

Pathways Call for Evidence Submission

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31 July 2026

NSW Net Zero Commission

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Re: NSW Net Zero Commission: Decarbonisation Pathways Call for Evidence

Dear Commissioners,

Jemena welcomes the opportunity to respond to the NSW Net Zero Commission's Call for Evidence on the development of NSW-specific decarbonisation pathways.

Jemena supports the Commission's objective of grounding these pathways in evidence, data and practical insight from organisations and communities with direct experience of the sectors being modelled. This will be essential to identifying a transition that is orderly, affordable, efficient, reliable and capable of supporting long-term investment.

Jemena owns and operates a diverse portfolio of energy assets across northern and eastern Australia, with more than \$12 billion in gas and electricity infrastructure delivering energy to millions of households, businesses and industrial users. Our assets include the Jemena Gas Network in New South Wales, the Jemena Electricity Network in northwest Melbourne, and major transmission pipelines including the Eastern Gas Pipeline, Queensland Gas Pipeline and Northern Gas Pipeline.

Natural gas remains fundamental to Australia's evolving energy system, supporting more than a quarter of national energy demand. Beyond its current role in homes and businesses, gas underpins manufacturing, firms renewable electricity and enables critical industrial processes, particularly in hard-to-abate sectors.

Both our gas distribution and transmission infrastructure are already supporting the energy transition by servicing existing and connecting new gas-powered generation across both distribution and transmission. This is helping to firm the rapid expansion of renewables while enabling the orderly retirement of coal by providing critical system security services. Our networks are also well positioned to support industrial heavy emitters transitioning from coal and diesel-based feedstocks to gas, unlocking significant emissions reductions. Together, this reinforces the role of gas distribution and transmission in maintaining economic and energy security while contributing to economy-wide decarbonisation.

In NSW, this role is already being delivered at scale through Jemena's infrastructure. The Jemena Gas Network is the state's largest gas distribution network, servicing over 1.5 million customers across the Greater Sydney basin, Central West, Riverina and Hunter regions, with around 70 per cent of throughput supporting commercial and industrial users – including gas-powered generators. This extensive footprint positions the network to play a critical role in delivering NSW's energy security and decarbonisation objectives.

We are also investing to strengthen supply and system resilience with a number of investments across NSW on the Eastern Gas Pipeline (EGP), a major transmission asset that transports gas from the Gippsland Basin in Victoria into New South Wales and the ACT, supporting reliable supply to key demand centres. In parallel, we support the development of local supply to improve energy security and support emissions reduction through coal-to-gas switching, firming of renewable generation and facilitating renewable gas development and connections.

Key messages

1. **NSW's decarbonisation pathways should adopt a whole-of-economy approach.** Pathways should optimise emissions reduction outcomes while supporting affordability, reliability, industrial competitiveness and deliverability, while explicitly accounting for dependencies between electricity, gas, transport, industry, waste and shared infrastructure.
2. **Replacing coal-fired generation with firmed renewable electricity should remain the first priority.** Electricity-sector decarbonisation is one of NSW's largest near-term abatement opportunities and an essential enabler of emissions reduction across transport, industry and the wider economy. Achieving this will require an appropriate mix of renewable generation, transmission, storage, demand response and flexible gas-powered generation to maintain reliability as coal retires.
3. **Existing gas infrastructure can support efficient and material emissions reduction.** Gas distribution and transmission infrastructure supports renewable generation by enabling gas-powered generation, facilitates industrial fuel switching away from higher-emissions coal-based processes, and will be needed to transport renewable gases as they scale to meet NSW Government targets and climate ambitions.
4. **Pathways should test genuinely different technology mixes and reflect real-world deployment constraints.** Because all scenarios reach net zero by 2050, assumptions about technology costs, deployment rates, infrastructure availability, customer behaviour, fuel switching, policy and regulatory constraints, workforce capability and capacity, and supply chains will materially shape results.
5. **Renewable gas and shared infrastructure should be assessed on their whole-of-system value.** Biomethane can complement electrification, use existing infrastructure and equipment, support commercial and industrial emissions reduction where electrification is difficult, costly or delayed, and deliver co-benefits across waste, agriculture, circular-economy outcomes and regional development. Pathways should preserve optionality and avoid prematurely foreclosing infrastructure that may support lower-cost or more readily deployable emissions reduction pathways.

