AEMC

ERC0339: Efficient provision of inertia

STAKEHOLDER FEEDBACK

SUBMITTER DETAILS

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PROJECT DETAILS

NAME OF RULE CHANGE:	Efficient provision of inertia
PROJECT CODE:	ERC0339
PROPONENT:	Australian Energy Council
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CHAPTER 1 – THE CONTEXT FOR THIS RULE CHANGE REQUEST

Comments	**GWA:** Goldwind recommends that the AEMC ensures that in seeking the efficient provision of inertia it considers the inertia and inertia-like products available from non-synchronous machines. Wind plants that are operating at grid-forming mode can support inertia, but their capacity is subject to network conditions and limited by the kinetic energy available in the turbine blades and drivetrains. With battery added to enhance the grid-forming capability for wind plants, their ability to provide inertia support can be extended. The use of Inertia Based Fast Frequency Response (IBFFR) should also be considered as an inertia-like product.

CHAPTER 2 – PROBLEM DEFINITION

1. Technical information on inertia	Do stakeholders consider there is any additional technical information required to assess the challenges and long-term system requirements related to inertia beyond what AEMO is doing? Do stakeholders have their own technical information or studies that can be shared to help answer these questions?

		GWA: It is not clear how the inertia could be measured and valued for participants in the proposed inertia spot market. The response time delay and expected duration of the active power inertia response are not clear in the consultation paper. That information are critical for some potential participants to decide if the available synthetic inertia is sufficient to participate in the proposed inertia market. An example of a wind farm's capability to provide the Inertia Based Fast Frequency Response is provided below. Please refer to the links below for more information. 1. Field Study at Gullen Range Wind Farm - Australian Renewable Energy Agency (ARENA) https://arena.gov.au/knowledge-bank/field-study-at-gullen-range-wind-farm/ 2. Findings from the demonstration of Inertia Based Fast Frequency Response https://arena.gov.au/assets/2020/10/field-study-at-gullen-range-wind-farm.pdf 3. What is Inertia Based Fast Frequency Response? (arena.gov.au) https://arena.gov.au/assets/2020/09/what-is-inertia-based-fast-frequency-response.pdf The IBFFR technology could enable the wind plant to mimic the behaviour of conventional synchronous machines to provide fast frequency regulation. It utilizes the kinetic energy (inertia) of the wind turbine blades (or drivetrains as well) to boost the active power output to try to maintain the demand and generation balance during system frequency drops. It may not be the exact "inertia" as defined in the traditional way, but it offers some features to act as inertia supports: a. about 1s fast response speed b. utilizing the kinetic energy c. lasting for up to 10s boosted MW output d. available even at full output condition This technology could provide several hundreds MW those inertia-like support even only by the already installed GW WTGs in Australia, through retrofitting these turbines with very low cost. It is also aligned with the intention of the Essential System Service (ESS) to efficiently promote consumer's interests in the usage of the electricity grid. Therefore, non-synchronous or grid following technologies which provide synthetic inertia should also be considered as eligible participants in the proposed inertia spot market.
2.	Inertia procurement and allocation in real-time	What are stakeholders' views on the merits (or not) of defining and procuring inertia requirements dynamically in operational timeframes, as opposed to the current approach (that is, annual assessments that inform longer-term inertia procurement to specified minimum levels)? **GWA:** The idea of procuring inertia requirements dynamically is benefiting the whole groups of consumers. This will impact the bidding decisions for the potential participants with existing inertia supporting facilities and would be one of the main considerations of new investment in the proposed inertia spot market. Therefore, sufficient information must be provided to the potential participants and investors.

3. Investment signals for inertia	What are stakeholders' views on the adequacy of the current inertia framework in providing long-term investment signals and the need for reform? **GWA:** The current inertia framework is not sufficient as new generation is justified based on the ability to deliver the lowest cost of energy and additional services would be a secondary consideration at best. We would expect that some additional signalling or standards may be needed to encourage future investment in inertia. A challenge, though, is assessing how much inertia is needed. For thermal generators, their control systems need to be quite slow due to the mass of the spinning components. With inverter-based generators they can respond quite quickly. That suggests that as the system transitions to more inverter-based generators, the system will be able to respond more quickly so would need less inertia than it currently requires. Furthermore, the Primary Frequency Response Requirements (PFRR) and the Fast Frequency Response Market are managing the NEM frequency security. Their impacts on the NEM frequency environment are not finally determined. Therefore, the need for inertia market should be thoroughly evaluated before implementing the inertia spot market and additional clear investment signals or standards should be rolled out to encourage investment in inertia market.

