14 February 2025

Submission: National Electricity Market Wholesale Market Settings Review Initial Consultation

The Australian Pipelines and Gas Association (APGA) represents the owners, operators, designers, constructors and service providers of Australia's pipeline infrastructure. APGA members ensure safe and reliable delivery of over 1,500 PJpa of gas consumed in Australia alongside over 4,500 PJpa of gas for export.

APGA welcomes the opportunity to provide comments to the National Electricity Market (NEM) Review Expert Panel. This review is timely, as Australia's energy systems face unprecedented transition challenges.

The National Electricity Market is a flexible and competitive energy-only market. It was developed this way at a time when almost all generation was dispatchable, being thermal generation from coal, gas and diesel or hydropower. The increasing contribution of intermittent renewable energy is essential to achieve Australia's net zero goal but puts strain on the energy-only market, with an emerging need for dispatchable capacity to simultaneously be available but with a decreasing total energy output.

The NEM post-2027 will need to explicitly value long duration dispatchable capacity, where it currently lacks investment signals to encourage new investment.[1] APGA recommends the NEM Review Expert Panel investigate a technologically-agnostic capacity market with two streams:

- A medium-duration stream, where eligible technologies would guarantee 8-12 hours at 80% nameplate capacity
- A long-duration stream, where eligible technologies would guarantee long term capacity, perhaps 3+ days, at 80% nameplate capacity.

This would provide an investment signal to both ends of the capacity market, while ensuring recipients of payments guarantee their ability to discharge when required.

[1] Energy Security Board, 2022, *Capacity mechanism – high level design paper*, https://www.datocms-assets.com/32572/1655620351-20220620-capacity-mechanism-high-level-design-consultation-paper_final.pdf

The NEM needs guaranteed dispatchable capacity

A post-2027 NEM that is dominated by renewables will need a significant dispatchable capacity. The 2024 ISP forecasts 75 GW of firm dispatchable capacity will be required by 2050, as well as additional power system security services.[2]

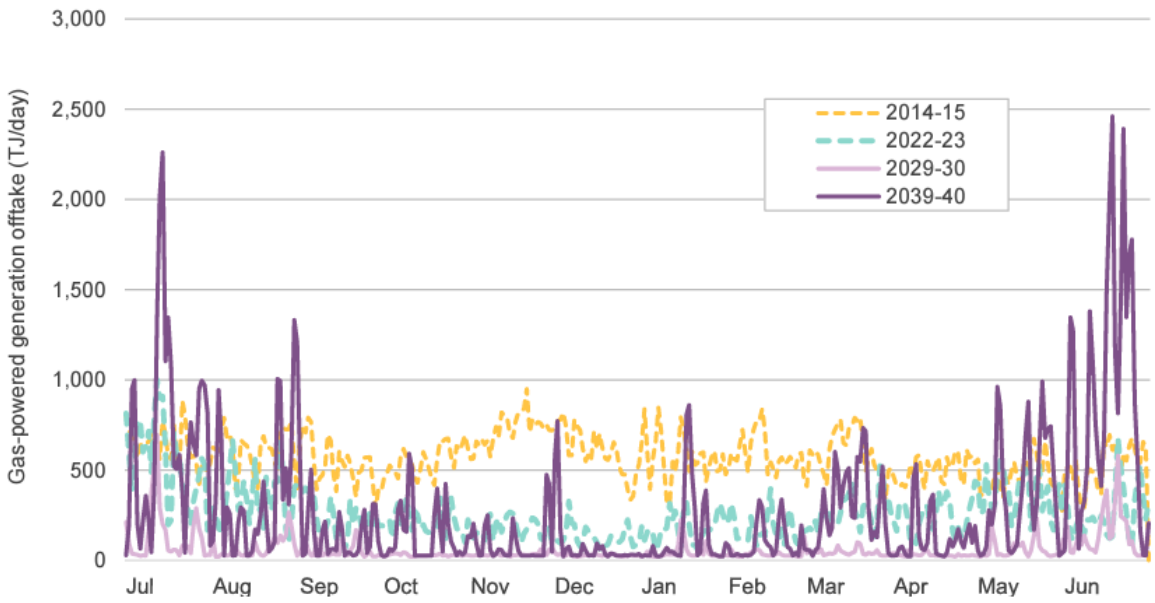
The Federal Government's Capacity Investment Scheme (CIS) aims to incentivise investment in an additional 32 GW of electricity capacity by 2030. However, only 9 GW capacity will be dispatchable, and thermal capacity, including gas powered generation, is excluded from the scheme. This scheme alone will not address the looming dispatchable capacity shortfall.

