2025 consultation

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NSW Net Zero Commission

Submitted via email:
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Re: Net Zero Commission: 2025 Consultation

Dear Commission,

Jemena welcomes the opportunity to respond to the NSW Net Zero Commission's 2025 Consultation.

Jemena owns and operates a diverse portfolio of energy assets throughout the northern and east coasts of Australia. With more than $12 billion of major gas and electricity infrastructure, we deliver energy to millions of households, institutions, and industries every day. Our assets include the Jemena Gas Network in New South Wales, the Jemena Electricity Network in northwest Melbourne and gas transmission lines such as the Eastern Gas Pipeline, Queensland Gas Pipeline and Northern Gas Pipeline.

As an integrated energy infrastructure and services company which owns, operates, designs, constructs and maintains both gas and electricity assets, we understand the scale and complexity of the energy transition. We are focused on playing our part in reducing greenhouse gas emissions within our networks. We have committed to an interim target of reducing our Scope 1 and 2 emissions by 30 per cent by 2030 (from 2021-22 baseline), and the goal of net-zero by 2050.

With over 1.5 million residential and business gas customers in Greater Sydney and regional NSW, Jemena plays a central role in maintaining energy reliability while enabling emissions reductions for our customers. This will in turn support the State's emissions reduction and manufacturing targets.

On the NSW Jemena Gas Network, large industrial and commercial customers purchase ~68 per cent of the gas we transport. Of these customers, 70 per cent include some of the hardest to electrify and will require some form of gaseous energy for their operations over the foreseeable future. However, these customers constitute ~2 per cent of connections, illustrating the risk to the network's viability from accelerating the removal of the other 98 per cent of connections.

This customer makeup is unique in the Australian context, and will require considered collaboration between Jemena, industry and the government throughout the transition. Doing so will support the economic viability of NSW business and industry, while securing reliable and affordable energy for vulnerable consumers as the State transitions.

Key messages

- A whole-of-system approach must be taken by the Commission when designing its decarbonisation strategy. This will support a more secure, cost-effective, and efficient transition for all.
- Natural gas use in some sectors will be required to increase in order to reduce emissions (e.g. coal-to-gas switching for steel production and gas-fired power generation). Existing gas infrastructure including distribution networks will be an important enabler of this emission reduction opportunity. Furthermore, renewable gases (biomethane and renewable hydrogen) can replace natural gas in many other sectors as carbon-neutral alternatives and must be supported by policy makers to fast-track emissions reductions. They offer a decarbonisation pathway for hard to electrify gas users, bolster energy reliability and can multiply emissions reductions across sectors.
- Supporting biomethane production can help unlock emission reduction pathways for the agriculture, industrial, waste and built-environment sectors. Jemena encourages the Commission to consider these cross-sectoral benefits, and how the network can help enable multiple pathways through circular economy principles to reduce near-term emissions.

For more information regarding Jemena's submission or to arrange a discussion please contact Emma Browning, Senior Policy and Government Relations Adviser via the following email [redacted]

Yours sincerely,

[redacted]

Executive General Manager Networks

Questions

General

2. What actions can the commission take to engage across the community to help drive the shifts needed for the net zero transition and for effective climate change mitigation and adaptation?

Jemena recommends the NSW Net Zero Commission consider biomethane's role as a cross-sectoral emissions reduction enabler and encourages the Commission to telegraph these benefits to the wider community. Jemena believes that biomethane represents an important opportunity to lower our domestic emissions, however, the lack of understanding around biomethane in Australia is a significant barrier to the development of a successful market. This limits the effective and immediate emission reduction pathway for industry and other hard-to-abate users who require a gaseous molecule.

Jemena recommends the Commission:

1. Distil the latest information from market bodies on biomethane supply, costs, and environmental benefits in Australia;
2. Acknowledge the potential of biomethane for cross-sectoral emissions reductions in its 2025 report; and
3. Recommend the government undertake a public awareness campaign for regional feedstock producers, and other members of the supply chain.

Misconceptions About Supply Potential, Feasibility and Cost

Biomethane production is often perceived as low-volume, expensive and complex compared to other renewable energy sources. This misperception is deterring investment and inhibiting action from policy makers; delaying immediate emissions reductions across NSW, and Australia.

Recent studies have illustrated the enormous supply potential of biomethane in Australia, and NSW. For example, the Australian Energy Market Operator (AEMO) commissioned ACIL Allen to provide it with biomethane prices and supply figures for its 2026 Integrated System Plan. As seen in Table 1, ACIL Allen and AEMO are forecasting significant availability of feedstock for biomethane across the State. To provide context, Jemena's NSW gas network currently delivers ~90 PJ of gas per annum. This highlights the enormous untapped potential of biomethane in NSW alone, and should provide confidence to policymakers looking to support the sector.

Table 1: New South Wales Biomethane Supply Potential (source: ACIL Allen[1])

	Petajoules (PJ)			
Scenario	Landfill gas	Waste	Crop residues	Total
Progressive Change	5.4	9.8	33.1	**48.2**
Step Change	5.4	17.1	45.1	**67.6**
Green Energy Exports	5.4	22.0	55.1	**82.5**

[1] Gas, liquid fuel, coal and renewable gas projections, Final Report, 22 February 2025, ACIL Allen. Retrieved from: https://aemo.com.au/-/media/files/major-publications/isp/2025/acil-allen-2024-fuel-price-forecast-report.pdf

The cost competitiveness of biomethane is another issue regularly raised by parts of the community when discussing the efficacy of the renewable gas. Like many commodities, biomethane feedstock costs generally follow a sliding scale as the difficulty of extraction increases. In some cases however, it can be significantly competitive. In the Australian Renewable Energy Agency (ARENA) Bioenergy Roadmap, the organisation identified biomethane generated from landfill gas had a lower levelised cost of energy (LOCE) than wind and solar.

Jemena encourages the NSW Net Zero Commission to explore the following reports to appreciate the cost-competitiveness and supply potential of biomethane and how it can play a constructive role in supporting the State's emissions reduction targets.

- ACIL Allen (prepared for AEMO) – Gas, liquid fuel, coal and renewable gas projections[2]
- ARENA – Australia's Bioenergy Roadmap.
- Boston Consulting Group – The Role of Gas Infrastructure in Australia's Energy Transition[3]
- Future Fuels CRC - A summary of the FFCRC RP1.2-04 Viable Case Studies Report[4]
- Guidehouse (prepared for the European Bioenergy Association) - Beyond energy: monetising biomethane's whole-system benefits[5]

Limited Public Awareness

Jemena recommends that the Net Zero Commission recommends the development an education campaign about the emissions benefits that can be realised from biomethane and renewable gases.

Many sectors of the economy are not familiar with biomethane as a renewable energy source and the emissions abatement potential for their own sector. There is often confusion between biogas, biomethane, and other forms of renewable energy. This lack of awareness hinders public support and adoption across the supply chain and in other sectors. Even within the energy sector, there can be limited understanding of how biomethane can be integrated into existing energy systems, leading to missed opportunities for investment and development.