Where Jemena aligns with the Commission's emerging findings

Jemena agrees with several themes reflected in the Commission's consultation material and recently released 2026 Annual Progress Report. In particular, Jemena supports the Commission's focus on evidence-based pathways that test technology availability, costs, trade-offs, policy drivers, economic impacts and dependencies between sectors.

Jemena notes the Commission's findings that NSW must accelerate emissions reduction to meet its legislated 2030 and 2035 targets, and that the largest near-term opportunities are likely to include replacing coal-fired generation, accelerating transport electrification and supporting practical industrial decarbonisation.

Jemena welcomes the Commission's recognition that pathways should consider outcomes beyond emissions, including impacts on business, jobs, land use, water and biodiversity. In Jemena's view, this broader lens should also include the efficient use of existing infrastructure to support total system cost, customer affordability, energy security, industrial competitiveness as well as regional development and circular economy outcomes.

This submission is intended to support that work by identifying practical considerations for pathway design, modelling assumptions and implementation. Jemena's central proposition is that NSW should prioritise the largest, lowest-cost and most deliverable emissions reductions, while recognising cross-sector dependencies, preserving energy security and future decarbonisation options and enabling existing infrastructure to evolve where it supports emissions reduction, reliability and affordability.

A whole-of-system approach to NSW's decarbonisation pathways

The Commission's pathways should identify the lowest-cost, most reliable and most resilient route to net zero across the NSW economy. This requires modelling that accounts for technology and labour availability, costs, trade-offs, policy settings, behaviour change and dependencies between sectors. These factors will determine whether NSW can meet its 2030, 2035 and 2050 targets while maintaining reliability, supporting investment and protecting consumers.

The pathways should therefore avoid optimising individual sectors in isolation. While sector-specific analysis is useful, decisions that appear cost-effective or practical within one part of the economy may increase costs, create infrastructure constraints or reduce resilience elsewhere.

A whole-of-system assessment is particularly important where pathways rely on major shifts in energy demand, network utilisation or fuel use. The costs, benefits and feasibility of these changes depend not only on what occurs within a particular sector, but also on how they interact with developments across the broader energy system.

This is particularly relevant for shared gas infrastructure. Material changes in residential demand, accelerated by government policy, can affect the cost and viability of infrastructure relied upon by commercial and industrial users, flexible electricity generation and prospective renewable gas markets. Pathway modelling should account for the consequences of sector-specific assumptions for customers and decarbonisation options elsewhere in the economy.

The Commission's pathways should consider dependencies between electricity, gas, transport and industrial systems, recognising that the long-term viability of energy infrastructure influences the emissions reduction options available across the economy. Pathways that reduce the cost-effective utilisation of existing gas infrastructure may increase costs for hard-to-abate sectors, constrain renewable gas deployment and limit future decarbonisation pathways that rely on shared network assets. This includes the contribution gas infrastructure can make to system reliability, industrial fuel switching and the deployment of renewable gases. This becomes increasingly important as total energy demand across sectors continues to grow.

This will help ensure NSW pursues emissions reductions in a way that supports affordability, reliability, industrial competitiveness and long-term investment.

Pathway design, modelling assumptions and policy complementarity

Because all three proposed pathway scenarios are designed to reach net zero by 2050, the sector-level results will be heavily influenced by the input assumptions used in the modelling. Assumptions about technology costs, infrastructure availability, customer behaviour, fuel switching, policy barriers, capital constraints, labour and skills requirements and availability, and deployment timelines will materially affect the emissions reductions allocated to each sector.

Jemena therefore encourages the Commission to publish the full set of modelling inputs and assumptions for stakeholder consultation before the pathways are finalised. This should include assumptions relating to renewable electricity build-out, gas infrastructure investment, coal retirement, replacement firming capacity, electrification costs, deployment rates, gas demand by customer class and sector, renewable gas production costs, industrial process change, network utilisation, customer affordability, waste and landfill gas capture, circular economy co-products, private sector investment requirements and supply chain constraints.