This NEM Review must consider what market settings will be needed beyond 2027, when the last CIS tenders will be issued. It is critical that the Expert Panel consider these factors when designing market settings for the NEM post-2027, including potential markets to provide the appropriate signals for investment in dispatchable capacity.

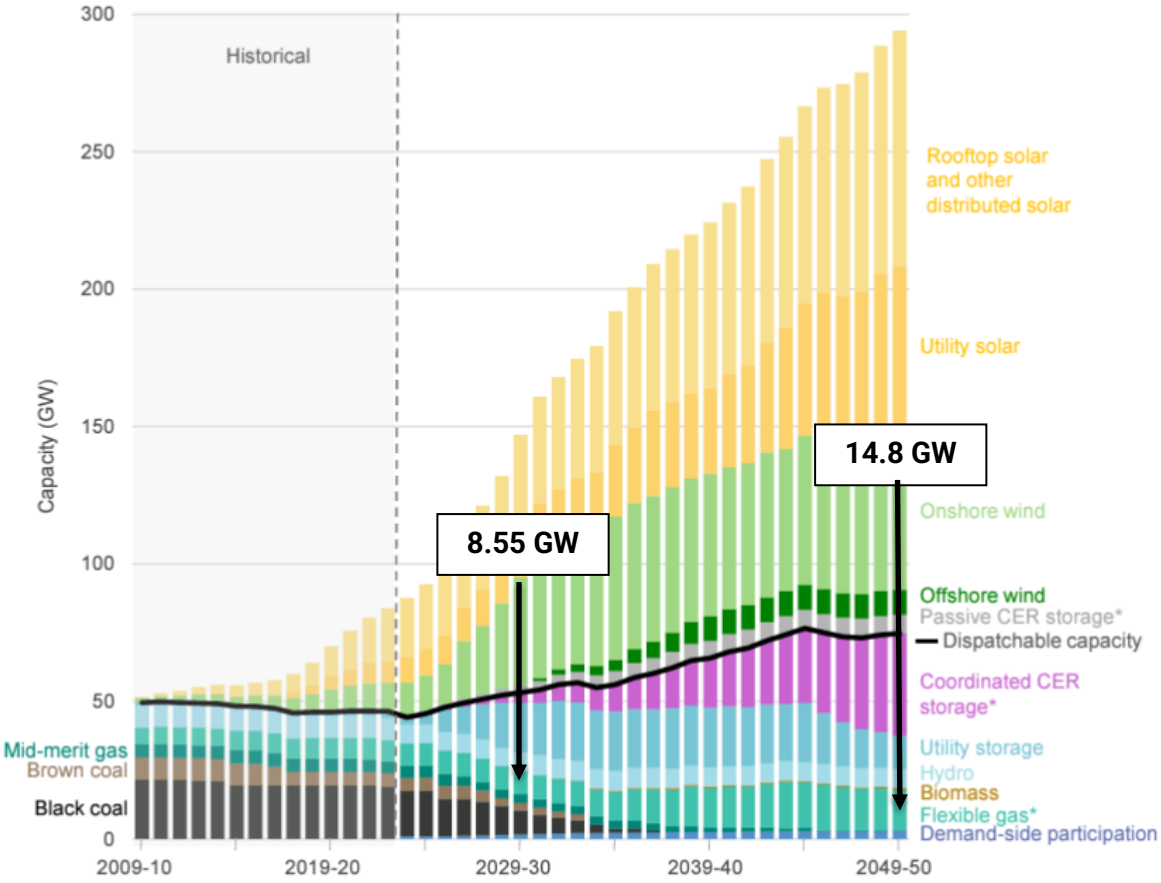
Gas remains critical for capacity

The ISP projects that GPG's contribution to the generation mix will fluctuate considerably, climbing from near-record lows of 140 TWh to a peak of 15,000 TWh in 2043-44. GPG will become a critical backstop, with projected winter demand peaks growing drastically in 2039-40 – on several days requiring close to 2,500 TJ/day.

