31st August 2023

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Ms. Anna Collyer
Chair
Australian Energy Market Commission
GPO Box 2603
SYDNEY 2001
Lodged via AEMC portal submission.

NATIONAL ELECTRICITY AMENDMENT (CLARIFYING MANDATORY PFR OBLIGATIONS FOR BIDIRECTIONAL PLANT) RULE 2023 – ERC0364

Dear Ms Collyer,

Toshiba International Corporation (TIC) – Australia appreciates the opportunity to respond to this consultation paper from the perspective of an original equipment manufacturer that has operated in Australia for over 40 years. With a portfolio of 12GW of Thermal Generation, 4.2 GW Hydro,1.3GW Pumped Hydro and 27GVA of Transformers, we have been an essential part of the development of Australia's power generation & transmission system.

Toshiba Energy Systems and Solutions business embraces a portfolio of energy systems, including, nuclear, thermal, hydro, new technology, renewable wind / solar generation and energy aggregation including battery energy storage systems and hydrogen. Toshiba also provides leading solutions in electricity transmission & distribution that deliver electricity directly to end users, along with digital, communications, control & automation technologies that support the operation of our energy markets.

As energy markets transition to a clean energy future, we are focused in supporting the orderly decarbonized transition of the Australian electricity market by:

- Supporting our existing thermal generation customers to supply safe and secure generation while also transitioning the machines to provide more flexible firming generation and to operate to their end of life reliably.
- Supplying the development of new main equipment for pumped hydro projects.
- Supplying key power electronics and transmission & distribution equipment for solar and wind projects.
- Supplying innovative technology solutions, and in particular for this submission, a bi-directional battery energy storage system capable of provide primary frequency response (PFR) services. Toshiba's battery chemistry is based on a lithium titanium oxide (LTO) anode that enable up to 6C (Charge & Discharge rate) high power application, 20,000+ cycle life with no idle degradation, rapid charging capability in 6 min charges up to 80% and finally are intrinsically safe with no thermal runaway (i.e. nil fire risk).

Although the AEMC position is to take a technology agnostic approach in the development of a clean energy market, we would recommend the AEMC consider the need for a classification framework to evolve for bi-directional units as it previously did with the classification for generating

units where today there are both scheduled and semi scheduled generators due to their technology characteristics and capabilities to provide energy and system services.

We also hope that with the introduction of a primary frequency payment mechanism in the form of a double-sided causer pay or a similar mechanism, this will also coincide with the phase out of scheduled and semi scheduled generator units being required to provide mandatory PFR. By confirming this phase out, the correct market signals will be provided to introduce innovative solutions where AEMO can seek competitive offers from all technologies to voluntarily provide PFR with only the cheapest providers used.

With respect to the Commission's questions, TIC provide the following responses.

> QUESTION 1: ISSUE 1 — NON-INCLUSION OF SCHEDULED BIDIRECTIONAL UNITS IN THE MANDATORY PFR OBLIGATIONS WHEN DISCHARGING
>
> - What are stakeholders views on the proposal to clarify the scheduled BDU's be required to provide PFR when discharging?
> - Is it consistent with the Commission's final determination for Mandatory Primary frequency response rule for scheduled bidirectional units to be included in the mandatory obligations?

As per above, TIC propose there be a phase out of scheduled and semi scheduled generators to provide mandatory PFR and therefore the same should apply to BDU's. Additionally, when PFR services are provided this service should be a voluntary remunerated obligation.

We also recommend that based on the various BDU's battery chemistry limitations the Commission should consider introducing a new participation and classification framework of "semi scheduled "Bi-Directional Units as outlined below.

- A semi scheduled, bi-directional unit which is not required to provide PFR as it is either technically unable to provide (flow battery) or for certain high energy battery chemistries with low cycle life such as LFP, NMC and NCA where they decide either commercially and/or from a battery life or fire risk perspective do not wish to provide PFR.
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- Where the existing classification for a scheduled bidirectional unit must provide PFR when enabled for market ancillary services and that in the future such a unit could also provide additional remunerated system strength services such as synthetic inertia and system restart services.