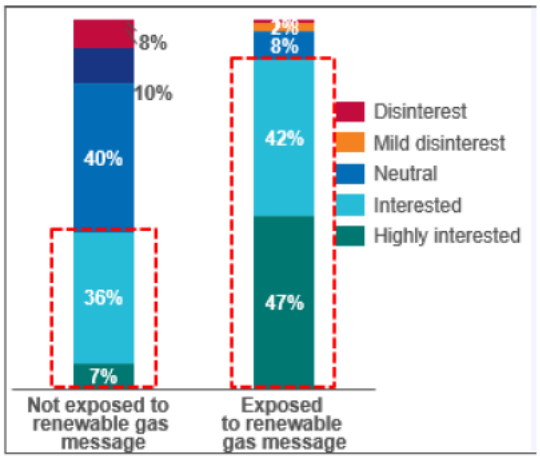

Figure 1 - Customer awareness vs. interest of renewable gas (Source: Jemena)

Jemena customer consultation has shown that when customers become aware that there is a renewable gas pathway, they become more interested in pursuing this as a decarbonisation

[2] ACIL Allen. (2025, Feb). *Gas, liquid fuel, coal and renewable gas projections. Final report.* Australian Energy Market Operator (AEMO). Retrieved from https://aemo.com.au/-/media/files/major-publications/isp/2025/acil-allen-2024-fuel-price-forecast-report.pdf?la=en

[3] Boston Consulting Group (2023, June), The role of gas infrastructure in the Australia's energy transition, Retrieved from https://www.jemena.com.au/siteassets/asset-folder/documents/gas/the-role-of-gas-infrastrcuture-in-australia-s-energy-transition.pdf

[4] Culley S.A., Zecchin A.C., Maier H.R.. (2022, June). *Where are the most viable locations for bioenergy hubs across Australia?.* Future Fuels CRC, Retrieved from https://www.futurefuelscrc.com/wp-content/uploads/RP1.2-04-BiomethaneViability_summary.pdf

[5] Guidehouse, (2023, Feb), *Beyond energy: monetising biomethane's whole-system benefits* retrieved from 20230213_Guidehouse_EBA_Report.pdf

pathway for their gas use, as shown in *Figure 1 - Customer awareness vs. interest of renewable gas.*

Education of feedstock owners

Biomethane is currently an emerging industry in Australia. As a result, educational material highlighting the benefits of renewable gas production for feedstock owners - such as additional revenue streams; waste management; and environmental advantages – are not yet widely available.

Boosting renewable gas production and use in industry will require research and knowledge sharing across the sector. **Jemena supports the NSW Net Zero Commission in working to bolster the skills and knowledge in this space and welcomes the opportunity to further engage utilising the lessons learnt from our Malabar biomethane production facilities.**

Electricity and Energy

6. The speed of deployment of electricity generation and infrastructure is a key risk to emissions reduction targets. What more could be done to fast-track deployment?

Jemena supports government efforts to accelerate the deployment of electricity generation and infrastructure to replace coal-fired power. This presents challenges when policy makers take a technology-prescriptive approach to decarbonising end-users while failing to consider the energy system as a whole.

In addition, the small, yet important role of gas-fired power generation in a system dominated by renewables needs to be fully appreciated by policymakers and the market. As it currently sits, the market settings are not appropriate to spur private investment in the GPG required to hit government renewable targets or AEMO's ISP. Appropriately valuing the system security services and long-duration value of GPG will enable faster decommissioning of coal, and greater shares of renewable energy across the grid.

Jemena recommends the Commission considers the importance of taking a whole-of-energy-system approach to its decarbonisation strategy, and focus on pathways to decarbonise fuels across the system. Articulating a strong ambition for renewable gases role, in particular biomethane, will have a positive impact on investment and accelerate emissions reductions.

In 2022, electricity and energy contributed 44.0 Mt CO_2-e or 40 per cent of NSW net emissions. As noted in the Net Zero Commission's 2024 Annual Report[6], "98.4 per cent of the sector's 44 Mt CO2-e of emissions in 2022 came from electricity generation, of which 96 per cent was from coal combustion."

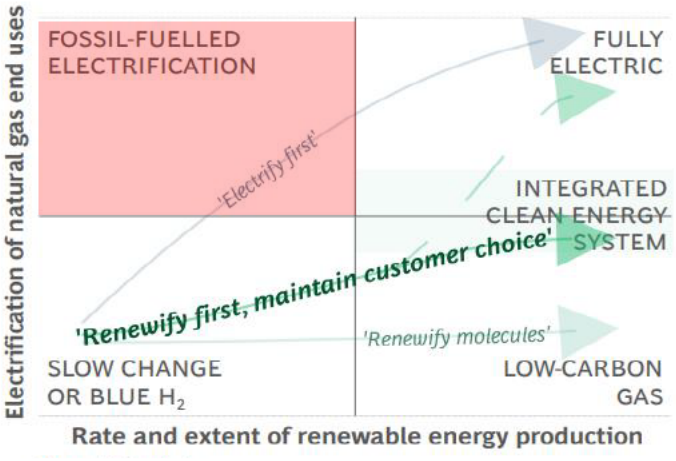

Figure 2 - Rate of renewable deployment and extent of electrification will determine the role of gas and gas infrastructure in the energy transition (source: BCG)

Removing coal from the NSW grid is crucial to reducing emissions and achieving the State's near-term climate targets. By 2030, ~6GW of coal-fired capacity is expected to be retired. This represents ~45% of today's dispatchable capacity in the State. From this period onwards, AEMO's Step Change forecasts GPG to almost double in capacity in NSW; signalling the important role it will play in a post-coal grid.

Figure 2Research by BCG**Error! Bookmark not defined.** indicates that, from a comprehensive energy system perspective, emissions can be reduced more quickly and cost-effectively if limited renewable electricity resources are used to replace the most emission-intensive energy sources, such as coal and liquid fuels, before replacing gas end-uses.

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[6] Net Zero Commission. (2024, November). *2024 Annual Report.* Retrieved from https://www.netzerocommission.nsw.gov.au/2024-annual-report