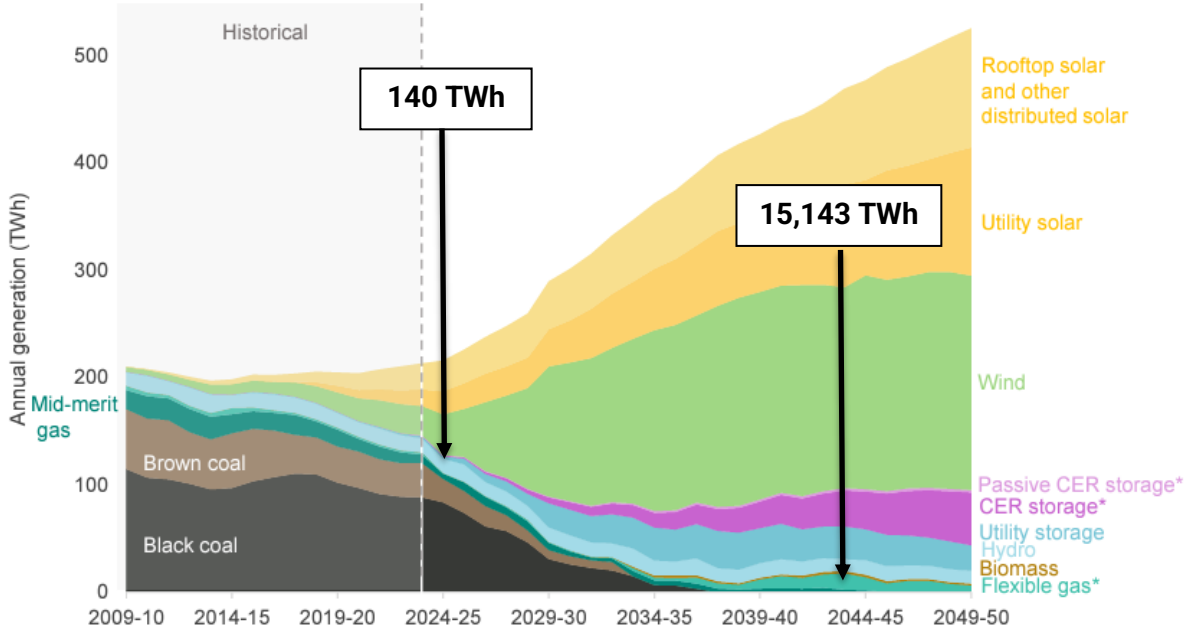
It is essential that the NEM develop a mechanism to secure investment in the 14.8 GW of flexible gas powered generation (GPG) by 2050 forecast in the ISP - nearly double the 8.55 GW needed in 2030.[3]



[2] AEMO, 2024, *2024 Integrated System Plan*, https://aemo.com.au/-/media/files/major-publications/isp/2024/2024-integrated-system-plan-isp.pdf
[3] AEMO, 2024, *2024 Integrated Systems Plan*, https://aemo.com.au/-/media/files/major-publications/isp/2024/2024-integrated-system-plan-isp.pdf



Notes: "Flexible gas" includes gas-powered generation and potential hydrogen capacity.
"CER storage" means consumer energy resources such as batteries and electric vehicles.
Projections for "Rooftop solar and other distributed solar" and "CER storage" are forecast based on unit costs, consumer trends and assumptions about payments received to participate in the electricity market.



Notes: Annual generation for 2023-24 has been estimated for the full financial year.
"Flexible gas" includes gas-powered generation and potential hydrogen capacity.
"CER storage" means consumer energy resources such as batteries and EVs.

Emissions can be managed

Analysis shows that, while critical, GPG will have a relatively low total contribution to the NEM in the future, with a capacity factor of below 13%. This also means that the emissions from GPG will be limited.[4]

Biomethane, as a carbon-neutral drop in fuel, does not require any technical modifications to turbines and can be used immediately to reduce emissions from GPG.