The pathways should also test different technology mixes, not simply different speeds of transition. A ‘fast’ pathway based primarily on higher levels of electrification may not be the lowest-cost or most resilient pathway if it assumes away constraints associated with electricity network capacity, customer capital costs, skilled labour availability, supply-chain bottlenecks, asset-replacement cycles or gas network viability.

Importantly, assumptions affecting demand in any one sector should account for their consequences for shared infrastructure and the customers that continue to rely upon it. Material changes in network utilisation may affect the cost and viability of infrastructure needed to transport renewable gases, support industrial decarbonisation and hard-to-abate industries and supply flexible gas-powered generation as coal exits the electricity system. The pathways should therefore capture these interdependencies and the associated whole-of-system costs, benefits and trade-offs, rather than treating each sector independently.

These scenarios should be assessed on their economy-wide outcomes. Accelerated electrification in one sector should not be assumed to deliver the optimal outcome if it increases costs, constrains future infrastructure options or limits emissions reduction opportunities elsewhere in the economy.

Similarly, a ‘delayed’ pathway should not assume that lower electrification necessarily means weaker decarbonisation. In some sectors, lower-emissions gaseous fuels, coal-to-gas switching, renewable gas deployment, demand flexibility, energy efficiency and circular economy measures may provide practical and material emissions reductions before full electrification is technically or commercially viable.

The Commission’s modelling should also recognise that some decarbonisation pathways may increase gas demand in specific sectors. For example, natural-gas-based direct reduced iron could provide a material transitional pathway for lower-emissions steelmaking until renewable gas is commercially available at scale. In its 2024 Gas Statement of Opportunities, AEMO estimated that low-emissions direct reduced iron projects could add around 80 PJ a year to national gas demand from the early 2030s, while supporting a shift away from more emissions-intensive coal-based steelmaking¹. In NSW, BlueScope’s Port Kembla Steelworks is the clearest candidate for this opportunity. Its connection to the Jemena Gas Network underscores the role existing gas infrastructure plays in supporting reliability today and enabling industrial decarbonisation pathways over time. The pathways should therefore test emissions outcomes, rather than assume gas demand falls across all sectors unilaterally.

The Commission’s modelling should therefore be technology-neutral, transparent about costs and grounded in practical deployment evidence. It should recognise that NSW’s transition will require a portfolio of solutions across electricity, gas, liquid fuels, waste, agriculture, industry and transport, and should seek to identify the combination of solutions that delivers the lowest-cost, most reliable and most resilient pathway to net zero.

¹ Australian Energy Market Operator, *2024 Gas Statement of Opportunities*, March 2024 (Accessed: https://www.aemo.com.au/-/media/files/gas/national_planning_and_forecasting/gsoo/2024/aemo-2024-gas-statement-of-opportunities-gsoo-report.pdf)

Drivers and risks to NSW's 2030, 2035 and 2050 targets

A principal determinant of NSW's emissions trajectory over the next decade will be the successful replacement of coal-fired generation with firmed renewable electricity. Decarbonising electricity is both a major emissions reduction opportunity in its own right and a critical enabler of lower emissions across transport, industry and the broader economy.

The Commission's pathway advice should therefore consider the sequencing of decarbonisation opportunities, not simply their aggregate potential. With finite public funding, constrained delivery capability and substantial infrastructure requirements, NSW should prioritise measures that unlock the largest economy-wide emissions reductions and establish the foundations for further decarbonisation.

This points to a clear sequence: accelerate the replacement of coal-fired generation with renewable generation, transmission, storage and firming capacity; then pursue electrification where it can deliver the greatest additional abatement. As electricity-sector emissions decline, transport electrification is likely to become one of NSW's largest remaining sources of cost-effective abatement, while also providing potential system benefits through flexible charging and, over time, vehicle-to-grid capability.

