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Project Leader, AEMC
Submitted online at: www.aemc.gov.au

Dear Project Leader,

Submission: Efficient Provision of Inertia

CS Energy welcomes the opportunity to provide a submission to the Australian Energy Market Commission's (**AEMC's**) *Draft Rule Determination – Efficient Provision of Inertia* (**Draft Determination**).

About CS Energy

CS Energy is a Queensland-owned and based energy company that provides power to some of the state's biggest industries and employers. We generate and sell electricity in the wholesale and retail markets, and we employ almost 700 people who live and work in the regions where we operate.

CS Energy owns thermal power generation assets, and we are building a more diverse portfolio that includes renewable energy, battery storage, gas fired generation and pumped hydro. We also have a renewable energy offtakes portfolio of almost 300 megawatts, which we supply to our large commercial and industrial customers in Queensland.

Overall views

As the National Electricity Market (**NEM**) transitions to a system with more variable renewable energy (**VRE**), the ability to effectively and efficiently manage grid security and reliability against this evolving landscape is crucial. Reforms are needed to ensure that essential system services (**ESS**) continue to be adequately provided at least cost to maintain grid security as thermal synchronous plants exit the NEM.

CS Energy does not support the draft determination and considers it to be short-sighted, compromising the long-term interests of consumers. The Improving Security Frameworks (**ISF**) should be leveraged now to establish the technical capability and frameworks required for the development of an inertia market in the long-term.

The existing ISF represents a resiliency and efficiency risk to the NEM due to its sole reliance on network solutions to supply inertia services with no explicit market signals for alternatives, i.e. non-network options. While network options may play a key role in the

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provision of ESS, non-network assets could also supply these services and should do so when they offer a more cost-effective alternative. This is particularly true given the non-delivery and delay risks of network assets have heightened due to financeability challenges and supply chain realities.

However, the lack of investment signals for non-network solutions leads to an uneven playing field between network and non-network options, which locks-in more expensive solutions and stifles innovation. This is inconsistent with the National Electricity Objective (**NEO**) of promoting efficient investment and operation in the long-term interests of consumers. CS Energy supports the development of efficient and adaptable frameworks that appropriately value ESS including inertia and provide crucial signals to facilitate investment.

An inertia market is a relatively low-cost[1] and effective approach to address the above risks by providing market signals to invest in non-network options and explore more innovative/cost-effective technologies to supply inertia, which would lead to a more diverse service provision and an overall more resilient power system.

CS Energy considers that the AEMC's proposals to enhance the ISF, while an improvement, do not go far enough in addressing systemic gaps and risks. CS Energy notes that:

- While the Reliability Panel has an indirect influence over inertia requirements through setting operating standards, it has no oversight to protect against the over-procurement of services. To improve the ISF, CS Energy is still of the view that the methodology for determining the minimum levels of inertia should be set by the Reliability Panel to better manage risks associated with over-procurement under the long-term contract framework. This would align with the Reliability Panel's role under the system restart frameworks; and

- The long lead time for market creation and investment in capability means that when an emerging inertia shortfall is identified by the Reliability Panel, it is unlikely that a market can be established in time to address the shortfall. Further, while the Australian Energy Market Operator (**AEMO**) can increase the visibility of its technical work, there is seemingly a lack of a transparent structured program with an overarching objective, progress monitoring and accountability. This was demonstrated by the 2024 Transition Plan for System Security (**TPSS**). To address these issues, AEMO should start developing a systematic technical work program to progress market procurement by leveraging the ISF, with oversight and progress reporting by the Reliability Panel.

[1] As a comparison, the wholesale demand response mechanism (with limited uptake) has cost close to $15 million to implement, while an inertia market (potentially with broad efficiency benefits) is expected to cost between $5 million and $10 million to implement (as estimated by the AEMC's consultant, HoustonKemp).

Analysis based on inaccurate assumptions

The AEMC's draft determination has been made on the basis that material net benefits of an inertia spot market are unlikely to be realised in the near-term. CS Energy considers this assessment to be flawed as it:

- Assumes that the marginal value of inertia services provided by synchronous generators is zero by not compensating these units for services supplied. In an environment where most generators are synchronous units, the marginal value of these services is likely to be low as they are provided in abundance as a by-product of generation. However, as the NEM transitions to more VRE with thermal units retiring, the marginal value of inertia services supplied by remaining synchronous units would appreciate as these services become increasingly scarce. These instantaneous inertia services are also the most valuable as they contribute to the minimum inertia levels required to maintain grid security;

- Overestimates the inertia supply from existing synchronous generators by basing it on the nameplate capacity and current expected retirement dates of these plants. The operational availability of these plants leading up to closure is likely to be uncertain due to market dynamics and it is likely that units will commence seasonal operation. This is particularly true if inertia services made available through energy dispatch are not fairly compensated. During periods of low and negative spot prices when inertia is most likely to be valued, there is little incentive for synchronous units to remain operational; and