Additionally, new GPG turbines are hydrogen-capable.[5] Tallawarra B (320 MW) and the Hunter Power Project (750 MW) are both capable of running on hydrogen blends. Some manufacturers are bringing to the international market turbines which can combust 100% hydrogen.[6]

Investment frameworks need reform

While the ISP provides a strong signal that investing in GPG is necessary and warranted, the actual investment case for GPG is turbulent. Because plants can be only dispatched a few times a year, it will be challenging to recover investment and fixed costs of power generation, especially considering the expected capacity requirements vs forecast generation in the ISP.

The uncertainty of gas supply and demand volumes and additional costs imposed by emissions reduction policies introduces additional investment risk. For these reasons, it may be difficult to maintain investment in existing GPG or bring GPG projects to FID.

The ISP does not consider what incentives or investments would be required to keep *existing* GPG in the market, to both meet near term demand and the ISP's projected demand from 2030. Without such incentives, it is not guaranteed that existing GPG will remain in the market long enough to form a foundation for future capacity investment.

Adjustments to the NEM, including the CIS, have disincentivised investment in this critical infrastructure relative to other infrastructure, which will be difficult to overcome in the absence of a technology-agnostic capacity scheme.

The South Australian Government has approached the issue by proposing the Firm Energy Reliability Mechanism, which provides another pathway for dispatchable investments that

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[4] Frontier Economics, 2021, https://39713956.fs1.hubspotusercontent-na1.net/hubfs/39713956/Media%20Releases%20PDF/210219_potential_for_gpg_to_support_renewables_-_final_report_0.pdf

[5] Hydrogen capability is also now being reflected in modelling for AEMO's ISP. CSIRO's latest GenCost has included capability for hydrogen blending and eventual conversion to hydrogen firing when hydrogen supply becomes more readily available (which have also increased the capital cost). This recognises the reality that gas generation is more likely to be deployed with multiple fuel options. See CSIRO, 2024, *GenCost 2024-25 Consultation draft*, https://www.csiro.au/-/media/Energy/GenCost/GenCost2024-25ConsultDraft_20241205.pdf

[6] Kawasaki Heavy Industries, 2023, *Kawasaki Launches World's First 1.8 MW Class, 100% Hydrogen-fueled, Dry-combustion Gas Turbine Cogeneration System*, https://global.kawasaki.com/en/corp/newsroom/news/detail/?f=20230905_2781; Siemens Energy, 2023, *HYFLEXPOWER consortium successfully operates a gas turbine with 100 percent renewable hydrogen, a world first*, https://www.siemens-energy.com/global/en/home/press-releases/hyflexpower-consortium-successfully-operates-a-gas-turbine-with-.html

may not otherwise reach FID. But a whole-of-NEM approach is necessary to put a value on capacity, and hence investment in that capacity.

Valuing energy and the means to keep that energy flowing

Putting a value on more than energy delivery

The current market settings in the NEM, including mechanisms such as the Retailer Reliability Obligation and the CIS, do not sufficiently value or reward system security services essential to the stability of the NEM. Frontier Economics described this situation succinctly in 2021 when considering a post-2025 NEM design:

> "*Because there has historically been a reliable supply of these security related services (and in some states, there still is), the costs associated with maintaining the system in a secure operating state have not been reported and rewarded in the same way as other services in the NEM. The ESB has identified several essential system services that are not currently explicitly priced including fast frequency response, operating reserves, inertia and system strength*."

Frontier Economics goes on to note the post-2025 market design that was being contemplated at the time may have placed a specific value on these services, through procuring an operating reserve through a spot market, arrangements to incentivise primary frequency response and support faster frequency response, a co-optimised inertia spot market or procuring and co-optimising faster frequency response.

Not all dispatchable technologies are equal

CIS NEM dispatchable storage tenders are largely being awarded to grid-scale batteries. There are obvious advantages to these -- they can be 'powered' by renewable electricity, can discharge readily into the grid, and do not have the geographic limitations of pumped hydro. They also appear to have a relatively low capital cost, relative to other options.

They do have their disadvantages. They can be useful overnight or for short duration outages, but can provide only limited duration capacity for large-scale grid support. This means they are of limited use for medium to long-term responses or for instances of 'dunkelflaute'.