The principal risk to this sequence is delay in delivering the infrastructure needed to replace coal-fired generation. This risk was highlighted by Boston Consulting Group's analysis of Australia's energy transition pathways, which found that electrification delivered ahead of renewable generation and firming capacity can result in higher electricity demand being met by fossil-fuelled generation, reducing near-term emissions benefits and increasing transition costs². The sequencing of generation, networks, storage and demand-side investment is therefore critical to maximising emissions reduction outcomes. The extension of Eraring demonstrates that reliability remains a key constraint on the pace of coal retirement. Unless sufficient renewable generation, transmission, storage and firming are delivered in time, coal closures may be delayed, slowing economy-wide emissions reduction and placing NSW's 2030 and 2035 targets at risk.

Dispatchable firming will therefore be essential. Gas-powered generation should be assessed alongside batteries, pumped hydro and demand response for its ability to manage periods of low renewable output and support the orderly retirement of coal. AEMO's 2026 Integrated System Plan projects that the National Electricity Market (NEM) will require approximately 17 GW of flexible gas-powered generation by 2050³. Its principal value will be the firming and reliability services it provides, rather than bulk energy production.

Realising this role will also require continued access to reliable and cost-effective gas infrastructure. The Jemena Gas Network, together with the broader east coast gas transmission system, currently supports gas-powered generation through the provision of flexible gas supply to existing generators and is well positioned to support future generation capacity required to maintain reliability as the NEM transitions away from coal. As AEMO's ISP highlights the ongoing need for flexible gas-powered generation, maintaining viable gas networks will remain important to ensuring generators can access fuel when required. Policies that unnecessarily accelerate declines in gas network utilisation risk increasing costs, reducing utilisation of existing infrastructure and weakening the economic foundations that support investment in gas supply infrastructure. Over time, this may reduce the ability of the gas system to support the dispatchable generation capacity needed to maintain reliability as coal-fired generation exits the market, while also increasing affordability pressures for hard-to-abate industrial customers that continue to rely on shared gas infrastructure for practical decarbonisation pathways.

Major new electricity loads, including data centres, should be assessed not only by the additional demand they create, but also by their potential to bring forward flexible load, storage, generation and firming infrastructure. Depending on their configuration, privately funded generation, storage, demand response and flexible load may reduce pressure on shared networks and contribute valuable system services.

The Commission should therefore test different configurations for major new loads and their implications for electricity transmission and distribution network augmentation requirements, renewable generation, storage, firming and reliability. The relevant policy question is how market and planning settings can encourage these loads to contribute flexibility and firming, rather than simply increase peak demand.

Ultimately, NSW's emissions reduction task should be approached as a sequence rather than a collection of independent sectoral targets. The success of many future decarbonisation opportunities will depend on the timely delivery of the infrastructure required to decarbonise the electricity system first. Prioritising this

² Boston Consulting Group (BCG), *The Role of Gas Infrastructure in Australia's Energy Transition*, June 2023 (commissioned by APA Group, Australian Gas Infrastructure Group and Jemena) (Accessed: 29 July 2026), available at: <https://apga.org.au/hubfs/The-Role-of-Gas-Infrastructure-in-Australia-s-Energy-Transition.pdf>

³ Australian Energy Market Operator (AEMO), *2026 Integrated System Plan (ISP)*, June 2026 (Accessed: 29 July 2026), available at: <https://aemo.com.au/energy-systems/major-publications/integrated-system-plan-isp/2026-integrated-system-plan-isp>

sequence will enable NSW to pursue the largest, lowest-cost and most durable emissions reductions while maintaining reliability and affordability throughout the transition.

Technology deployment barriers and the role of renewable gas

Electrification will play a central role in reducing emissions across many sectors. However, the pace at which it can be deployed will vary considerably across commercial and industrial facilities. While many industrial processes may be technically capable of electrification, substantial practical barriers may prevent this occurring within the timeframes required to meet NSW's interim emissions targets.

The NSW Government's Renewable Fuel Strategy highlights the scale of this challenge. It identifies approximately 78 PJ of hard-to-abate black coal use and 61 PJ of hard-to-abate natural gas use across the NSW economy⁴. These fuels support industrial activities where production processes and plant configurations have been optimised around combustion-based fuels over many decades. In sectors such as energy-intensive manufacturing and steel production, emissions reductions may involve a staged transition in which higher-emitting fuels are progressively displaced by natural gas, renewable gas and ultimately lower-emissions technologies as they become commercially viable at scale.