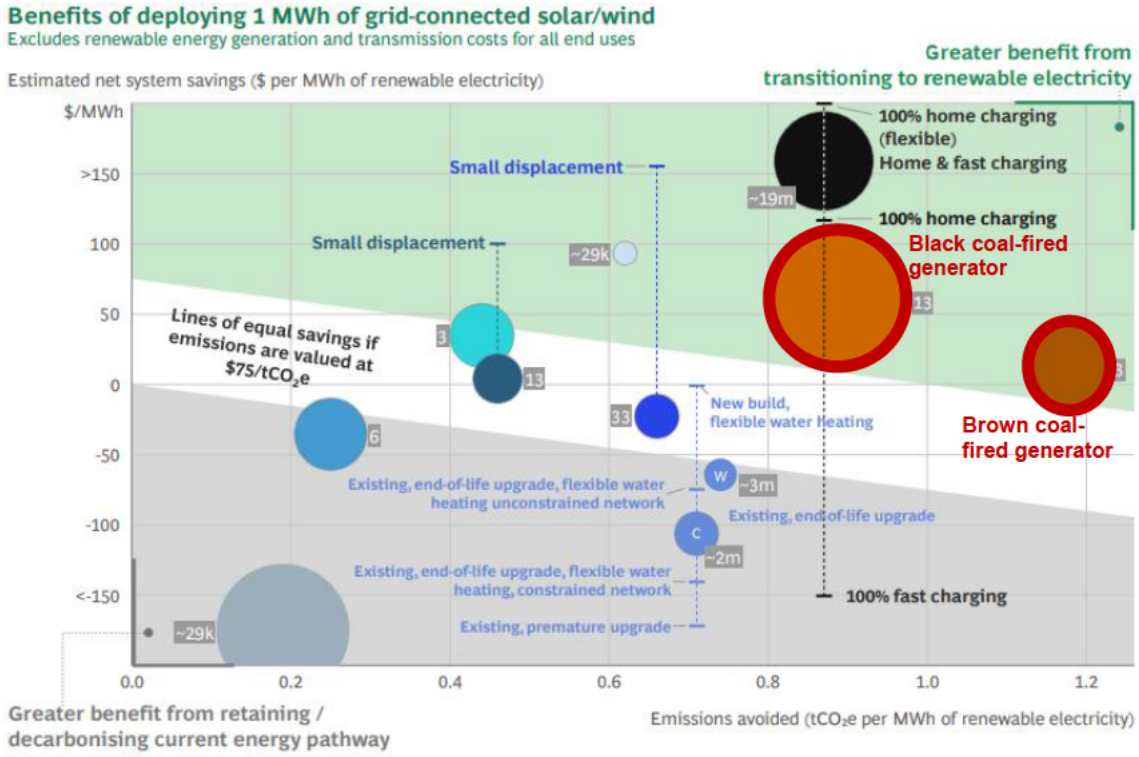

Figure 3 – Net system savings and emissions avoided from renewable electricity by fuel type and uses. Coal-fired electricity generation highlighted in red. Refer to Appendix A for more information on interpreting the chart and a full legend (Source: BCG)

Implementing policies that accelerate the electrification of gas uses could result in a period of fossil-fuelled electrification (Figure 2), compromise the 2030 (and 2035) targets and disproportionately impact hard to electrify industrial and vulnerable consumers.

Taking a whole of system approach to the energy transition is crucial for achieving a sustainable and efficient decarbonisation process. This approach involves considering the entire energy system, including various technologies, fuels, and infrastructure, rather than focusing on individual pathways in isolation. By doing so, it maximises system efficiency, reduces costs, and ensures reliability for consumers.

Provide investment certainty for emerging markets and fuels to help the transition

Net Zero Australia research indicates $7-9 trillion of capital will need to be committed to domestic and export energy and industrial infrastructure by 2060 (six times current investment levels).[7] A pro-investment environment is therefore vital to underpin the enormous private sector investment that will be required to deliver Australia's energy transition. A consistent and long-term approach to climate policy, energy policy and regulation will provide clearer signals for private sector investment and reduce the need for government intervention.

We note that at the most recent Energy and Climate Change Ministerial Council (ECMC) meeting in March, Ministers discussed options for developing a renewable gas industry in Australia, recognising 'renewable gases as one of the most viable pathways to decarbonise parts of industry where electrification is not a viable option'. **Jemena believes that providing a long term ambition**

[7] Net Zero Australia. (2023, July). *Net Zero Mobilisation report: How to make net zero happen.* Retrieved from https://www.netzeroaustralia.net.au/wp-content/uploads/2023/09/Net-Zero-Australia-Mobilisation-How-to-make-net-zero-happen-updated-19-Sep-23.pdf

acknowledging the need for renewable gases such as biomethane, will lower investment risk and in turn drive private investment capital into this nascent market.

7. Are the measures now in place sufficient to ensure community engagement and benefit sharing from the build out of infrastructure for the energy transition?

Biomethane, being a drop-in fuel, can be directly injected into the existing natural gas network without the need for extensive new infrastructure or end use appliances. The repurposing of existing infrastructure will minimise the need for new infrastructure This approach reduces costs and maintains consumer energy choice. However, it also avoids social licence and environmental considerations inherent to new large scale construction, which can facilitate faster adoption, and thereby enhancing community engagement through the continued use of familiar practices.

As discussed in the answer to Question 2, by 2050 bioenergy could have a $14 billion impact on annual GDP, create 35,300 additional jobs and reduce emissions by 12 per cent[8] with a lot of these benefits being realised in regional Australia. This economic and jobs boost to areas that need it the most, should help to create social licence and highlight the benefits of renewable gases for regional NSW and Australia.

[8] ENEA Consulting & Deloitte (2021, November). *Australia's Bioenergy Roadmap*. Report for Australian Renewable Energy Agency (ARENA). Retrieved from https://arena.gov.au/assets/2021/11/australia-bioenergy-roadmap-report.pdf

Agriculture and Land

10. What specific actions or policies could increase uptake of emissions reduction strategies in agriculture, both in the short and long term?

Biomethane represents a no-regrets circular economy opportunity that can reduce emissions across multiple sectors, improve sovereign fuel security, create regional jobs, and provide on-demand renewable energy. In particular, a robust market with appropriate regulatory settings can have a material impact on emissions reduction efforts in the agricultural sector.

Jemena encourages the NSW Net Zero Commission:

1. **Advocate for the need of a biogenic digestate market in NSW**. This would include establishing streamlined regulations and knowledge sharing support, and consideration of timely implementation of an "End-of-Waste" code for digestate (similar to what exists in Queensland).
2. **Consider the need to reform waste incentives to redirect feedstocks towards higher order uses (i.e biomethane production**). This would reduce on-farm emissions, and increase the amount of renewable energy available to substitute fossil fuels.

Biomethane can be derived from the upgrading of biogas produced by anaerobic digestion of wastewater sludge, municipal solid waste, animal manure or crop residues. In addition to energy recovery, biomethane production results in two valuable by-products: biogenic carbon dioxide (CO_2) and organic digestate. Biogenic CO_2 can replace fossil-derived CO_2 for use in industry (e.g. food and beverage, oil and gas) and organic digestate is a suitable substitute for synthetic fertilisers derived from natural gas.

In 2022, agriculture contributed 22.4 Mt CO_2-e or 20 per cent of NSW net emissions. Biomethane has the potential to support emissions reductions within the *Agricultural soil management*, *Manure management* and *Fuels and other uses* sub-sectors (Table 2).

Table 2 - Summary of Biomethane's potential to support emissions reductions in the Agriculture sector

Sub-sector	2022 Emissions (Mt CO_2-e) [% of Sector]	Emissions reduction supported by Biomethane Production
Enteric fermentation	14.3 [64%]	N/A
Agricultural soil management (fertiliser and urea application)	3.6 [16%]	Digestate by-product of anerobic digestion can be used as a synthetic fertiliser substitute Crop stubble can be sourced and used as a feedstock for anaerobic digestion
Manure management	1.3 [6%]	Manure can be sourced and used as feedstock in anaerobic digestion
Fuels and other use	3.1 [14%]	Biomethane is a direct substitute for natural gas

Organic Digestate and its potential to support emissions reductions in agricultural soil management

Digestate is a direct output from anaerobic digestion and contains a mixture of solid and liquid organic matter with readily available nutrients. Digestate can be directly applied to soils, or further processed to separate the solid-liquid fractions. This optimisation of nutrient composition makes it more suitable for use as soil amendments and bio-fertilisers.

