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SUBMISSION: AEMO DRAFT 2021 INPUTS, ASSUMPTIONS AND SCENARIOS REPORT AND CSIRO GENCOST 2020-21 CONSULTATION DRAFT

The Australian Pipelines and Gas Association (APGA) represents the owners, operators, designers, constructors and service providers of Australia's pipeline infrastructure, with a focus on high-pressure gas transmission. APGA's members build, own and operate the gas transmission infrastructure connecting the disparate gas supply basins and demand centres of Australia, offering a wide range of services to gas producers, retailers and users.

APGA welcomes the opportunity to comment on the CSIRO GenCost 2020-21 Consultation Draft and the AEMO Draft 2021 Inputs, Assumptions and Scenarios Report. In this submission, APGA will focus on the value of gas-powered generation in the electricity mix. Our key concern is that the assumptions and scenarios in both reports undervalue the role of gas-powered generation in the NEM in enabling high levels of penetration of variable renewable electricity generation. Much of this value is present in gas-powered generation's insurance value in the event of a prolonged renewables drought.

A failure to fairly value the critical role of gas-powered generation in the NEM in the next iteration of the ISP and other strategic planning documents could lead to under investment in gas powered generation capacity and associated gas infrastructure such as pipelines. This is important because this outcome could result in significantly higher power system costs in very high renewables penetration scenarios - thereby creating an economic disincentive and hampering decarbonisation efforts. It could also result in unnecessarily high energy costs for Australian households and businesses and/or lead to suboptimal security of supply/reliability outcomes.

To further develop the evidence-base on this topic, APGA commissioned a report from Frontier Economics on the *Potential for Gas-Powered Generation to Support Renewables*. The report's findings show that gas powered generation can allow very high renewable electricity systems (i.e., those with more than 90% renewables penetration) to function reliably at much lower system cost than they would otherwise. The report's Executive Summary with key findings is attached (confidentially) to this submission; APGA will publicly release the full report later in February.

CSIRO GenCost 2020-21 Consultation Draft

The section of the GenCost 2021 Consultation Draft of key relevance to APGA's concerns is Section 5 on Levelised cost of electricity analysis.

The report identifies three 'issues and concerns' in calculating and interpreting levelised cost of electricity (LCOE) highlighted in the report. These are:

1. LCOE does not take account of the additional costs associated with each technology and in particular variable renewable electricity generation technologies
2. LCOE applies the same discount rate across all technologies even though fossil fuel technologies face a greater risk of being impacted by the introduction of new state or commonwealth climate change policies
3. LCOE does not recognise that electricity generation technologies have different roles in the system. In particular, some technologies are operated less frequently, increasing their costs, but are valued for their ability to quickly make their capacity available at peak times.

APGA acknowledges and welcomes efforts by CSIRO to address the first two issues. Particularly the adoption of a new method to better take into account additional investment costs associated with variable renewables, such as the need for additional transmission infrastructure and additional storage facilities like battery and pumped hydro storage.

However, point three has not yet been adequately addressed – especially in relation to the insurance value of gas-powered generation in the event of a prolonged renewables drought. Additional modelling is required to address this issue.

AEMO Draft 2021 Inputs, Assumptions and Scenarios Report

Apart from the five scenarios elaborated in the Draft 2021 Inputs, Assumptions and Scenarios report, there are no specific sections in this report that are directly applicable to APGA's concerns about undervaluing the insurance value of gas-powered generation. For this reason, APGA's primary focus in this consultation round is the GenCost 2020-21 Consultation Draft – the key document for discussion and analysis relevant to our concerns. We expect this will in turn inform AEMO's Draft Inputs, Assumptions and Scenarios report and the scenario development process for the next iteration of the ISP.

APGA notes that in some scenarios (i.e., the Central Scenario and the Sustainable Growth Scenario) in the Draft 2021 Inputs, Assumptions and Scenarios report the "increased cost-competitiveness of VRE and storage technologies relative to fossil fuel generation" is a key factor. It is important that the limitations and/or cost implications of storage technologies relative to gas powered generation in the event of a prolonged significant reduction of VRE generation is factored into these scenarios.