For many businesses, energy-consuming equipment is deeply integrated into production processes, plant layouts and operating practices. Electrification may require premature asset replacement, major facility modifications, extended shutdowns, workforce retraining and upgrades to onsite electrical infrastructure. Broader electricity network augmentation may also be required before large additional loads can be connected, adding cost, uncertainty and delivery time.

These constraints will influence the speed at which emissions reductions can be achieved. A pathway requiring widespread asset replacement, significant capital expenditure and operational disruption may deliver more slowly than one capable of leveraging existing infrastructure and equipment.

Renewable gas provides an important complementary pathway in these circumstances. Biomethane can be injected into existing gas networks and used in existing commercial and industrial equipment, avoiding many of the capital, operational and infrastructure barriers associated with immediate electrification. This can allow businesses to begin reducing emissions while working through longer-term plant replacement, process redesign, electrification and electricity network requirements.

Renewable gas certificates could provide a procurement framework familiar to large energy users, allowing businesses to support renewable gas production and account for associated emissions benefits, subject to applicable certification and reporting rules, while continuing to use existing infrastructure and equipment.

This will be particularly valuable for commercial and industrial customers seeking near-term emissions reductions, including those responding to the Commonwealth Government's Safeguard Mechanism. Jemena is seeing interest from customers whose gas-consuming equipment is embedded within buildings or production processes and cannot be replaced without significant capital expenditure and operational disruption. Renewable gas and accompanying certificates may allow these customers to begin reducing emissions while longer-term replacement or electrification options are assessed.

These customers may be technically hard-to-abate or face substantial physical, operational and economic barriers to deploying what modelling identifies as the least-cost technology. Renewable gas can complement, not displace, electrification by providing a practical pathway that uses existing infrastructure, avoids premature asset replacement and aligns decarbonisation with normal business investment cycles.

The NSW Renewable Fuel Strategy and proposed Renewable Fuel Scheme provide a strong foundation for this market. The Commission's pathways should therefore assess renewable gas not simply as a residual option for a small number of hard-to-abate customers, but as a practical emissions reduction pathway that can address deployment barriers, accelerate commercial and industrial abatement and preserve a broader range of decarbonisation options for NSW businesses.

⁴ NSW Department of Climate Change, Energy, the Environment and Water, *NSW Renewable Fuel Strategy* (2025), p. 12, available at: <https://www.energy.nsw.gov.au/nsw-plans-and-progress/regulation-and-policy/renewable-fuel-strategy>.

Biomethane as a cross-sector decarbonisation and circular economy opportunity

Biomethane is one of the clearest examples of a cross-sector decarbonisation technology. Through a single production process, it can support emissions reduction across waste, agriculture, industry, energy and the built environment.

Organic material from wastewater, landfill, food organics, agricultural residues and animal manure can be processed through anaerobic digestion to produce biogas. This biogas can then be upgraded into biomethane and injected into the existing gas network for use by commercial and industrial customers. In doing so, the process captures existing waste-derived methane and converts it into renewable energy, while also producing valuable co-products such as digestate and biogenic CO₂.

This is directly relevant to the Commission's pathway work because biomethane's value may be understated when its costs and benefits are considered within individual sectors. Biomethane is not solely an energy, waste or agricultural technology; it facilitates decarbonisation across multiple sectors simultaneously.

The Commission's modelling should therefore assess biomethane on its whole-of-system contribution. While biomethane may have a higher delivered energy cost than some alternatives, a fuel-only comparison may overlook material benefits elsewhere in the economy. These include:

- renewable gas can provide a carbon-neutral pathway for commercial and industrial customers facing practical electrification barriers;
- methane emissions from waste and agriculture can be reduced;
- digestate can support soil health and reduce reliance on emissions-intensive synthetic fertilisers;
- biogenic CO₂ can be captured for use in food and beverage manufacturing, industrial applications and future fuel production;
- organic waste can be diverted from landfill or otherwise better managed;
- regional feedstock supply chains can create new revenue streams for the agricultural and waste sectors;
- existing gas infrastructure can transport renewable energy, including from dispersed production sites to demand centres.