Using digestate on agricultural soils presents a regenerative approach to agricultural productivity that has multiple benefits. In particular, it can improve soil health indicators and sequesters organic carbon in the soil. These organic-rich attributes can in turn help support the recovery of degraded Australian soils, while reducing the need for fossil-fuel derived synthetic fertilisers. Close to 80 per cent of these fertilisers are imported yearly into Australia. Leveraging biogenic digestate from biomethane production would further decrease the country's reliance on imports.[9] Furthermore, organic digestate use can support emissions reduction efforts, as studies in Europe have estimated that "producing a tonne of synthetic mineral fertiliser emits an average of 9.7 tonnes of CO_2 equivalent".[10]

Sydney Water currently uses the organic digestate produced from the anerobic digestion process at Jemena's Malabar (and other facilities), to supply over 40 farms across the central west and south west of NSW to help improve soil. These large farms grow canola, wheat, oats, barley and pastures for domestic and international consumption. Around 73 per cent of the 'biosolids' produced from its water resource recovery facilities are directly applied to these agricultural soils. The remaining 'biosolids' are sent for further processing where they are mixed with other materials such as green waste and further composted to be used in horticulture, mine rehabilitation, and gardens and parklands within Sydney.

This is an illustration of the unique circular economy sectoral cross over benefits involved in biogas/biomethane production. However, it also highlights the important role Sydney Water has played in harnessing the digestate based off its deep understanding of the anaerobic digestion process and how to monetise this product across different end-users. This market expertise and technological understanding is not widespread amongst prospective biomethane producers within Australia, which is proving to be a limiting factor on monetising a crucial revenue stream for them, and emission reduction pathway for agriculture.

Due to the importance of the agriculture sector, healthy Australian soils are crucial to our country's economic activity, food security, and biodiversity. According to the Commonwealth Government's 2021 National Soil Strategy, Australia's soil provides ~$930 billion per year to the economy. However, the Strategy highlights our soil, although rich in biodiversity, is among the oldest and most nutrient poor in the world.[11] Digestate use is scientifically proven to regenerate soils, locking in nutrients that can enhance the long term productivity.

Race for 2030's report '*Opportunity Assessment: Anaerobic digestion for electricity, transport and gas*'[12] highlights these issues, with contributors claiming technologies required to upgrade digestate

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[9] Fertilizer Australia. (n.d.). *Australian Fertiliser Market.* Retrieved June 18 2025 from https://fertilizer.org.au/about-fertiliser/the-fertiliser-industry/australian-fertilizer-market

[10] GHD for Bioenergy Australia. (2022). *Fertile Ground The role of digestate in Australia's circular economy*. Bioenergy Australia. Retrieved from https://cdn.revolutionise.com.au/cups/bioenergy/files/6ukmpvvrwewhfyw5.pdf

[11] Department of Agriculture, Water and the Environment (DAWE). (2021). *National Soil Strategy*. Australian Government. Retrieved from https://www.agriculture.gov.au/sites/default/files/documents/national-soil-strategy.pdf

[12] Kaparaju, P., Conde, E., Nghiem, L., Trianni, A., Cantley–Smith, R., Leak, J., Katic, M., Nguyen, L., Jacobs, B., Cunningham, R.(2023). *Anaerobic digestion for electricity, transport and gas. Final report of Opportunity Assessment for*

and the lack of understanding of the land applications of the product were key challenges. It also noted that most of the technology providers that could enable value creation from digestate were from Europe. The report raises that European suppliers are not participating in the Australian market due to unfamiliarity with Australia's differing biomethane regulations. This presents an opportunity for Australian technology providers to fill gaps in technology required for treatment of digestate, supported by government policy and regulations.

> A 2023 study commissioned by the European Biogas Association found numerous additional benefits of biomethane when viewed through a circular economy lens. The report, titled *Monetising biomethane's whole-system benefits*, found an additional benefit of €23 – 78/GJ of biomethane produced was unquantified by the market (depending on production pathway).
>
> This higher externality value was the result from a larger (positive) greenhouse impact due to reducing fugitive emissions in agriculture, and the benefits of biogenic digestate application and organic waste processing.
>
> The authors then considered these new value streams in the economics of biomethane which resulted in lower overall costs to produce a marginal unit of the renewable gas. This led to lower total system costs and higher energy security benefits, resulting in (EU 27) economy-wide benefits by 2030 of €38-78 billion per annum, rising to €133-283 billion by 2050[13].

Insights from the more advanced biomethane market in Europe highlights the importance of establishing clear and operational legislation on digestate-derived products, whether from waste or animal by-products[14]. In addition, providing an "end-of-waste" status for digestate positively impacts public perception of digestate,[14] which is important for successful commercialisation.

The commercial use of biomethane by-products in Australia is impeded by unsupportive regulatory policy. Across most states, there is a lack of clarity and consistency surrounding the use, transport, and sale of these by-products. Victoria and Queensland are currently the only states in Australia to have implemented digestate-specific regulations.

To support emissions reductions in the agriculture sector, the NSW Net Zero Commission should consider supporting timely implementation of an "End-of-Waste" code for digestate similar to that of the Queensland Government[15]. This would provide clear guidance for biomethane producers on when digestate can be classified as a resource and support further downstream emissions reductions in the agriculture sector from a thriving bioenergy market.

Manure as a feedstock and its potential to support emissions reductions in manure management

Implementing policies to incentivise the use of livestock waste has the dual benefit of producing low-carbon renewable gas (biomethane) and reducing livestock emissions (i.e improving manure management). This would contribute to both environmental sustainability and energy security.

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research theme B5. Prepared for RACE for 2030 CRC. Retrieved from https://www.racefor2030.com.au/content/uploads/21.B5-OA_-Final.pdf

[13] 20230213_Guidehouse_EBA_Report.pdf (europeanbiogas.eu)

[14] Decorte, M., Papa, G., Pasteris, M., Sever, L., Gaffuri, C., Cancian, G., Bremond, U., & Flamin, C. (2024). *Exploring digestate's contribution to healthy soils* [White paper]. European biogas Association. Retrieved from https://www.europeanbiogas.eu/wp-content/uploads/2024/03/Exploring-digestate-contribution-to-health-soils_EBA-Report.pdf

[15] Waste Assessment, Department of Environment, Science and Innovation. (2024, Mar) *End of Waste Code Digestate (EOWC 010001054)*. Queensland Government. Retrieved from https://www.des.qld.gov.au/policies?a=272936:policy_registry/wr-eowc-approved-digestate.pdf

The Australian Biomass for Bioenergy Assessment (ABBA) estimated that, on average, New South Wales produced 1.26 million tonnes of manure residue annually between 2010 and 2015. Of this, dairy manure accounted for 659 thousand tonnes, poultry manure for 550 thousand tonnes, and piggery manure for 55 thousand tonnes. The Australian Bioenergy Roadmap[16] estimates a biogas potential of 8.8 PJ from livestock residue in NSW which is the equivalent of powering over 450,000 households annually[17].

Recent ACIL Allen modelling in their AEMO IASR assumptions report[2] found biomethane produced by anerobic digestion of waste can be supplied to the market at a LCOE in the range of $18 – $27/GJ in 2030. Internationally, Denmark has indicated that they plan to introduce the world's first carbon emission tax from 2030 on livestock emissions; emissions from spreading manure and; emissions from carbon-rich agricultural land. This has the potential to incentivise anaerobic digestion of manure, increasing the volume of feedstock available for biomethane production.[18]

Other advocacy to support emissions reductions in the Agricultural sector

In addition to the use of organise digestate as a substitute fertiliser and diverting manure to anaerobic digestion, a ban on stubble burning can assist in the diversion of crop residues to anaerobic digestion and in turn, reduce on-site emissions associated with the practice.