Frontier Economics Report: Potential for Gas-Powered Generation to Support Renewables

As noted above, APGA commissioned a report from Frontier Economics on the *Potential for Gas-Powered Generation to Support Renewables* to further advance the evidence-base in this area.

The report's findings show that gas powered generation can allow very high renewable electricity systems (those with over 90% renewables penetration) to function reliably at much lower system cost than they would otherwise. Gas powered generation provides effective energy storage over periods of weeks and months - much longer time periods than batteries and pumped hydro can provide. This makes gas-powered generation particularly well suited to managing energy requirements during sustained periods of low renewable generation, either due to seasonal weather patterns or prolonged renewable droughts.

Low VRE generation can persist for a long period of time. AEMO projections show renewable droughts can last from days to months. In high-VRE scenarios, investment is required in additional generation or storage capacity to ensure the lights can be kept on during these renewable droughts. The flexible nature of gas-powered generation means it is uniquely placed to provide support to renewable generation, protecting the security and reliability of the electricity system.

The Frontier Economics report models total system costs for two VRE output years (2030 and 2035) indexed against the system costs of a 100% renewable power system each year. The 2030 model doesn't contain any particularly long periods of low wind output; whereas 2035 features a prolonged wind drought. The models for both years include four scenarios:

- 100% renewables;
- 99% renewables;
- 95% renewables; and
- an optimised high VRE system where the level of gas-powered generation is not stipulated (93% renewables in this model).

In 2030 the inclusion of a small proportion of peaking gas-powered generation reduced system costs by approximately 28% (equating to around $5 billion in cost savings in a NEM sized electricity system). In 2035, the inclusion of a small proportion of gas-powered generation reduced system costs by approximately 36% (equating to around $7.5 billion in cost savings).

This reduction in total resource costs reflects the report's conclusion that investment in some gas-powered generation enables the system to avoid costly and wasteful overbuilding of renewable generation required to deliver system security to manage renewable drought.

The key point in the context of the GenCost 2020-21 Consultation and the AEMO Draft 2021 Inputs, Assumptions and Scenarios Report is that while gas-powered generation is uniquely placed to provide support to renewable generation, long-term investment modelling will often under-value this insurance role for gas-powered generation. Long-term investment modelling of the type undertaken by AEMO for the ISP tends to model outcomes for typical conditions expected in the electricity market, or average conditions. It is typically not well-suited to modelling investment decisions for generation or storage assets that earn a return during atypical conditions, such as periods of unexpectedly low VRE output. Modelling these investment decisions typically takes additional modelling and analysis.

A confidential copy of the Executive Summary of the Frontier Economics report on the *Potential for Gas-Powered Generation to Support Renewables* is attached **[see APPENDIX A]**. APGA will publicly release the full report later in February.

To discuss any of these issues further, please contact APGA's National Policy Manager, Andrew Robertson on 0439 491 102 or at arobertson@apga.org.au.

Yours sincerely

STEVE DAVIES
Chief Executive Officer

APPENDIX A:

Executive Summary of Report prepared for APGA by Frontier Economics
Potential for Gas-Powered Generation to Support Renewables

[CONFIDENTIAL]

1 Executive summary

The Australian electricity sector is in transition to a future with net zero emissions. Gas-powered generation is a critical resource that will enable us to undertake this transition in a way that simultaneously ensures a secure and reliable system, maintains affordability and does so at emissions levels that are consistent with a future with net zero emissions.

APGA has engaged Frontier Economics to develop a robust and approachable evidence base on the role of gas-powered generation in Australia's future generation mix. Our key findings are outlined in the following subsections.

