appliance (such as burners) may require conversion, upgrade or replacement. Even though many end use appliances may be rated for up to 13% hydrogen blend, this rating is for a momentary mixture of hydrogen and natural gas rather than for continuous hydrogen blended fuel.

- As the IEA also notes, while appliances may be certified to these levels, "the effects of such levels over many years of use are still unclear."[4]

- In addition to converting end-use appliances noted above, it may also be necessary to replace or convert related systems such as exhaust systems (to handle the water vapour formed through hydrogen combustion to avoid rusting or condensation build up) and sensors for safety. For instance "hydrogen burns much faster than methane. This increases the risk of flames spreading. A hydrogen flame is also not very bright when burning. New flame detectors would probably be needed for high-blending ratios."

- The costs of any necessary end-use conversions, upgrades or replacements are omitted from cost-benefit analyses that support blending hydrogen into gas networks.

- Establishing a safe blend limit is not straightforward as "the upper limit for hydrogen blending in the grid depends on the equipment connected to it, and this would need to be evaluated on a case-by-case basis. The component with the lowest tolerance will define the tolerance of the overall network."[5]

- "The biggest constraint is likely to be in the industrial sector, where many industrial applications have not been certified or assessed in detail for hydrogen blending. For example, chemical producers using natural gas as a feedstock may need to adjust processes and contracts with natural gas suppliers that stipulate a narrow specification of gas content. The control systems and seals of existing gas turbines are not designed for the properties of hydrogen and can tolerate less than 5% blended hydrogen (ECS, 2015). A similar issue

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3 IEA, 71.
4 IEA, 71.
5 IEA, 71.

> arises for many installed gas engines, where the recommended maximum level of blended hydrogen is 2%."[6]

These factors are covered in more detail by PIAC in a presention and panel discussion hosted by the Grattan Institute available here: https://grattan.edu.au/podcast/hydrogen-coming-to-a-stovetop-near-you-sydney/ starting at 37:30.[7]

Hydrogen blending can exacerbate cost pressures on consumers

For a range of reasons, the long term viability of gas networks for providing energy is already in doubt and the costs and risks inherent in blending hydrogen into gas networks will only exacerbate these.

Analysis from the Grattan Institute found households would save money and Australia would reduce emissions if new houses in NSW, Queensland, South Australia, and the ACT were all-electric.[8]

Analysis by Renew (formerly Alternative Technology Association) also found that new homes and existing electric-only homes would likely be locking themselves into higher energy costs over the longer term by connecting to the gas network. The analysis also found, it significantly more cost effective to replace gas heaters with multiple reverse cycle air conditioners for space heating and that switching all gas appliances to efficient electric and disconnecting from the gas network offers better economic returns in warmer climates including many parts of NSW.[9]

As fewer households use gas from the network, the remaining costs will have to be recovered from a smaller pool of customers – leading to rising costs per customer. This would be exacerbated by any new network investments required as, given the nature of regulated infrastructure investments, any new assets are incorporated into a business' Regulated Asset Base (RAB) and have significant, long-term impacts on consumer prices.[10]

This is especially important as many of the households who may find it difficult to transition away from network supplied gas may also be more at risk of facing affordability challenges. Due to the upfront cost involved in converting or replacing household appliances from gas to electricity, vulnerable households or those facing disadvantage may be unable to fuel switch and may be forced to remain on gas supply. Similarly, renters may also be unable to switch due to the need for landlords, rather than the tenants themselves, to switch some or all gas appliances to electricity.

6 IEA, 71-72.

7 Grattan Institute, *Hydrogen: coming to a stovetop near you?*, public panel discussion held 2 July 2019. Audio recording available here: https://grattan.edu.au/podcast/hydrogen-coming-to-a-stovetop-near-you-sydney/ PIAC presentation begins at 37:30

8 Grattan Institute, *Flame out The future of natural gas*, November 2020, 3. https://grattan.edu.au/wp-content/uploads/2020/11/Flame-out-Grattan-report.pdf

9 Renew (formerly Alternative Technology Association), *Are we still cooking with gas?*, November 2014. https://renew.org.au/wp-content/projects/CAP_Gas_Research_Final_Report_251114_v2.0.pdf

10 The positive impact to affordability from lowering the RAB can be even stronger as regulated rates of return are expected to rise in the future from their current low levels.

Hydrogen blending can delay decarbonisation

All jurisdictional governments in Australia have committed to net-zero by 2050 or earlier, and the federal government is under pressure to do so too. Australia is a signatory to the Paris Agreement, which aims to keep global warming to 1.5 degrees.[11] Numerous bodies have warned radical cuts to emissions will be required by 2030 to avoid crossing the 2 degree threshold (let alone 1.5 degrees) by 2100. Gas would need to be phased-out soon for Australia to meet international obligations and ensure a safe climate for generations to come.