[16] ARENA. (2021). *Australia's Bioenergy Roadmap – Appendix – Resource Availability.* Retrieved from https://arena.gov.au/assets/2021/11/appendix-resource-availability-australias-bioenergy-roadmap.pdf
[17] Average Electricity Use - Average Electricity Use - Data.NSW. Average household annual use of 5,000 kWh/y
[18] Yarnold, J., MacDonald, H., Wade, B. & Wood, J. (2025, May 12). *Policy Pathways to advance Australia's biomethane sector: learning policy lessons from international jurisdictions.* Future Fuels CRC (FFCRC). Retrieved from https://www.futurefuelscrc.com/wp-content/uploads/RP2.2-05-Policy-pathways-to-advance-Australias-biomethane-sector.pdf

Industry

13. What policies or programs at a sectoral level could complement the Safeguard Mechanism to support the accelerated decarbonisation of heavy industry in NSW?

In 2022, industry accounted for 15.4 Mt CO2-e, representing 14 per cent of NSW net emissions. According to the Net Zero Commission's 2024 Annual Report, reductions in industry emissions since 2005 are primarily due to a decrease in industrial production. This indicates a need to identify cost-effective decarbonisation options that support economic activity while meeting the state's climate targets and manufacturing ambitions.

Jemena recommends the Commission:

1. Consider the essential role of natural and renewable gases in supporting net-zero by 2050 and beyond as outlined by the Federal Government's Future of Gas Strategy. Including as an immediate-term decarbonisation pathway for heavy industry, and how government strategies, such as the NSW Gas Decarbonisation Roadmap, can support this.
2. Acknowledge the importance of existing gas infrastructure in supporting emissions reduction for heavy industry in NSW, and the need for policy certainty to drive the investment in low-carbon solutions for the State's hard-to-abate entities.
3. Consider the need for government to set a long-term market signal for renewable gas investors through a statement of ambition and provide financial support through existing clean energy mechanisms.
4. Education for the Industrial sector to show that biomethane is a viable emissions reduction pathway. The decarbonisation benefits of Biomethane are now recognised in NGERS allowing Industrial end users to reduce their scope 1 emissions through direct substitution of natural gas.

The importance of gas and gas infrastructure in Australia's transition

Jemena encourages the Commission to consider total emissions and cost of abatement when developing its policies and key principles. As discussed in Question 5, consideration of the whole-of-energy system provides a perspective that can lead to a lower cost, more reliable, and faster decarbonisation, across multiple sectors.

As we transition, there is likely to be a reduction of natural gas use in some sectors, a substitution of it in others (e.g. biomethane), and an increase by some large industrials (e.g. coal-to-gas switching and GPG). It will become increasingly important for policymakers to appreciate this nuance as they develop further climate supportive policies, while not inadvertently impacting the viability of existing infrastructure and its ability to enable the decarbonisation of several sectors.

The economic viability of hard-to-electrify gas users connected to shared gas infrastructure, and others transitioning to natural gas from higher emitting fuels, would be undermined if the scale of the network is substantially reduced through increased accelerated electrification policies.

Australian gas pipelines and networks rely on aggregating demand and sharing infrastructure costs across all network users to achieve economies of scale, supporting the efficient and cost-effective transportation of natural gas. Jemena's NSW Gas Network has over 1.5 million residential and business customers. However, large commercial and industrial customers represent just over 2 per cent of all connections despite consuming 68 per cent of the gas we transport (typically more than 60 PJ per year).

Gas network costs are largely fixed, so when a customer leaves a network these costs are not reduced, rather the same costs are recovered from the remaining customers based on the relative proportional use of the infrastructure. In addition, if large numbers of disconnections occur (driven by government policy), network augmentation would be required to maintain pressure, with these additional costs borne by the remaining connections. This means that large scale disconnections driven by accelerated electrification policies pose a real viability and affordability risk to hard-to-electrify industrial customers.

CASE STUDY 1: BlueScope Port Kembla[19]

Company Overview

The Port Kembla Steelworks (PKSW) employs around 3,000 people directly in the Illawarra and supports a further 10,000 jobs. It accounts for over $2 billion in sales of locally produced steel each year, and has a production capacity of just over 3 million tonnes of steel per annum.

The Challenge

At PKSW, steel is manufactured using a Basic Oxygen Furnace (BOF) process. Iron oxide is reduced to iron inside a blast furnace using coke (derived from coking / coal) as the reducing agent. The resulting molten, carbon-rich 'pig iron' is processed into steel in a BOF, where oxygen is blown through it to reduce its carbon content. According to the Clean Energy Regulatory, the PKSW emitted ~6mt CO_2-e in FY24, representing ~5 per cent of NSW's total emissions.

The Intermediate Solution – Coal-to-Gas Switching

To achieve its emissions reduction targets, the PKSW has identified Direct Reduced Iron (DRI) ironmaking process as the most near-term economic option. This process relies on hot gases (natural gas or hydrogen), rather than a coal-based BOF for turning raw materials into iron.

PKSW plans to use natural gas as a bridging fuel to replace coal before biomethane and hydrogen are available at scale. This, compared to BlueScope's current blast furnace arrangement, offers a *60 per cent reduction in emissions*, or ~3.6mt CO_2-e of Scope 1 emissions annually. This is equivalent to about *3.25 per cent of total NSW emissions* or ~25 per cent of NSW industrial emissions. Representing an enormous opportunity for immediate term decarbonisation.

This substantial reduction is due to the higher efficiency and cleaner combustion process of natural gas compared to coal. This switch not only reduces CO_2 emissions but also decreases other pollutants like sulphur dioxide (SO_2) and nitrogen oxides (NOx), contributing to improved air quality.

For further information please refer to Bluescope's Climate Action Report[20].

Biomethane as a low-emissions and low capital substitute for natural gas

As described in the answer to Question 7 above, renewable gases including biomethane and hydrogen blends can be used as substitutes to natural gas within existing gas infrastructure, with

[19] BlueScope Steel Limited. (2024, September). *Climate Action Report.* Retrieved from https://www.bluescope.com/content/dam/bluescope/corporate/bluescope-com/sustainability/documents/FY2024-Climate_Action_Reportv2.pdf

[20] https://www.bluescope.com/content/dam/bluescope/corporate/bluescope-com/sustainability/documents/FY2024-Climate_Action_Reportv2.pdf

biomethane being a cost-competitive, and sometimes the only, decarbonisation option for many gas users today.

Policy is required to stimulate a renewable gas market to ensure it is available for hard-to-electrify users in a timely manner. Jemena endorses the implementation of a non-mandated biomethane ambition for 2035 and 2050, both at a state and national level. This would support NSW in achieving its emission reduction targets by encouraging private investment in renewable gas projects.

In addition, the NSW Net Zero Commission could advocate for inclusion of biomethane into current hydrogen policies, at both state and federal levels, such as the Renewable Fuel Scheme in NSW and the Hydrogen Production Tax Incentive (HPTI) and Hydrogen Headstart and Hub funding initiatives.

14. What measures could accelerate industrial heat electrification in NSW, where technology is viable?

As discussed in the answer to Question 6, emission reductions can be achieved sooner and at a lower cost by using scarce renewable electricity to replace coal fired generation and liquid fuels in light vehicle transportation before replacing natural gas. As highlighted in BCG's report[Error! Bookmark not defined.], high grade industrial heating applications and feedstocks see greater benefit from retaining and decarbonising natural gas rather than electrification.