Gas-powered generation provides support when renewable generation is not available

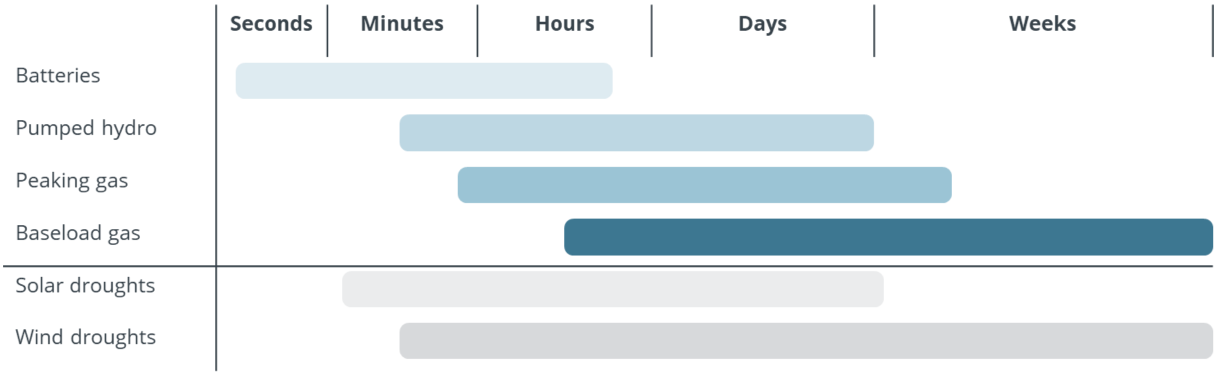
Gas-powered generation that is connected to the gas pipeline network provides effective energy storage over periods of weeks and months, much longer time periods than batteries and pumped hydro can provide. This makes gas-powered generation particularly well-suited to managing energy requirements during sustained periods of low renewable generation, either due to seasonal weather patterns or prolonged renewable droughts.

Solar and wind are the most important sources of variable renewable energy (VRE) in Australia. The electricity available from these generation technologies varies in response to the intermittent availability of wind and solar energy. Solar generation, and wind generation, tends to occur at the same time within regions and even between regions in the National Electricity Market (NEM). This means that when solar or wind generation is not producing much energy in one region, it also tends not to be producing much energy in other regions.

To ensure a reliable supply of electricity, additional generation or storage must be available to meet demand even when variable renewable generation is low. Low levels of VRE generation can persist for a long period of time. Australian Energy Market Operator (AEMO) projections show renewable droughts can last from days to months. In high-VRE generation scenarios, investment is required in additional generation or storage capacity to ensure the lights can be kept on during these renewable droughts.

The flexible nature of gas-powered generation means it is uniquely placed to provide support to renewable generation, protecting the security and reliability of the electricity system. **Figure 1** illustrates the capability of various effective storage options for dealing with renewable droughts.

Figure 1: Effective electricity storage comparison



Source: Frontier Economics

While gas-powered generation is uniquely placed to provide support to renewable generation, long-term investment modelling will often under-value this insurance role for gas-powered generation. Long-term investment models operate in a simplified representation of reality with perfect foresight over states of the world which are, in reality, difficult to predict. Gas-powered generation is well suited to support the system in all conditions and in the event of outcomes not predicted – such as an earlier than expected coal retirement, a long renewable drought or changing ramping requirements over time. While it is difficult to capture this 'insurance' benefit of gas in market modelling, it is important to keep this context in mind in thinking about the future role of gas.

Gas-powered generation provides security that supports renewable generation

The security and reliability provided by the gas-powered generation system in South Australia has enabled the state to achieve the second highest level of VRE penetration in the world. Although the levels of gas consumed in the system reduced during this period, gas-powered generation continues to play a critical role in keeping the lights on in South Australia's high VRE system.

Electricity markets require more than just electrical energy to operate safely and stably. They require additional services broadly classified as security services. Different generation technologies have different capabilities to provide security services. The physical characteristics of gas-powered generation has inherent properties that support system security, and gas-powered generation can provide all generation-based security services required by electricity systems.

Gas-powered generation delivers important benefits in South Australia by providing reliability and system stability in a generation mix with a high proportion of variable renewable energy. South Australia saw a rapid uptake in VRE over the past decade and in the same period saw the retirement of its last coal-fired power station. This change has led to a number of challenges for the system operator, but gas-powered generation proved critical for maintaining system stability and reliability, particular in times of high VRE output.