CHAPTER 3 – THE AEC'S INERTIA SPOT MARKET PROPOSAL AND ALTERNATIVE OPTIONS

4. Will the AEC's proposed solution best address the problems raised?	What are stakeholders' views on the AEC's proposed solution? Is it the best solution to improve the: • efficiency of inertia provision in the operational timeframe? • efficiency of inertia provision in the investment timeframe? • transparency of the power system's inertia requirements? **GWA:** AEMC tries to ensure the least-cost mix of frequency control services is dispatched in its proposal of the inertia spot market and finally achieve an unbundled most efficient inertia procurement method. However, in addition to the suggested technologies, others may also have certain capabilities to provide inertial support, such as grid following inverter-based wind farms with Virtual Synchronous Generator control or IBFFR capability. The advantages include: a. Better utilize the existing IBRs, such as wind farms with abilities to provide inertia, reduce the total investment in the NEM b. Encourage the existing generations to do technical upgrading to participate in the inertia market, with possible lower cost (modify control, algorithms, none-hardware investment) More information about the criteria of being a participant in the proposed inertia market must be provided, to value all inertia and

	inertia-like capability and reduce the risk of inertia shortfall at the lowest cost. AEC needs to accommodate specs that do not inherently favour synchronous machines – therefore technical studies will also need to assess system needs not only from an inertia perspective but also a response time perspective. We suggest testing a hypothetical grid to investigate if with IBRs-only based forms of inertial support, the system can operate to the same quality levels. This would inform whether the procurement of inertia will need to distinguish between rotational inertia and "synthetic" inertia. Should such a scenario prove to be feasible, then this provides a pathway for a technology agnostic specification for inertia provision. Supportive of dynamically determining the inertia requirements, however that is dependent on having a technology neutral. Anything that tends to favour synchronous machines primarily will distort the market, especially as the existing generators decommissioned over time.
5. Alternative options	Do stakeholders consider that any of these options address the problems identified (see Chapter 3) more effectively than the proposed solution of an inertia spot market? Are there any additional options not identified in this consultation paper that should be investigated? **GWA:** Transparency is key in whatever solution that is adopted. An opaque system where only AEMO makes decisions behind closed doors with no clearly defined criteria will lead to a negative impact on long term consumer prices. On that basis, any adopted option be it AEC's proposal or any one of the alternative options will require AEMO and AEMC to define what counts very clearly as inertia and what does not.
6. Implementation consideration	What are stakeholders' views on the implementation considerations identified? **GWA:** We believe we can find an efficient balancing where RoCoF is controlled within the system need and the level of inertia is enough to maintain that RoCoF rather than having unnecessarily high inertia. As part of the AEMO assessment to determine the system inertia needs during system normal, we suggest this trade-off is considered – this may not be part of the current methodology used for deriving the minimum inertia requirements for each region.

CHAPTER 4 – MAKING OUR DECISION

7. Assessment Framework	Do you agree with the proposed assessment framework? Are there additional principles that the Commission should take into account or principles included here that are not relevant? **GWA:** There is no clear guidance on how IBRs can contribute to inertia market. Normally, the provision of inertia can be a relatively minor upgrade for IBRs, which investors could choose to make up front given the potential to participate in the inertia market. Any guidance that favours synchronous machines purely from the point of view of being the status quo as well as

	the more well understood option, will likely prevent those incremental investments.

OTHER COMMENTS

8. Additional comments	**GWA:** In the Market Ancillary Service Specification Version 8.0, two new markets are added for very fast frequency control ancillary services (FFR), where a fast active power response time of 1s is considered. There is no clarity on the expectation of inertia based active power response time from IBRs (either grid forming or grid following), which may be faster than current FFR market. Additionally, more clarification on inertia definition is required, especially on considering the synthetic inertia provided by IBR technologies in inertia definition. AEMC should clarify/unify all those definitions in official documents.