Your ref: ERC0339

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Mr John Kim
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Submitted online at: www.aemc.gov.au

Dear Mr Kim,

Submission: Efficient Provision of Inertia

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

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, hydrogen-ready 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. CS Energy's vision is to lead Queensland's energy transformation to create a better future.

Overall views

As the National Electricity Market (**NEM**) transitions to a system with more variable renewable energy (**VRE**) resources, 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 baseload synchronous generation exits the NEM.

In this context, CS Energy supports the development of efficient and adaptable frameworks that appropriately value inertia services and provide crucial signals to facilitate investment

in assets that supply inertia. Such frameworks would be more efficient, improving system security outcomes and minimising costs for consumers in the long-run.

In the short to medium-term, CS Energy supports:

- the procurement of minimum inertia via long-term contracts, with the methodology for determining the minimum level set by the Reliability Panel. CS Energy expects the providers of this minimum inertia to be diverse and over time comprise of traditional and non-traditional providers;

- the establishment of an inertia market ancillary to the energy and frequency control ancillary service (**FCAS**) markets. This represents a relatively low-cost approach that will open up opportunities for diverse service provision, reducing resiliency risks; and

- systematic trials of low carbon inertia services such as grid forming inverters facilitated by the Improving Security Frameworks (**ISF**).

In the longer-term, CS Energy supports the evolution of the long-term contract procurement of minimum inertia to a real-time market in order to realise the benefits of such a market. This approach allows time for the Australia Energy Market Operator (**AEMO**) to develop capabilities necessary to transition to operational procurement and the inertia market to mature with greater depth and diversity of services, thus enhancing market resilience.

Detailed Comments

The Directions Paper outlines the AEMC's economic assessment of the potential operational procurement of inertia (i.e. every 5 minutes), noting that:

- The minimum level of inertia required for secure system operation is unsuitable for operational procurement due to its critical role in system security and high costs of undersupply. For these reasons it posits minimum inertia should instead be sourced through long-term contract-based arrangements; and

- Additional inertia above the minimum level is more suitable for operational procurement as the undersupply of additional inertia does not pose immediate system security risks. Instead, the operational procurement of additional inertia can deliver benefits by:

    - Reducing frequency management costs through the co-optimisation of inertia and fast frequency response (**FFR**) services; and
    - Improving dispatch efficiency through the alleviation of inertia related constraints, which may allow lower-cost generation to be dispatched, depending on constraint formulation and market bids.

<u>Defining minimum inertia</u>

The Directions Paper assumed a static level of minimum inertia up to 2045 based on AEMO's projections required under the planning framework. It also postulated that this level would be met largely by existing generation dispatched for energy and potential synchronous condensers with flywheels attached procured by Transmission Network Service Providers (**TNSPs**) to fulfil their system strength obligations.

There is a lot of uncertainty not considered by these assumptions:

- Coal retirement timings are uncertain as is their operational availability leading up to closure. This is particularly true if their inertia services made available through energy dispatch are not fairly compensated. During periods of low and negative spot prices when their inertia is most likely to be valued, there is little incentive for synchronous generators to remain operational. This would then necessitate reliance on more expensive inertia services or directions to maintain grid security; and

- The future nature of contingency events, which are expected to change under the evolving network and generation topology of the NEM, has not been considered:

    - The AEMC noted that inertia demand will decline as VRE resources replace synchronous generators given their superior ability to withstand higher rates of change of frequency (**RoCoF**). However, firming this system will require gas and hydro plants whose size may determine the contingency. Also, more studies are needed to better understand the effects of these plants' RoCoF withstand capability and its impact on inertia demand;

    - Further, as the NEM transitions to more VRE generation, ramping events (i.e. large fluctuations of generation over short periods) are likely to increase in frequency and severity. This is likely to affect the future nature of credible and non-credible contingencies;

    - Depending on the nature and topology of their connection to the transmission network, large clusters of VRE projects in Renewable Energy Zones (**REZs**) may increase the overall size of contingencies and therefore the minimum level of inertia required;