Option	Storage length	Advantages	Challenges
Gas turbines – H2 capable	Seconds to unlimited	• Lower emissions than coal • Rapid response time and ramp-up capabilities • Able to provide grid stability services • Reliable – limited only by supply of gas • Can be powered with renewable gas and blends	• Volatile fuel prices and supply • Emissions are still significant if powered with natural gas
Battery storage (BESS)	Seconds to hours	• Rapid response time • Able to provide grid stability services • Renewable integration • Modular and scalable	• High upfront costs • Resource-intensive production • Limited duration for large-scale grid support.

		• Able to recover capital costs daily	
Pumped hydro (PHES)	Minutes to days	• Can provide up to a week of energy storage • Renewable • No fuel costs	• Very high capital costs • Geographical limitations and some environmental impacts • Vulnerable to climate conditions • Round trip efficiency not as high as BESS

While not specifically 'priced' in the NEM, batteries can recover some of the capital cost of construction through interacting in the daily market, which also provides frequency regulation services. But there is a trade-off: doing so inhibits their ability to guarantee discharge when required.

Hence, any payments must be sufficient to compensate for the requirement for participants to guarantee discharge when required. For batteries, this may mean sitting fully charged even while the wholesale price is very high. This will affect the operating margins of those batteries and hence the impetus for investment.

A balanced capacity and services market scheme

APGA recommends investigating *two* types of capacity market. This would accommodate the differences in capacity technologies and encourage breadth of investment. This scheme should differentiate support for hours of capacity, and support for days of capacity. It should include an emissions factor limit, and require any new investment after 2040 to occur in a credibly transitioning portfolio.

APGA recommends the NEM Review Expert Panel investigate an investment scheme with two streams:

- **A medium-duration stream, where eligible technologies would guarantee 8-12 hours at 80% nameplate capacity**
- **A long-duration stream, where eligible technologies would guarantee long term capacity at 80% nameplate capacity.** The time period should be sufficient to outlast modelled dunkelflaute events, perhaps 3+ days.

Key to the success of this scheme would be ensuring that tendered participants can *guarantee* discharge when required. This would limit the ability to interact with the daily market that may offset some of the costs of participation. Hence the payments must be sufficient to discourage this behaviour where it may interfere with that guarantee.

Ideally this would be administered through AEMO Services, which currently manages the Long Term Energy Service Agreements in NSW as well as the tendering and due diligence processes for the CIS. This would not require direct government involvement with tendering and commissioning dispatchable capacity.

Consultation questions

Is there a role for certificated schemes to promote investment in firmed, renewable generation and storage and what might these look like?

Yes. APGA recommends investigating two types of capacity market. This would accommodate the differences in capacity technologies and encourage breadth of investment. This scheme should differentiate support for hours of capacity, and support for days of capacity. It should include an emissions factor limit, and require any new investment after 2040 to occur in a credibly transitioning portfolio.

The two streams could consist of:

- A medium-duration stream, where eligible technologies would guarantee 8-12 hours at 80% nameplate capacity
- A long-duration stream, where eligible technologies would guarantee long term capacity at 80% nameplate capacity. The time period should be sufficient to outlast modelled dunkelflaute events, perhaps 3+ days.

Could other capacity mechanisms efficiently attract investment in firmed, renewable generation and storage capacity?

The CIS has certainly attracted investment in renewable generation and storage capacity, but those investments still rely on the firming provided by gas turbines.

South Australia is an example of a jurisdiction which is aware risks of a renewable-dominated grid without sufficient dispatchable capacity, and is taking steps to mitigate it. On 12 February 2025 in South Australia a LOR2 event was declared. At 7pm, gas generation accounted for 58.3% of SA's electricity supply, while diesel generators and brown coal imports from Victoria made up 3.4% and 17.9%.

South Australia's proposed Firm Energy Reliability Mechanism (FERM) will provide another pathway for long term dispatchable investments that may not otherwise reach FID. Crucially, and unlike the CIS, it does not exclude gas powered generation investments. Under the FERM, contracted capacity providers must be available for dispatch during potential reliability events (Lack of Reserve/LOR events) in South Australia. Ideally this would prompt gas power generation investment sufficient to avoid LOR events or prevent them from progressing.

A national capacity mechanism that does not specifically exclude gas powered generation, and does place a value on long term dispatchable capacity, would efficiently attract investment in this kind of technology. APGA provides an example above.