Gas-powered generation is a cost-effective way to manage renewable droughts

Providing reliable electricity supply in a 100% renewable electricity system is challenging and costly. Gas-powered generation that is connected to the gas pipeline network can allow very high renewable electricity systems (90%+) to function reliably at much lower cost.

To illustrate this, we developed a simplified model of the electricity system in South Australia to analyse the role of gas-powered generation to support an electricity system that is close to 100% renewable. Our modelling found that total system cost is highest with 100% renewable electricity generation and the lowest when the amount of gas generation in the system is not limited.

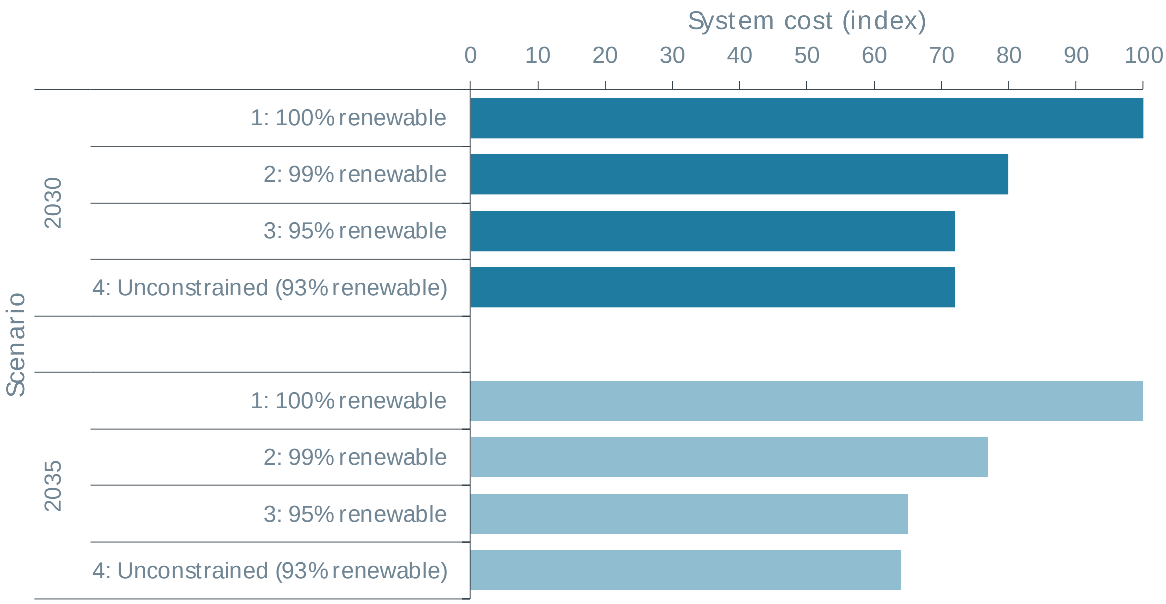
Figure 2 presents total system costs for two VRE output years modelled (2030 and 2035), indexed against the costs of the 100% renewable system costs in each year. It includes four scenarios: the 100% renewable system, a 99% renewable system, a 95% renewable system, and an optimised system (where the level of gas-powered generation is not stipulated) – with 93% renewables.

In 2030, which doesn't contain any particularly long periods of low wind output, the inclusion of a small proportion of peaking gas-powered generation reduced system costs by approximately 28%. In 2035, which features a prolonged wind drought, the inclusion of gas-powered generation reduced system costs by approximately 36%. This difference in system costs amounts to $320 million per annum in 2030 and $475 million per annum in 2035 in the model of the electricity system in South Australia. If these differences in system costs were scaled up to a NEM-sized system they would amount to $5 billion per annum and $7.5 billion per annum. Even if factors like diversity of renewable droughts between regions, or diversity in demand between regions, lessen the available savings in system costs as the NEM approaches 100% renewable (compared to South Australia), it is clear that there is the potential for substantial savings.

The cost differences identified in our model of the electricity system in South Australia primarily relate to the difference in the annualised cost of the mix of generation and storage to meet demand in our simplified model of the electricity system in South Australia. This reduction in total resource costs reflects our finding that investment in some gas-powered generation enables the system to avoid costly and wasteful overbuilding of renewable generation required to deliver system security to manage renewable drought.