First mover in the renewable gas space

Malabar Biomethane Project: Putting Waste to Work

Jemena's Malabar Biomethane Project (Malabar) is the first project in Australia to produce biomethane and inject it into a gas network; providing on demand renewable energy to network consumers.

At the Malabar facility, Jemena has partnered with Sydney Water to upgrade biogas produced from organic waste at the Malabar Water Resource Recovery Facility to a quality that meets the required specifications for injection into the natural gas network.

The facility is located in the Malabar Headland National Park, and is one of Sydney Water's multiple anaerobic digestion (AD) plants in NSW which produce biogas from organic waste in waste water. Before the development of the biomethane injection facility, the bulk of the AD biogas output was used for electrical power generation and water heating on site. The balance of biogas that could not be used via site processes was subsequently flared through waste gas burners.

Jemena has sought to demonstrate technologies that allow for a transition to renewable gases in order to reduce the emissions of its network customers including those that cannot electrify. In this context, biomethane has the benefit of leveraging waste products, to deliver a competitive and sustainable natural gas substitute.

Malabar injects ~95 terajoules (TJ) of biomethane into the NSW gas network per annum. This reduced emissions by ~4.4 thousand tonnes of carbon dioxide equivalent (CO₂-e) in its first twelve months, roughly the same as taking 1,000 internal combustion engine vehicles off the roads.



Realising this opportunity depends on more than feedstock availability. Biomethane deployment also depends on practical regulatory and market settings for feedstock collection, planning approvals, network connections and injection, certification, digestate use, biogenic CO₂ markets and demand creation.

NSW has significant potential across food and garden organics, wastewater biosolids, landfill gas and agricultural residues. Where production facilities are located near existing gas networks, biomethane can be transported to customers without extensive new energy transport infrastructure, reducing system costs, improving project economics and supporting regional circular-economy development.

This opportunity is consistent with existing NSW Government policy. Through the Renewable Fuel Strategy, Renewable Gas Production Program and Net Zero Manufacturing Initiative, NSW has already supported renewable fuel development and established a foundation for renewable gas markets as part of the state's decarbonisation pathway.

The Commission should therefore ensure its modelling captures the full value of biomethane and other cross-sector technologies, rather than allocating their costs and benefits to individual sectors in ways that obscure their broader contribution. Biomethane should be assessed not only as a renewable energy source, but as a circular-economy platform capable of supporting waste reduction, agricultural productivity, regional development, industrial decarbonisation and more efficient use of existing infrastructure.

Economic impacts and just transition considerations

The economic implications of different decarbonisation pathways are driven less by the ultimate destination of net zero by 2050 and more by the pace, sequencing and certainty of the transition.

For organisations making long-lived investment, operational and workforce decisions, policy predictability is critical. Unclear or inconsistent policy signals can delay private investment, increase financing costs and make it harder for businesses to choose decarbonisation pathways with confidence.

The Commission's modelling should account for several economic pressures that will influence the pace and cost of decarbonisation, including planning approvals and infrastructure delivery timelines, constraints in skilled labour, equipment and supply chains, customer capital costs and payback periods, access to affordable finance, electricity network augmentation requirements, gas network utilisation and cost allocation, industrial competitiveness, regional employment and equity impacts for customers who cannot electrify easily or affordably.

This is especially important where policy settings could accelerate exit from shared gas infrastructure. If policy settings materially reduce utilisation of shared gas infrastructure before remaining users have viable alternatives, costs may be reallocated rather than avoided, including to commercial, industrial and vulnerable customers that cannot readily switch.

There are also sovereign capability implications. If rising energy costs or constrained decarbonisation options cause gas-dependent domestic production to close, NSW may lose economic activity and increase reliance on imports. These impacts may not be fully captured in emissions-only modelling but are relevant to the State's economic resilience, supply chains and manufacturing capability.