This type of BDU in a future electricity market, with a lower share of scheduled synchronous generation, will be needed and market mechanisms need to be developed for drive the development of innovative technology solutions.

We also recommend that different scheduled & semi-scheduled generation & BDU units by capacity and type, all with varying frequency control settings, can improve control of power system frequency in a more technically robust and cost-effective delivery than a one size fits all mandatory PFR approach.

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QUESTION 2: ISSUE 2 — LONG-TERM PROVISION OF PFR

- What are stakeholders' views on AEMO concerns in relation to the long-term provision of PFR?
- What are stakeholders' views on the role of bi-directional units in providing PFR?

AEMO's requirement for scheduled, semi scheduled generators, and per the submission for BDU's to supply mandatory PFR, do not consider the various technical concerns and limitations or biases for scheduled, semi scheduled generators and certain BDU's battery chemistries to provide PFR. Additionally providing an obligatory requirement to provide PFR will not promote the correct market signals to introduce innovative solutions to provide PFR as the share of scheduled synchronous generation withdraws from the NEM system. It also limits the ability to ensure the principles of market efficiency on which AEMO could seek competitive offers form all technologies to provide voluntarily PFR with only the cheapest providers used.

As an OEM, with a large share of scheduled generators in operation, TIC have first hand experience of seeing the units being pushed to achieive minimum loads far beyond what they are designed to operate for long periods of time due to the high renewable penetration and negative electrcity prices.

As outlined above, the AEMO obligation does not consider the various operational and technical concerns to provide PFR, and as TIC have a unique understanding on the plants potential operational issues, we are advocating for the phase out of the provision of mandatory PFR.

By adding the additional requirement to provide mandatory PFR, AEMO is creating potential operational, maintenance and relaiblity issues as the minimum load levels are lowered. Addtionally at these periods of high renewable penetration, and subsequent low system strength in the network, the prioirty is for these scheduled generators to provide system interia and not have a mandatory obligation to provide an addtional layer of operational control. For these reasons we are recomendeing the phase out of manadatory PFR. It will also assist these scheduled generators achieive even lower & more reliable stable minimum load and operate the units more relaiblity with more optimium thermal efficiency than if they were required to also provide PFR.

QUESTION 3: ISSUE 1 — PROPOSAL TO INCLUDE SCHEDULED BIDIRECTIONAL UNITS IN THE MANDATORY PFR OBLIGATIONS

- Do stakeholders agree with the Commission's preliminary position that the proposal to require bi-directional units to provide PFR while discharging aligns with previous determinations for scheduled semi-scheduled generators to be required to provide PFR while generating?

Although we agree the proposed preliminary position aligns with the earlier determination. As we have outlined above that the introduction of a primary frequency payment mechanism in the form of a double-sided causer pay or a similar mechanism, should also coincide with the phase out of scheduled and semi scheduled generator units and if implemented BDU's while discharging being required to provide mandatory PFR.

QUESTION 4: ISSUE 2 — STAKEHOLDER VIEWS ON AEMO'S PROPOSAL FOR SCHEDULED BIDIRECTIONAL UNITS TO BE REQUIRED TO PROVIDE PFR WHEN THEY ARE CONSUMING ELECTRICITY FROM THE GRID

- Do stakeholders agree with AEMO's proposal that scheduled bidirectional units should be required to provide PFR when charging?
- Do stakeholders agree with AEMO's assessment of the costs and benefits of the change?
- What are stakeholders views on the cost impacts for batteries providing PFR while charging?

As mentioned above, due to certain battery chemistry limitations, we do not agree that it is mandatory for all types of BDU's to provide PFR when charging. As mentioned above for high energy 2–4-hour l lithium-ion battery chemistries where the C rating in the order of 1 or less with low cycle life. There is both a potential increase in fire safety risk due to periods of erratic charging due to providing PFR and accelerated degradation (i.e., battery life issue) if these batteries are required to provide PFR during charging. Also, generally the conditions/warranties of these battery chemistries for charging as compared to discharging are more onerous and therefore the cost but also safety impacts on such batteries will be high.