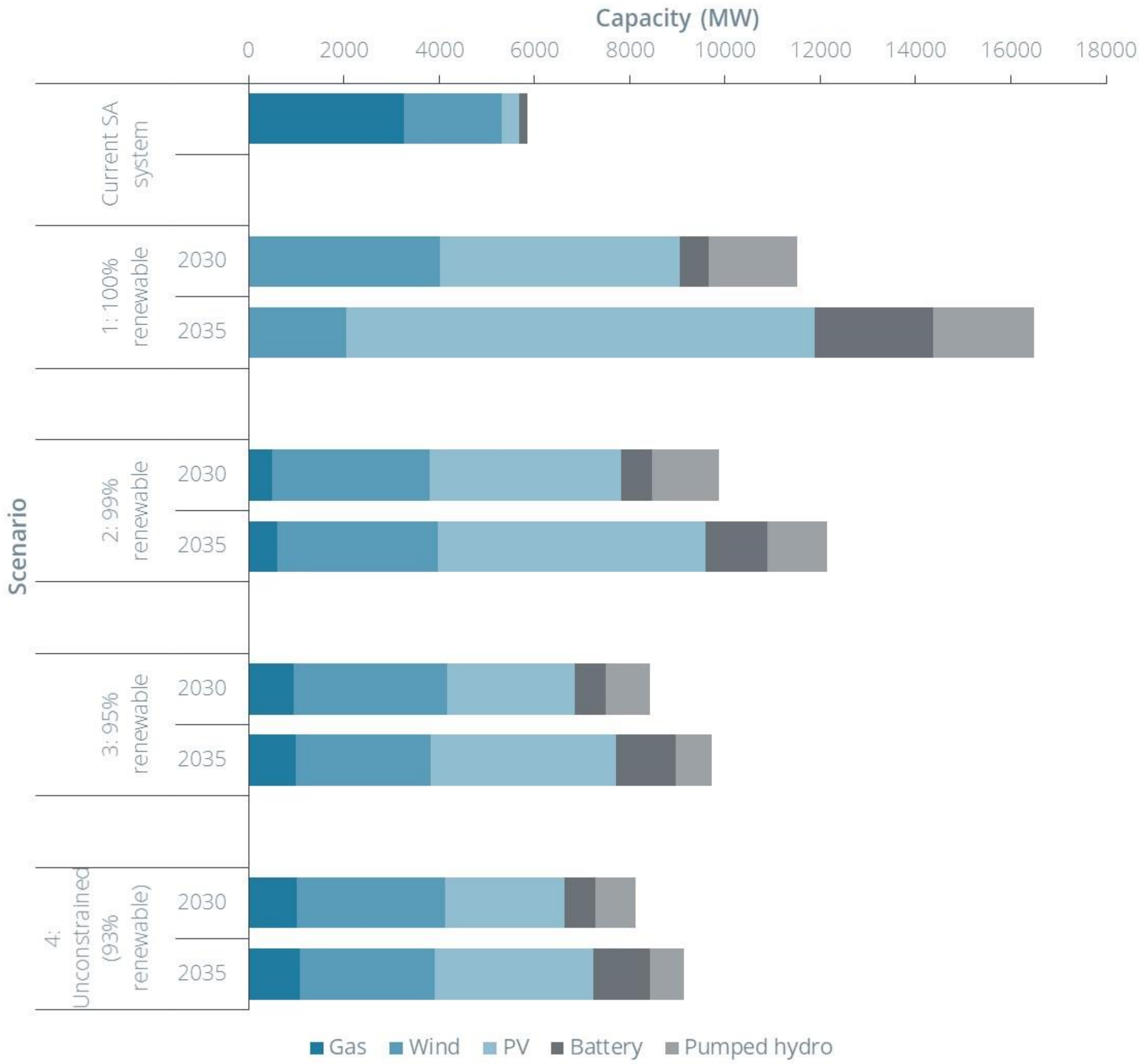
Figure 3 presents the corresponding gas, wind, solar PV, battery and pumped hydro capacity in each scenario, compared with the existing generation mix on South Australia.