Conversely, pathways that preserve optionality and enable the deployment of the lowest-cost and most practical emissions reduction technologies can create broader economic benefits across regional supply chains. This includes renewable gases such as biomethane, as well as the continued use of existing gas infrastructure where it supports emissions reduction, industrial competitiveness and energy system reliability. Biomethane production can support agricultural income, waste management, regional jobs, renewable energy supply, organic fertiliser production and industrial decarbonisation. More broadly, technology-neutral pathways provide businesses and consumers with greater flexibility to adopt decarbonisation solutions that reflect their operational requirements and investment cycles. These benefits are distributed across multiple sectors and should be incorporated into the Commission's assessment.

Finally, the pathways should consider broader economic and social impacts. A just transition extends beyond communities affected by coal retirement to include industrial users seeking practical decarbonisation pathways, regional communities supporting energy supply chains, vulnerable customers and businesses making long-lived investment decisions. Pathways that reduce emissions while supporting affordability, reliability, economic resilience and industrial competitiveness are likely to deliver more durable and broadly supported outcomes.

Evidence to inform pathway inputs and assumptions

Jemena would welcome further engagement with the Commission to provide practical evidence supporting its pathway modelling, including:

- insights from industrial and commercial customers on electrification barriers;
- insights into new large loads on the Jemena Gas Network, including gas-powered generation and industrial decarbonisation projects;
- lessons from the Malabar Biomethane Injection Plant;
- evidence on biomethane production, injection and certification;
- insights on renewable gas market development;
- evidence from circular-economy and waste-infrastructure projects;
- examples of customer decarbonisation pathways involving natural or renewable gas;
- evidence on the practical decarbonisation constraints affecting compressors, pipelines and remote infrastructure;
- information on potential renewable gas supply and proximity to existing infrastructure; and
- practical evidence on the regulatory barriers affecting digestate, biogenic CO₂ and biomethane project development.

Beyond emissions reduction, what outcomes should be considered?

While emissions reduction is the primary and important objective of the Commission's pathways work, the pathways should also be assessed against a broader set of economic, social and system outcomes. Different pathways may achieve similar emissions outcomes while producing materially different impacts on affordability, reliability, investment, regional communities and industrial competitiveness.

Jemena supports the Commission's recognition that pathways should consider impacts on business, jobs, land use, water and biodiversity. In our view, the assessment framework should also include:

- total system cost;
- customer choice, affordability and equity for vulnerable customers;
- energy security and system resilience;
- industrial competitiveness and sovereign capability;
- regional economic development and employment;
- private sector investment requirements;
- system resilience and decarbonisation optionality;
- circular economy outcomes;
- implementation risk and deliverability.

Importantly, pathway assessment should distinguish between theoretical emissions outcomes and achievable emissions outcomes. A pathway that delivers lower modelled emissions but depends on rapid technology deployment, significant customer expenditure or major new infrastructure may ultimately prove more costly or difficult to implement than a pathway that achieves a similar outcome using existing infrastructure and proven technologies.

The Commission should also consider the value of maintaining optionality during the transition. The pace, scale and location of electrification remain uncertain and will depend on technology costs, customer preferences, capital availability, workforce constraints and infrastructure delivery. Pathways should therefore consider not only the costs of maintaining infrastructure, but also the costs of foreclosing future decarbonisation options that may become increasingly valuable if assumptions underlying the preferred pathways do not eventuate as expected.

The Commission should also consider impacts on industrial users seeking practical decarbonisation pathways, regional communities supporting energy supply chains and businesses making long-term investment decisions.

Pathways that reduce emissions while supporting consumer choice, affordability, reliability, economic resilience and industrial competitiveness are likely to deliver more durable and broadly supported transition outcomes.

NSW's emissions reduction challenge is not simply to identify scenarios capable of reaching net zero by 2050, but to determine which pathway can do so most cost-effectively, reliably and practically.

Jemena encourages the Commission to adopt a whole-of-system perspective that recognises sequencing, cross-sector interactions, deployment constraints and infrastructure utilisation. The Commission should prioritise the largest and most deliverable sources of abatement, support private-sector investment and preserve optionality where future technology deployment, customer behaviour and infrastructure requirements remain uncertain.

Existing gas infrastructure, renewable gases and flexible gas-powered generation can contribute where they provide lower-cost, more reliable or more readily deployable pathways to emissions reduction. Consistent with AEMO's system planning, the Commission should assess the combined requirements for renewable generation, networks, storage and flexible generation rather than assume that a single technology pathway will produce the optimal result.