- Underestimates inertia demand by assuming a static level up to 2045. Such an assumption does not appropriately account for the future nature of contingency events that may increase inertia need, which is expected to change as the NEM becomes more weather dependent with evolving network and generation topology. AEMO highlighted in its recent General Power System Risk Review (**GPSRR**) draft report[2] that contingency sizes may increase due to more generation being connected via high-capacity transmission lines and a higher likelihood of distributed PV shake-off (i.e. the sudden disconnection or output reduction following power system disturbances). Larger contingency size would increase the level of inertia needed to maintain system security. The GPSRR also noted resiliency risks stemming from more VRE generation relying on inertia from other sources, which means that any contingency events that separate them may cause wide-ranging impacts. Changes in contingency size from the demand side are also expected with the anticipated growth of new large loads such as data centres.

In summary, these flawed assumptions have artificially diminished the potential benefits of an inertia market. Further, a market that appropriately compensates synchronous generators for inertia supplied (in line with their marginal values) would yield efficiency benefits by incentivising more cost-effective existing units to remain operational to manage the transition, thereby minimising costs for consumers.

Market signals also deliver the benefits of reducing the resiliency risk that AEMO identified by incentivising a broader pool of inertia providers to increase the diversity of supply (both geographically and technologically). These considerations would also enhance the materiality of benefits associated with an inertia market. These are just the direct benefits; indirect benefits would accrue from increased locational capability to assist in black start restoration, a need identified by AEMO.[3]

[2] AEMO, 2025 General Power System Risk Review Report – Draft, June 2025.
[3] Reliability Panel, Review of the System Restart Standard Issues Paper, December 2024.

Limited market signals for non-network options

The AEMC noted that, under the ISF, inertia requirements would be predominantly met by new synchronous condensers with flywheels attached or grid-forming plants commissioned by Transmission Network Service Providers (**TNSPs**) to fulfil their system strength obligations, before large synchronous plants can retire.

This approach represents a resiliency and efficiency risk to the NEM due to its sole reliance on network solutions to supply inertia services with no explicit market signals for alternatives. The non-delivery and delay risks of network assets have heightened due to financeability and supply chain challenges. Further, under the ISF, TNSPs currently face no real repercussions for the delay or non-delivery of network solutions.

For example, Transgrid noted that it is facing financeability challenges in maintaining its investment-grade credit rating while investing in synchronous condensers. It is currently seeking underwriting support for up to $700 million from the New South Wales Government to purchase five synchronous condensers.[4] Further, securing synchronous condensers in a timely manner is becoming more challenging as demand for these assets is increasing rapidly, leading to longer delivery times. It was reported in 2023 that delivery timeframes for synchronous condensers have been extended from 18 months to 30 months[5] and this is likely to now be even greater. A delay in synchronous condenser delivery can be costly. For example, Transgrid estimated that such a delay could reduce the net benefit of these assets by $2.2 billion.[6]

The lack of market signals for non-network solutions also leads to an uneven playing field between network and non-network options. For example, the installation of a synchro-self-shifting (**SSS**) clutch in a gas turbine system is commonly regarded as a cost-effective and straightforward non-network solution to provide inertia services.

However, there are complex economic and engineering trade-offs involved in such an option. For a combined-cycle system, our preliminary investigation found that the installation of a clutch on a larger gas turbine, while theoretically possible, is engineeringly untested as such an option has never been deployed in practice. This unproven solution carries inherent engineering risks, likely leading to performance and reliability issues or even failures.

An alternative option is to install clutches on two smaller gas turbine systems to provide inertia services. While such a solution has been implemented overseas, it involves substantial cost, capacity and efficiency trade-offs. Specifically, this two-turbine configuration is significantly more expensive, around 10% to 20% lower in capacity and 2% to 4% less fuel efficient relative to a single larger turbine configuration.

In addition to being more costly to construct and operate, a two-turbine configuration would lead to reduced revenue from the wholesale electricity market compared to a single larger turbine configuration. This is due to the trade-offs contributing to less available capacity with higher short-run marginal costs (owing to reduced efficiency), which means a two-turbine configuration would operate at lower levels, and less frequently, only during periods of higher spot prices.

These complex trade-offs are likely to be applicable across non-network solutions from multi-use assets. Without an inertia market providing marginal and scarcity signals to account for these trade-offs, it will be more challenging for non-network solutions to be

[4] The Australian Financial Review, Transgrid seeks government support for vital $700m grid investment, March 2025.
[5] DIgSILENT Pacific, Repurposing existing generators as synchronous condensers, June 2023.
[6] Transgrid, Meeting system strength requirements in NSW, RIT-T Project Assessment Conclusions Report (PACR), July 2025.

viable, thereby leading to an uneven playing field between network and non-network options. A market mechanism would level the playing field by allowing for transparent and efficient price incentives that reflect the prevailing supply-demand balance, which will encourage the participation of a wider range of different assets and technologies.