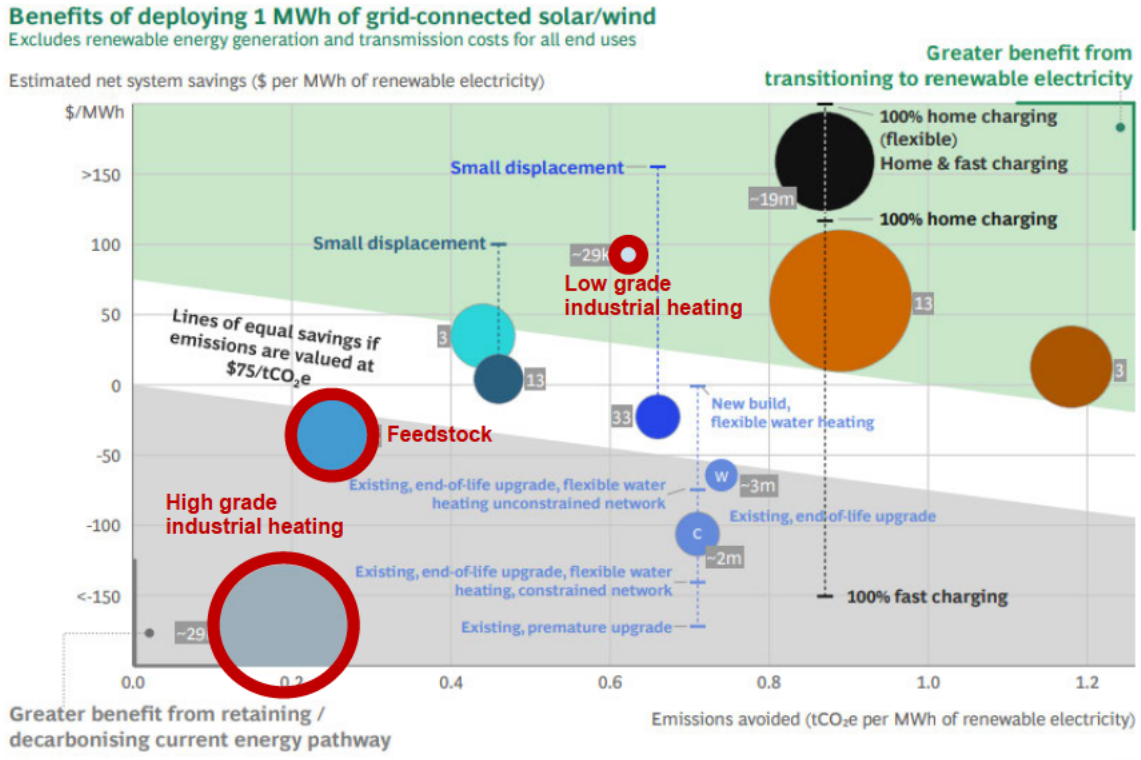

Figure 4 – Net system savings and emissions avoided from renewable electricity by fuel type and uses. Low and high grade industrial heating and feedstock vectors highlighted in red. Refer to Appendix A for more information on interpreting the chart and full legend (Source: BCG)

Electrification in industry provides several challenges. It not only demands a significant initial capital investment to upgrade equipment and infrastructure, but also requires periods of shutdowns for installation and commissioning. This is particularly problematic for operations that run 24/7, 365 days a year and increases the overall cost and economic payback period. Other challenges and costs lie in the upskilling of workers in new technologies, and expensive infrastructure connection costs to

expand electricity availability to the site. For example, Bluescope have indicated that if they were to convert PKSW to fully hydrogen-capable DRI, it would require the same amount of electricity as is consumed in all of South Australia. This would require enormous upgrades to electricity infrastructure not considered by any market body at present.

Discussions with industry partners (Case Study 2 and Case Study 3) have highlighted that, even when electrification is technically feasible, the total costs pose an insurmountable barrier to implementation. Biomethane is a preferred solution for these users as it is a straight forward drop-in fuel that alleviates the above concerns, and is considered the lowest cost solution for them to reach net-zero.

CASE STUDY 2: Hospitals

The Challenge

Recently the NSW Government announced that all government agencies need to report annually their scope 1 and 2 emissions. An assessment of decarbonisation options for government buildings including hospitals is now underway.

Hospitals currently use natural gas for HVAC boilers, sterilisation boilers and domestic hot water systems. Some hospitals use natural gas for space heating through hydronic heated floor and wall panels and cooking.

Electrification

Upgrades of existing gas systems to full electric are expensive and could require rebuilding of plant rooms and major infrastructure rearrangement leading to extensive shutdown periods and decommissioning of assets before the end of their usable life. This is particularly challenging in hospitals where extensive and costly downtime periods impact the cost and availability of health services.

The Alternative Biomethane Solution

Renewable gas, acting as a drop in fuel, means there are no lengthy shutdowns of these critical resources, and decarbonisation can occur without extensive capital outlays or decommissioning of assets that still have a functional life.

CASE STUDY 3: Lion Australia

Company Overview

Lion is an iconic beverage manufacturer employing over 2,000 people with over 2 billion AUD revenue producing household brands such as Toohey's, XXXX and Little Creatures.

The Challenge

Lion produce beer at multiple sites across Australia, with one of their largest within the Jemena Gas Network. Their manufacturing process requires continuous (24/7) low-grade heat for steam generation which is currently supplied by natural gas.

Lion have purchased long-term renewable Power Purchasing Agreements (PPAs) to decrease their scope 2 emissions however, their scope 1 emissions from natural gas use remain unabated.

Lion have considered electrification as a possible pathway to decarbonise for small-scale breweries, however for larger sites, such as Toohey's and XXXX, electrification is not an

economically feasible pathway due to the 24/7 energy use profile and associated high energy demand and costs.

The Alternative Biomethane Solution

Lion have used biogas to reduce their natural gas usage behind the meter (ie produced on site) and have proven the technology works within their boilers, however their onsite generation is not enough to abate all pipeline natural gas usage – still consuming over 150,000GJ/year.

Lion have identified renewable gas, as a decarbonisation pathway for their remaining natural gas use. Substituting natural gas with biomethane will enable Lion to continue their manufacturing process during the transition, removing the need for capital outlays and lengthy shutdowns to decommission old equipment and commission new equipment.

Waste

15. What short to medium term measures could be prioritised to address the systemic challenges regarding waste generation and resource recovery?

In 2022, waste contributed 4.3 Mt CO_2-e or 4 per cent of NSW net emissions. At Jemena, we believe the production process of biomethane can play an important part in reducing these.

Jemena has also submitted feedback to the NSW Environmental Protection Agency in regards to their Waste and Circular Infrastructure Plan.

We suggest the following be considered:

- Proximity of any new waste transfer or processing facility to the existing gas infrastructure should be considered in the planning process. This will enable ease of connecting any biomethane facilities to the existing gas infrastructure.
- Centralising Food Organics and Garden Organics (FOGO) processing infrastructure provides significant economies of scale for biomethane upgrading projects. This approach not only streamlines operations but also enhances the efficiency of anaerobic digestion conversions, leading to more effective waste management solutions.

Recent ACIL Allen modelling in their AEMO IASR assumptions report[2] found biomethane produced by anerobic digestion of waste can be supplied to the market at a LCOE in the range of $10 – $16/GJ in 2030. It is estimated that 3.4 – 5.4 PJ of biomethane could be produced from landfill gas, equivalent to providing gas to 180,000 – 300,000 households annually[17].