The most successful pathway for NSW will be one that reduces emissions while maintaining affordability, reliability, industrial competitiveness and community support. Jemena looks forward to continuing to work with the Commission to identify practical, evidence-based options capable of delivering these outcomes.

We trust this submission is of assistance and welcome further engagement with the Commission. For further information or to arrange a discussion, please contact Joeb Northey, Manager Policy and Government Relations, [REDACTED].

Yours sincerely,

[REDACTED]

Nerise Cook
Executive General Manager, Jemena Gas Network

Appendix A - Interpretation of BCG's grid-connected renewable electricity substitution analysis

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 (CO₂-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 (CO₂-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 represent **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**.

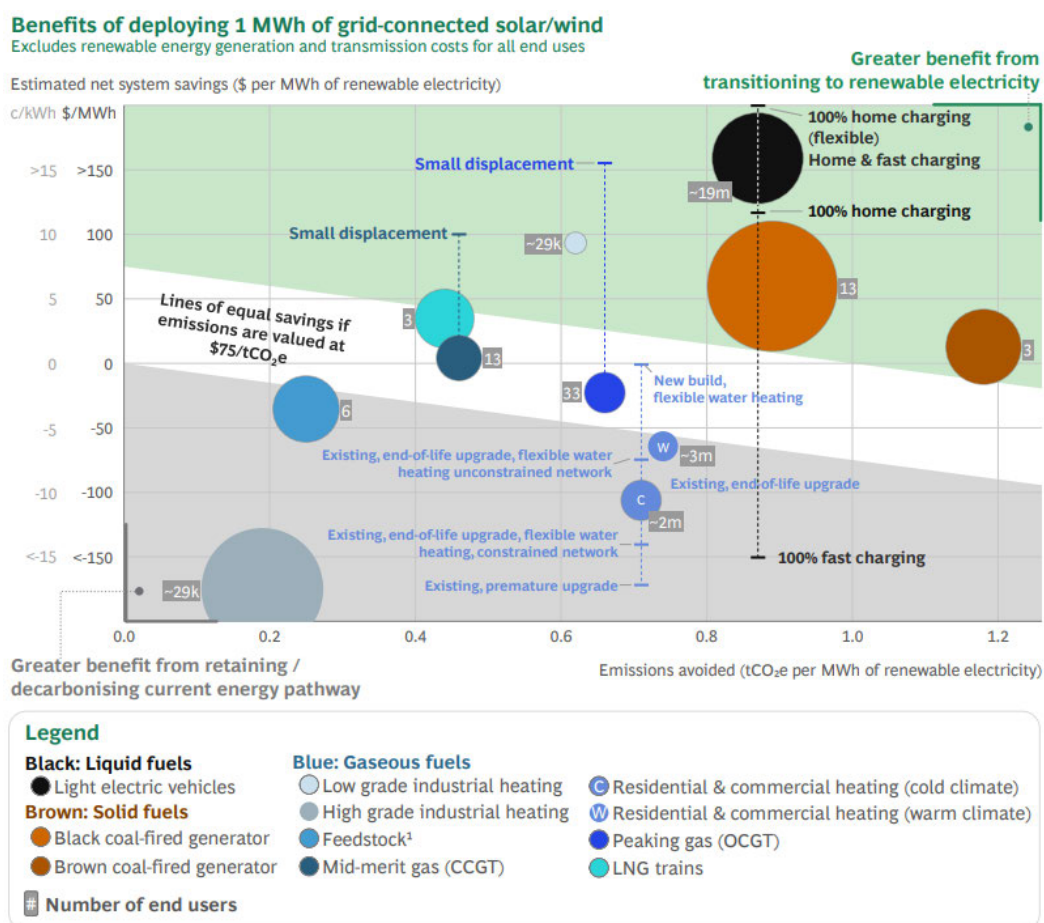


Figure 1 - Net system savings and emissions avoided from renewable electricity by fuel type and uses (Source: BCG)³

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 for end uses in the top right, natural gas can continue to support end uses that are lower priority to electrify because they are hard or expensive to electrify.