QUESTION 5: ISSUE 2 — STAKEHOLDER VIEWS ON AEMO'S PROPOSAL FOR SCHEDULED BIDIRECTIONAL UNITS TO BE REQUIRED TO PROVIDE PFR WHEN ENABLED TO PROVIDE A MARKET ANCILLARY SERVICE

- What are stakeholders views on AEMO's proposal that scheduled bidirectional units be required to provide PFR when enabled for market ancillary services?
- Do stakeholders agree with AEMO's assessment of the costs and benefits of this change?
- What are stakeholders views on the impacts for a battery in providing PFR while:
  - enabled for regulation services?
  - enabled for contingency services?

As outlined above AEMO / AEMC should consider introducing a new participation and classification framework of "semi scheduled bidirectional units" as outlined above so that batteries can provide services in the market based on their capabilities.

Additionally, the requirement for PFR is likely to result in an increased number of small individual micro cycles required on the BDU and over time this effect could be significant on the battery life depending on the battery chemistry.

QUESTION 6: ISSUE 2 — COMMISSION'S OTHER PROPOSED CHANGES TO PROMOTE THE LONG-TERM PROVISION OF PFR

- What are stakeholders views on the Commission's proposed amendments to promote consistent and predictable PFR?
- Are stakeholders aware of any other incremental changes that would help promote consistent and predictable PFR while aligning with the existing mandatory PFR obligation and the incoming Frequency performance payment arrangements?

Additional to our above comments on the proposed ideas on new clarification framework BDU's and the benefits of adopting a class of BDU that has high power, long cycle life to provide PFR services. Additionally, such a class of BDU is also better suited to supply other future services such as synthetic inertia and system restart where a grid forming inverter would be employed.

As per the consultation paper, we understand the Commission is considering further incremental changes and amendments to improve control of system frequency such as the integrated price responsive resources into the NEM or the unlocking CER benefits through flexible trading rule change. These incremental changes do not aid in the provision of system strength services. The reason for promoting the idea of an additional class of BDU that can not only provide PFR services but also provide synthetic inertia as a key criteria to an orderly transition that has the ability to provide both PFR and system strength services to the grid in renewable energy zones.

QUESTION 7: IMPLEMENTATION CONSIDERATIONS OF REQUIRING SCHEDULED BIDIRECTIONAL UNITS TO COMPLY WITH THE PFRR WHEN DISCHARGING

- Do stakeholders consider that there are any further implementation costs that should be considered by the Commission when assessing extending the mandatory PFR obligations to scheduled BDUs while discharging ?

As per above points this should be a voluntary obligation whether BDU's provide the PFR obligation while discharging.

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QUESTION 8: IMPLEMENTATION CONSIDERATIONS OF SOLUTIONS TO PROMOTE THE LONG-TERM PROVISION OF PFR

- What are stakeholders' views on the implementation considerations identified for BDU's to be required to provide PFR while charging and providing FCAS?
- What are stakeholders' views on the implementation considerations for the other incremental changes identified by the Commission to support predictable and consistent provision of PFR?

Please refer to our comments to question 4, where the issues related to battery chemistries that are high energy, low cycle life are outlined. Added to the commercial consequences of accelerated degradation is the more critical issue of the potential fire risk that can apply to these types of battery chemistries.

I would like to thank the AEMC for the opportunity to supply feedback and hope our ideas and insights from an OEM perspective are considered to ensure that existing assets are operated safely, securely & reliably and new innovative technology solutions are introduced to ensure the orderly transition to a decarbonized electricity system.

Should you have any queries about the information provided in this submission please contact myself as per below details or Andrew Lees, Technical Leader (New Energy) Mob: +61 (0) 417 631 415.

Best Regards,

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