It should also be noted that extracting the energy potential of waste in the form of biomethane is one of the most efficient uses of this resource. Biomethane production from biogas upgrading has an over 90 per cent conversion efficiency[21]. In comparison, methane destruction through electricity generation achieves a ~30 per cent energy conversion efficiency[22]. Additionally, flaring or composting waste results in no energy gain.

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[21] BiogasWorld. (2023, May 29). *Biogas upgrading to biomethane: Discover BiogasWorld's clients and their technology*. BiogasWorld. Retrieved July 3, 2025, from https://biogasworld.com/news/biogas-upgrading-to-biomethane-discovers-biogasworlds-clients-and-their-technology/

[22] Landfill Methane Outreach Program (LMOP). (2023, September). *Landfill Gas Energy Cost Model User's Manual Version 3.6*. U.S. Environmental Protection Agency Retrieved from https://www.epa.gov/system/files/documents/2023-09/lfgcost_web_v3.6_usersmanual_sep2023.pdf. Fuel use rate for a CHP Reciprocating Engine-Generator Set = 11,250 BTU/kWh. 1 BTU/kWh = 0.001055 GJ/MWh, therefore 11,250 BTU/kWh = 11.87 GJ/kWh. 3.6 GJ / MWh, therefore electrical efficiency = 3.6 / 11.87 = 30.3%

Built Environment

19. What additional measures could accelerate electrification and increase energy efficiency of new and existing buildings?

In 2022, the Built Environment contributed 13.8 Mt CO_2-e or 12 per cent of NSW net emissions. As noted in the Net Zero Commission's 2024 Annual Report[6], "the largest source of direct emissions in this sector (53 per cent) is the use of onsite fossil fuels in homes and buildings in operation. Homes account for about 60 per cent of gas use in buildings, with the remaining 40 per cent estimated to come from other buildings."

The benefits of sequenced electrification on the whole of energy system

As discussed in the answers to Questions 6, 7, 13 and 14, research by BCG**Error! Bookmark not defined.** indicates that, from a comprehensive energy system perspective, emissions can be reduced more quickly and cost-effectively if limited renewable electricity resources are applied to replace the most emission-intensive energy sources, such as coal and liquid fuels, before replacing gas end-uses. This is because the current pipeline of renewable electricity development is not sufficient to decarbonise all end-uses and implementing policies that accelerate the electrification of gas uses could result in a period of fossil-fuelled electrification, compromise the 2030 (and 2035) targets and disproportionately affect hard to electrify industrial and residential consumers.

The image below shows that although there are some emissions benefits of replacing natural gas in residential and commercial buildings at the end of life, the net system savings are negative.

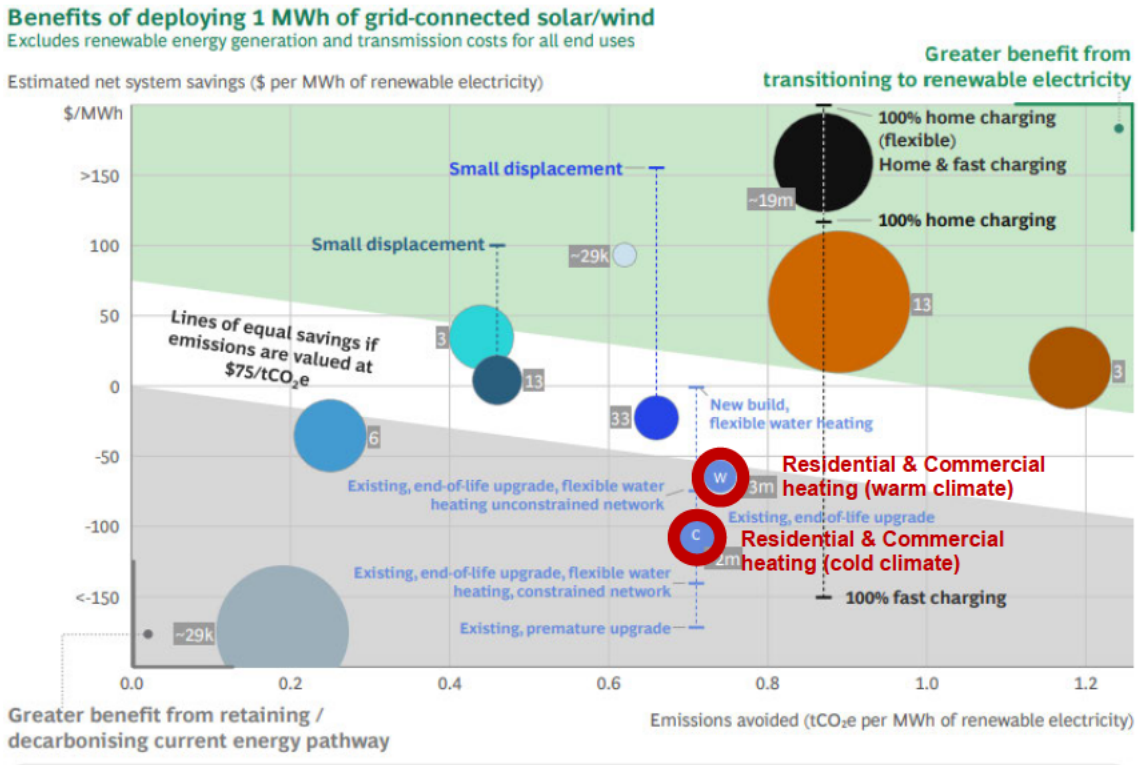

Figure 5 – Net system savings and emissions avoided from renewable electricity by fuel type and uses. Residential & Commercial heating - warm and cold climate vectors highlighted in red. Refer to Appendix A for more information on interpreting the chart and full legend (Source: BCG)

Modelling undertaken by L.E.K for Energy Networks Australia (ENA)[Error! Bookmark not defined.] on the Victorian Government's proposed Electrification Regulatory Impact Statement (RIS), also found that pursuing *forced* electrification policies, would increase overall energy system costs for Victorians by $22bn over 20 years. This is as a result of the accelerated electrification approach requiring material amounts of new gas powered generation to meet the electricity demand during peak periods (driving up wholesale electricity prices) and also the emission and production costs of pushing out the time needed to keep coal in the system.

The result of this is no net emissions savings for the first 6 years, and then a small amount of carbon abated at a cost of $1,222 per tonne of CO_2. This is an extremely high abatement cost when compared to other decarbonisation options. This is equivalent to a biomethane price of ~$60/GJ, which (according to ACIL Allen's biomethane cost curves provided to AEMO for their Inputs, Assumptions and Scenarios Report) is significantly above even the most expensive sources of biomethane.

Research by ENA[23] also shows that in NSW, the current emissions intensity of electricity is 0.81 kg CO_2-e/kWh versus 0.185 kg CO_2-e/kWh for natural gas. Therefore replacing natural gas with electricity in homes without decarbonising the electricity network first will result in a significant increase in emissions in the short term and have adverse impacts on 2030 and 2035 targets.

20. How could social equity be better addressed in the transition to an electrified built environment?

On the NSW Jemena Gas Network, large industrial and commercial customers purchase ~68 per cent of the gas we transport. Of these customers, 70 per cent include some of the hardest to electrify and will require some form of gaseous energy for their operations over the foreseeable future.