    - While the imposition of protection schemes could reduce the effective contingency size and required minimum inertia, it is likely that such schemes would be less cost-effective relative to a more efficient and competitive framework such as real-time procurement of inertia. Further analysis will be needed to better understand the cost/efficiency implications of protection schemes; and

    - The changing nature of inertia from the demand side has not been considered. Load-side inertia from industrial synchronous motors is expected to decline and new loads stemming from electrification of vehicles and industrial processes, hydrogen production and data centres are projected. These loads can be very substantial and would likely increase the contingency size and therefore minimum inertia needed.

CS Energy considers there a need for AEMO to develop a robust methodology for determining the minimum level of inertia dynamically with oversight from the Reliability Panel. This would be required regardless of the procurement framework developed.

Such work would need to consider the potential providers of inertia and the resiliency risks of a system with low diversity of supply (both geographically and technologically). The Directions Paper refers to TNSP obligations under the system strength framework and draws upon assumptions that 36 synchronous condensers will be built and will contribute to minimum inertia. This approach represents a resiliency and efficiency risk to the NEM as it stifles innovation, locks in expensive resources and ignores supply chain realities.

CS Energy does compliment the approach Powerlink is undertaking in its procurement of system strength services. While it has identified that a portfolio of synchronous condensers

represents the most economical outcome at present, it acknowledges that this may change as the market evolves. For example, Powerlink acknowledges that new gas or hydro plant may have the capability to run in synchronous condenser mode if incentives are there, an option not considered in the Directions Paper. Rather than invest in the full suite of synchronous condensers upfront, Powerlink is investing in three as "no regrets" and allowing the market to demonstrate its capability in the interim.[1]

Procuring minimum inertia

CS Energy acknowledges the risk of undersupplying minimum inertia poses to system security. However, similar risks exist in the procurement of energy and FCAS, where an undersupply of these services can also lead to system instability and outages that impose substantial economic costs.

While the costs of undersupply are theoretically high, the risk of these costs eventuating is largely mitigated by the operational procurement of energy and FCAS through spot markets. This is because spot markets provide transparent investment and scarcity signals that facilitate supply adequacy at least cost.

The recently commenced very fast FCAS market is a good case in point. Since its commencement in October 2023, the very fast FCAS market has matured rapidly with substantial increase in service availability and average availability consistently exceeds enabled services. For example, for Q2 2024,

- Contingency raise of 1-second services' (**R1SE**) enablement averaged 277 MW with availability averaging 654 MW;

- Contingency lower of 1-second services' (**L1SE**) enablement averaged 27 MW with availability averaging 513 MW;

- Victorian Big Battery, Hazelwood Battery Energy Storage System and Riverina collectively increased their availability of R1SE and L1SE by 186 MW and 165 MW respectively compared to Q1 2024.[2]

Therefore, CS Energy considers that the risk of undersupplying minimum inertia could be substantially mitigated through transparent and effective investment signals provided by an operational procurement framework with residual risk addressed through out-of-market mechanisms such as AEMO's directions framework and an equivalent Reliability and Emergency Reserve Trader (**RERT**).

Conversely, long-term contract-based frameworks:

- Are less transparent in terms of investment signals due to their bilateral nature and limited disclosure, which would likely reduce the incentive for service providers to explore new innovative and more cost-effective technologies to supply inertia;

- Increase the risk of over-investment in more well-established technologies that supply inertia, which may become less efficient or obsolete over time. This risk should be explored by the AEMC as part of its economic assessment; and

- Would likely over-procure services due to challenges involved in accurately forecasting minimum inertia requirements, especially over a longer time horizon. Minimum inertia

[1] Powerlink, Addressing System Strength Requirements in Queensland from December 2025, November 2024.
[2] AEMO, Quarterly Energy Dynamics Q2 2024, July 2024.

demand fluctuates in real-time according to the nature of contingency events, which is influenced by dispatch outcomes, network constraints, interconnector flows and other system conditions. Further, inertia requirements are likely to vary significantly over-time and at different locations due to the evolving NEM's topology with new generation, load and REZ developments. Due to these challenges, projected minimum inertia is likely to be more conservative, which increases the risk of over-procurement and costs for consumers in the long-run.