The ACT Government has committed to phase out fossil-fuel-gas in the ACT by 2045 at the latest, and set a goal of no new gas mains infrastructure to new developments by 2023. While the ACT is the only jurisdictional government to make this kind of commitment, the many benefits of electrification make it likely other governments will follow suit. These benefits include:

- Overall cost savings from avoiding appliance fuel and capital cost as well as the cost of gas network connections
- Higher appliance efficiency
- Improved health and safety
- Ability to participate in electricity services and markets
- Easier and more cost-effective decarbonisation.

As noted previously, hydrogen blending in networks is likely to remain prohibitively expensive. Pursuing it will divert resources from already cost-effective options to decarbonise stationary energy, impeding the optimisation of overall energy use and slowing emissions reduction.

Jemena's application and the Western Sydney Green Gas Project

Costs to consumers

PIAC will not support Jemena's licence application if granting it will introduce any new direct or indirect costs to consumers either immediately or in the future. These costs may include:

- the need for new, regulated network investment to inject, monitor or manage the hydrogen content in the gas network,
- the need for changes to consumer appliances to safely operate with or manage the presence of hydrogen in the fuel supply,
- possible shortening of assets lives of consumer appliances due to higher operating pressure and/or embrittlement of hydrogen in the system,
- the cost of increased leakage associated with more hydrogen, or
- the fuel costs for consumers due to the higher cost to produce and inject hydrogen and the lower energy content of natural gas blended with hydrogen.

11 The Paris Agreement, https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement

PIAC recommends the use of a beneficiary-pays framework for recovering costs and allocating risks such that those who benefit from a given investment should also pay for that investment. Where it is not practical and transparent to identify the beneficiaries, a causer-pays principle should be used. Cross-subsidies should only be permitted where they are accepted by informed consumer feedback or immaterially small.

It is network businesses who would benefit from the use of hygrogen, not consumers, through increased use of their network as well as the potential for new investment or expansion of the existing network. As noted by E3G:

> today's gas consumers, especially households, are unlikely to be tomorrow's hydrogen consumers, and should therefore not have to pay for the development of the hydrogen infrastructure. If hydrogen use is focused on demand centres, such as industrial facilities, costs can be clearly allocated to beneficiaries. This becomes practically impossible if hydrogen is blended into the existing grid, reaching a very fragmented set of existing consumers.[12]

PIAC considers it unacceptable that gas consumers bear any of the costs and risks of hydrogen blending. In keeping with the beneficiary-pays principle, it is more appropriate that costs – including any costs within customers' homes – are fully borne by the shareholders of network businesses themselves.

Hydrogen levels

PIAC notes the project proposes to introduce up to 2% by volume of hydrogen into the existing gas supply which will remain within the limits defined in the Australian Standards and have no or minimal impact on consumers' gas appliances.

The permissible level of hydrogen blending will also affect the energy density of the fuel supplied to customers – hydrogen has a three times lower energy density than natural gas.[13] As a result, consumers will have to consumer a slightly higher volume of the blended gas supply and pay more as a result under the volume-based gas billing.

Even though many end use appliances may be rated for up to 13% hydrogen blend, this rating is for a momentary mixture of hydrogen and natural gas rather than for continuous hydrogen blended fuel. As the IEA also notes, while appliances may be certified to these levels, "the effects of such levels over many years of use are still unclear."[14] The pipes, fittings, burners, valves and pressure settings of consumer appliances and premises may need to be adjusted to accommodate the different physical characteristics of hydrogen blended in the gas supply.

It is important the trial does not impose costs on consumers from accelerated degradation of their gas appliances as a result of the hydrogen content. As E3G note, "many industrial end users of natural gas rely on a high and constant gas quality for their processes. A blending of hydrogen into the existing gas grid would therefore pose a risk to their operations."[15]

12 E3G
13 E3G
14 IEA, 71.
15 E3G

Investment in gas innovation

While there is merit in allowing investment in innovative gas technologies, these should only be funded by consumers if they are:

- relatively low risk
- related to core network technologies, and
- not related to contestable service provision such as fuel supply.

Projects improving leak detection, communications and metering, real-time asset monitoring or trialling new materials and joinery are some examples of innovative projects that may be in consumers' interests to help fund.

In contrast, hydrogen blending does not meet these criteria and should instead be funded, if at all, through other means including dedicated research funding or by the business' shareholders directly.