The economic viability of these hard-to-electrify gas users (connected to shared gas infrastructure) would be significantly undermined if the scale of the network is substantially reduced through accelerated government-led electrification policies. This is because Australian gas pipelines and networks rely on aggregating demand and sharing infrastructure costs across all network users to achieve economies of scale, supporting the efficient and cost-effective transportation of natural gas.

In this context, it is Jemena's position that maintaining the safety and reliability of the network is critical to ensuring the viability of NSW industry and supporting vulnerable network-connected customers throughout the transition. However, as Australia increasingly values lower-emission goods and services, the gas network will need to adapt. Jemena believes the existing gas network needs to support the energy transition by supporting fuel switching from higher emitting fuels such as coal and thereafter displacing unabated natural gas in favour of renewable gases.

This approach provides the lowest-cost to NSW consumers by leveraging already built infrastructure and allowing the gas transported through it to compete on price and pace of emissions reduction. However, in lieu of any form of carbon signal in the market, government policy and support is required to effectively and efficiently value low-emission gases and facilitate a robust market to support this nascent, net-zero compatible fuel.

Further, the above-mentioned BCG report found that for some households many factors, such as: upfront appliance costs; long term fuel costs; bespoke remediation costs; consumption levels; and connection costs, can influence the relative cost of gas versus all electric by $5,000 and alter the least cost alternative for consumers. This emphasises the highly individual nature of residential

[23] Energy Networks Australia. (2021, July). *Reliable and clean gas for Australian homes*. Retrieved from energynetworks.com.au/resources/fact-sheets/reliable-and-clean-gas-for-australian-homes-2/

natural gas customers, and the potential consumer detriment of policies that mandate consumer behaviour.

Appendix A – Interpretation of BCG's Grid renewable electricity substitution analysis chart

To supply more context to our submission, this appendix provides further explanation and interpretation of BCG's renewable electricity substitution chart.

The chart shows the benefits (cost impact and emissions savings) of deploying 1 MWh of grid connected wind or solar for different applications.

- The top right corner (green area), reflects applications with the highest net system saving ($ per MWh of renewable electricity) and the highest emissions avoided (CO_2-e per MWh of renewable electricity). Applications in this area achieve a **greater benefit from transitioning to renewable energy**.
- The bottom left corner (grey area) reflects applications with the lowest net system saving ($ per MWh of renewable electricity) and the lowest emissions avoided (CO_2-e per MWh of renewable electricity). Applications in this area achieve a **greater benefit from retaining or decarbonising their current energy pathway**.
- The bubbles on the chart represents **total annual volume of renewable electricity required to meet demand**. The larger the bubble, the more renewable electricity is needed to meet the demand.
- Numbers in the grey boxes next to the bubbles represent the **number of end users of each application**.

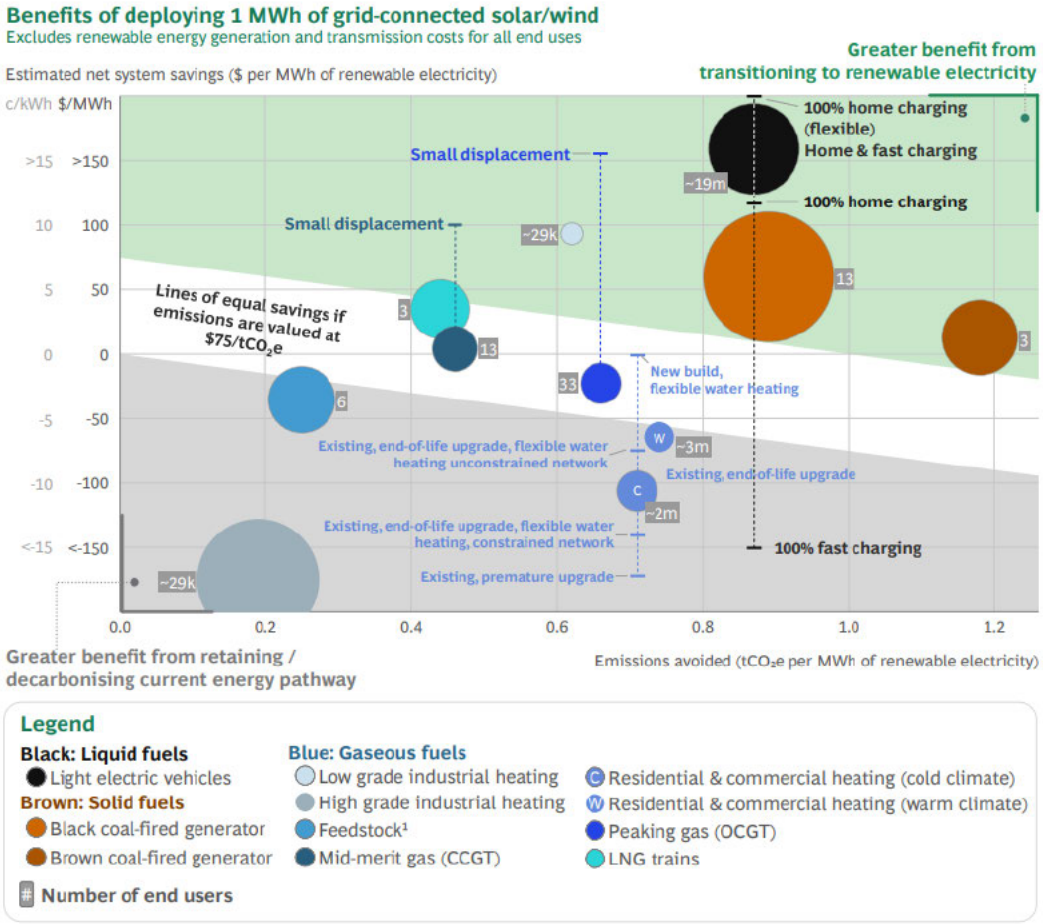

Figure 6 - Net system savings and emissions avoided from renewable electricity by fuel type and uses (Source: BCG)[3]

As there is not currently enough renewable electricity molecules to decarbonise Australia's entire energy system through electrification, it follows that priority should be given to use these molecules to applications that achieve the greatest benefit from transitioning to renewable electricity.

BCG found that:

- Grid-connected renewable electricity will have the greatest impact if first used to displace coal generation and liquid fuels.
- Electrification of residential gas applications is prioritised lower due to their impact on system cost, in particular where they coincide with electricity demand peaks. There are additional costs to:
    - Match the profile of variable renewable electricity generation (when it is sunny and windy) to the profile of consumption (when people are heating their homes)
    - Transport the electricity (with potential upgrades to the electricity distribution network)
    - Buy new electric equipment (e.g. a heat pump), currently at higher capital cost
- Electrifying end uses such as high-grade industrial heating, industrial feedstock (via green hydrogen produced from renewable electricity), residential and commercial heating (in particular in cold climates) and peaking gas-powered generation would have a higher cost for the system and avoid fewer emissions.
- While electrifying light vehicles does incur additional costs, charging could be more flexible – if the vehicle is charged when overall (or local) electricity demand is low, it provides a benefit by balancing the system
- In this prioritisation, natural gas plays a complementary role to renewable electricity While renewable electricity is prioritised to end uses in the top right, natural gas can continue to support the end uses that are lower priority to electrify because they are hard or expensive to electrify.