The absence of market signals locks-in more well-established network technologies (that may become less efficient or obsolete over time) and stifles innovation (due to the lack of incentive to explore more novel and cost-effective non-network solutions). For example, the risk of over-procuring network assets arises as TNSPs are less concerned about the efficient utilisation of their assets as they recover their costs regardless of the rate of asset utilisation. These outcomes are inconsistent with the NEO to promote the efficient investment in and operation of electricity services in the long-term interests of consumers.

The ISF should be enhanced further to manage risks

In the draft determination, the AEMC proposed measures to improve the ISF, including by instructing the Reliability Panel to monitor system conditions and encouraging AEMO to increase the visibility of its technical work. CS Energy considers that these proposals, while an improvement, do not go far enough in addressing systemic gaps and risks in the ISF.

In relation to minimum levels of inertia, while the Reliability Panel indirectly influences inertia requirements through the determination of the Frequency Operating Standard (**FOS**), it has no oversight to protect against the over-procurement of inertia services.

This is in the context of significant challenges involved in accurately forecasting inertia requirements, especially over a longer time horizon. Minimum inertia demand fluctuates in real-time according to the nature of contingency events and is likely to vary significantly over-time and at different locations due to the NEM's evolving topology with new generation and load. Due to these challenges, AEMO's projected minimum inertia is likely to be more conservative, which increases the risk of over-procurement. To better manage such a risk and improve the ISF, CS Energy is still of the view that the methodology for dynamically determining the minimum levels of inertia should be set by the Reliability Panel. This would be consistent with the governance arrangements in place for system restart services, with the Reliability Panel setting the aggregate level of reliability of restart services in each identified sub-network.

To inform the need for an inertia market, the AEMC intends to ask the Reliability Panel to monitor system conditions, including emerging inertia shortfall, delays in infrastructure roll-out and early retirement of synchronous generators. However, the long lead time for market formulation and capability investment means that, when an emerging inertia shortfall is identified, it is unlikely that a market can be established in time to incentivise non-network options to address this shortfall.

This lead time is not only a function of the technical work required for market creation but also the extended time needed to operationalise assets given supply chain issues such as increased global demand and materials/labour shortages. In other words, if the non-delivery or delay of network solutions eventuate, the lack of a timely market to incentivise alternative investment would necessitate greater reliance on AEMO directing remaining thermal synchronous units, which may not be adequate to address the inertia shortfall and certainly not cost-effective.

Further, while AEMO can be encouraged to increase the visibility of its technical work through the TPSS, there is seemingly a lack of a transparent structured program with an overarching objective, progress monitoring and accountability. An appropriate objective

would be to progress the unbundling of inertia from other ESS in order to move from an asset-based to a service-based framework. Without such a program, it is unlikely that further visibility of AEMO's work would be sufficient, by itself, to support industry confidence and enable system readiness to transition to an inertia market. This was reinforced by the 2024 TPSS which fell well short of its intended nature.

CS Energy is also concerned that AEMO has limited incentive to use the ISF's Type 2 contracts to trial and demonstrate provision of inertia by non-traditional technologies, such as grid-forming inverters. For example, AEMO anticipates to only enter into only one or two Type 2 contracts per year in an ad hoc manner.[7] These Type 2 trials need to be systematic with a clear governance framework to effectively facilitate technical development and market readiness.

To address these lead time and framework issues, CS Energy considers that AEMO should start developing a systematic technical work program to progress market procurement by leveraging the ISF, especially Type 2 contracts. Accountability for this work program should be enhanced with oversight and progress reporting by the Reliability Panel through terms of reference issued by the AEMC. This would enhance the ISF by improving the focus, transparency, coordination and avoiding duplication of AEMO's different technical workstreams. An example of a robust governance framework would be Ireland's transmission system operator's (**Eirgrid's**) *Operational Policy Change Process*, which allows Eirgrid to trial, monitor and update its operational procedures subject to oversight by an expert panel.[8]

Governance framework for ESS under the ISF

On a more strategic level, CS Energy also considers that the broader ISF's governance framework should be enhanced to develop a pathway for establishing enduring market mechanisms beyond the transition for ESS, including for system strength, inertia and voltage control services. Specifically, an enhanced governance framework should mandate that AEMO establishes a transparent and systematic work program to trial the technical/economic unbundling of ESS with the aim of facilitating market mechanisms by leveraging the ISF's Type 2 contracts.

Accountability for such a program could be achieved by expanding the remit of the Reliability Panel to include the monitoring, reviewing and critiquing AEMO's progress in the unbundling of ESS. As CS Energy has consistently noted in its submissions, separate markets for unbundled ESS are the most economic, transparent and efficient means to value, procure and deliver ESS.

If you would like to discuss this submission, please contact Wei Fang Lim, Market Regulatory Manager, at wlim@csenergy.com.au or on 0455 363 114.

Yours sincerely

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[7] AEMO, 2024 Transition Plan for System Security, Dec 2024.
[8] Eirgrid and Soni, Operational Policy Roadmap 2023–2030, December 2022.