Figure 2: Indexed system costs for 2030 and 2035



Source: Frontier Economics analysis

Figure 3: Required electricity generation and storage capacity by scenario



Source: Frontier Economics analysis

Gas powered generation provides a cost-effective means of navigating low wind generation without overbuilding all other components of the electricity system. Allowing for some gas-powered generation reduces costs and improves utilisation of assets materially. While a battery or pumped hydro storage may be depleted over the course of a day, gas-powered generation can continue to provide electricity over many days, weeks or months.

Gas-powered generators can continue to generate as long as they have access to gas. Gas storage in the NEM is plentiful and relatively low cost. This means that gas generators that are connected to gas pipeline network (and therefore are able to make use of the gas storage available through that network) can provide cost-effective 'insurance' against electricity shortages during renewable droughts.

While the simplified model of the electricity system that we developed to analyse the role of gas-powered generation to support an electricity system that is close to 100% renewable suggests that lowest cost would be achieved with gas-powered generation making up 7% of the generation mix, the optimal amount of gas-powered generation will obviously vary depending on the characteristics of electricity network. What our analysis reveals is that the insurance offered by gas-powered generation is primarily driven by the following:

- The intermittent nature of VRE, particularly variations that result in renewable droughts that extend over many days, weeks or months. As the amount of VRE in the system increases, the importance of managing this variation increases.
- The availability of other forms of generation or storage to manage renewable droughts that extend over many days, weeks or months. In the NEM, both coal-fired generation and gas-fired generation are able to provide insurance against renewable droughts because both coal-fired generation and gas-fired generation are able to operate at high capacity for long periods of time. However, as existing coal-fired generation retires over coming decades, the insurance role is likely to increasingly fall to gas-powered generation. As we have seen in South Australia, gas-powered generation becomes increasingly important as coal-fired generation retires.

The insurance provided by gas-powered generation does not imply significant carbon emissions

Much of the benefit of gas-powered generation is based on retaining sufficient capacity in the system to ramp up and provide electricity during periods of low renewable generation. This doesn't necessitate high gas consumption, and is compatible with a future with net zero emissions.

Emissions are only produced when gas-powered generators are generating electricity. Gas-powered generators providing insurance for renewable generation in the future, and therefore running infrequently, are unlikely to produce emissions that would prevent the achievement of net zero emissions.

In the scenarios we modelled, we found that the capacity factors of gas-powered generation can remain low while providing a firming role. For example, in the scenarios that included gas-powered generation, the capacity factor was below 13% in each case. In practice, this means that the emissions from gas-powered generation supporting renewable generation in the future are likely to be relatively limited.

Electricity generated by gas-powered generation in the NEM, and the associated emissions, has fallen in recent years. Our modelling shows gas-powered generation operating to provide insurance is likely to generate infrequently in the future, limiting its carbon footprint.

Improvements in the efficiency of gas-powered generation have reduced operating costs and emissions. As the efficiency of gas-powered generation improves its emissions could fall further.

Potential developments in the NEM assist gas-powered generation in insuring against renewable droughts

The market mechanisms that facilitate electricity supply have not kept pace with the changing roles of different generation technologies. This undervalues the services provided by gas-powered generation and will provide inefficient investment signals in the future.

There are four important initiatives that may address the under-valuation of services provided by gas-powered generation in the future. These include:

- The Retailer Reliability Obligation was introduced to promote investment in dispatchable generation capacity, including gas-powered generation, at times of low reliability.

- The Energy Security Board is considering whether a capacity market can ensure reliable capacity required to deliver energy security is available. This may make it easier for gas-powered generation to support variable renewable energy in the NEM in the future.
- The Energy Security Board is considering if ahead markets can better coordinate and dispatch generators providing security services across the NEM, including gas-powered generators, to protect the security of the energy system.
- Missing markets mean service providers are not directly rewarded for the security products or services they provide. The Energy Security Board is considering arrangements that could support the important role played by synchronous generation, including gas-powered generation, in supporting system security.