Unlike a long-term contract-based framework, operational procurement:

- Provides transparent investment and scarcity signals that:
    - Encourages more efficient and targeted investment to supply inertia services and therefore facilitates supply adequacy at least cost;
    - Incentivises service providers to explore new innovative and more cost-effective technologies to supply inertia; and
- Allows for inertia to be determined in real-time (likely with greater level of accuracy).

On the basis of these considerations, CS Energy favours the operational procurement of minimum inertia over a long-term contract-based framework.

CS Energy acknowledges that in the near-term minimum inertia would need to be contracted, allowing AEMO the time to perform the necessary steps to evolve to operational procurement.

Under the ISF rule, AEMO is required to determine:

- Minimum inertia requirements for all regions, including for interconnected and islanded operation;
- The least cost combination of long-term contracts to meet system security requirements (including inertia and system strength) and enabling these contracts as close as practicable to real-time but no more than 12 hours in advance of the relevant dispatch interval.

This framework marks the beginning of a market and lays down the foundation for real-time procurement of inertia. An example of a successful transition is the FCAS market, which was converted from a centrally managed contract framework to a real-time market. To facilitate this transition, CS Energy considers that AEMO should develop a framework with scope specified under the National Electricity Rules (**NER**) and oversight from the Reliability Panel.

Over time, the inertia market will mature with greater liquidity coupled with AEMO's improved operational capability would substantially address any potential risk of undersupply. This in turn allows for the transition that facilitates the realisation of efficiency and innovation benefits stemming from the operational procurement of inertia, which lowers costs for all consumers. Residual undersupply risk could be effectively addressed through out-of-market mechanisms such as AEMO's directions framework and the RERT.

AEMO should also use the ISF framework to demonstrate the provision of inertia by non-traditional technologies such as grid forming inverters through systematic trials. CS Energy would like to see a scope of tasks specified under the NER and oversight by the Reliability

Panel to promote transparency and accountability and an appropriate level of operational planning. 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.[3]

Additional inertia

CS Energy supports the operational procurement of additional inertia as it provides crucial pricing signals to encourage investment in assets that supply inertia services. It is a relatively low-cost approach to optimising the benefits of inertia provision and will facilitate a diversity of inertia providers and help manage system risk.

As an interim measure, the co-optimisation of contract enablement and real-time procurement of additional inertia will deliver an efficient level of inertia. The real-time procurement could also be used to cover unexpected shortfalls in the provision of minimum inertia.

CS Energy prefers a separate ancillary market for inertia as opposed to co-optimising it within the FFR service. The AEMC highlighted that additional implementation costs for an inertia spot market could arise from the need for real-time monitoring of inertia. However, under the ISF framework, AEMO already needs to undertake such monitoring to determine minimum inertia demand in real-time. Therefore, including these monitoring costs would artificially inflate the implementation costs of an inertia spot market.

It was also noted in the Directions Paper that technical challenges may arise in terms of constraint formulation when co-optimising inertia with other system requirements. CS Energy considers that learnings from Tasmania could assist in overcoming this challenge. For example, FCAS requirements have been a function of system inertia for some time in Tasmania, which allows for the non-linear relationship between inertia and fast FCAS to be appropriately incorporated.[4]

If you would like to discuss this submission, please contact Wei Fang Lim, Market Regulatory Manager, [redacted] or on [redacted]

Yours sincerely

[redacted]

Dr Alison Demaria
Head of Policy and Regulation

[3] Eirgrid and Soni, Operational Policy Roadmap 2023–2030, December 2022.
[4] Hydro Tasmania and TasNetworks, Managing a High Penetration of Renewables – A Tasmanian Case Study, August 2016.