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Australian Energy Market Commission (AEMC)
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RE: Stakeholder input to Frequency Control Frameworks Review Draft Report, March 2018 Reference: EPR0059

Dear AEMC,

Fluence is a global energy storage technology solutions and services company. Our solutions are built on the foundation of three industry-leading technology platforms that are optimized for different application groupings.

Fluence also offers a comprehensive services suite to ensure customers are staying ahead of the market. From early stage feasibility and cost-benefit analysis that stand up in the real world, to ensuring optimal performance of storage assets, Fluence provides the expert advice and services to propel customers forward.

Fluence is part of a consortium with Spotless, AusNet Services, and EnergyAustralia that has signed a contract with the Victorian Government and the Australian Renewable Energy Agency to design, construct and operate Victoria's first utility-scale, grid-connected battery-based energy storage system. The 30 MW, 30 MWh battery-based energy storage system will be located at the AusNet Services Ballarat Terminal Station in Warrenheip, Ballarat. It will operate 24/7 to support critical peak demand and frequency control services to improve the security and reliability. Additionally, the system will support the clean energy transition and lower customer costs

Fluence offers the attached set of comments on AEMC's Frequency Control Frameworks Review Draft Report consultation.

Fluence Comments

Grid-scale battery-based energy storage resources are the most-cost effective way to provide frequency control and manage the second-to-second fluctuations between supply and demand. Battery-based energy storage is bidirectional—it can both deliver and absorb power from the system at speeds that are significantly faster than traditional generators. As a result, it is able to support grid stability from fewer MW of storage compared to traditional generators. This means lower operating costs and increased network reliability; particularly as renewable energy penetration increases. Our battery-based energy storage systems are providing frequency

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control in the United States, Germany, United Kingdom, Netherlands, Philippines, Chile and Dominican Republic.

AEMC Draft recommendation 2

That the providers of a primary regulating response should be remunerated for the costs of providing the service, in particular where the opportunity costs of maintaining the capacity to provide the service (e.g. maintaining headroom to be able to increase output) are likely to be high.

The implementation of one of the following two options is likely to build on the existing market frameworks and support improved frequency control during normal operation:

- provision of a primary regulating response through the existing regulating FCAS markets
- changes to the causer pays arrangements to facilitate the provision of incentive payments for primary frequency response during normal operation.

Further work is required to investigate and describe the potential arrangements for the implementation of these options, and the associated costs and benefits of these arrangements.

Fluence Comment: We appreciate the AEMC establishing different possible solutions to the issues with the current provision of primary regulating response. We believe primary regulating response should be procured in a competitive fashion to ensure the service is provided in the least cost way. It is critical that the mechanism be designed so resources are compensated for both the quantity of regulation they provide and how fast and effective it is at correcting frequency deviations. We believe that providing the right market structures for compensating for FCAS services will help increase the bidirectional transfer capabilities of all interconnection systems among Australian states. This in turn will lead to lower power prices, reduced transient/voltage instability in the system and significantly higher quality and security of energy delivery.

As we discuss in greater detail in our response to AEMC Draft Recommendation 8, we propose the AEMC adopt market rules to ensure each resource is fairly compensated for the service they provide. The supply requirement and compensation for frequency control in each hour should be based on accuracy, speed of response, and substitution factors between fast and slow responding resources. This will lower customer costs, increase reliability, and support the transition to a clean energy future.

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The California ISO[1] primary frequency response reform principles provide a solid framework that the AEMC can build on. Similar to AEMO, California ISO relies on conventional generators built in frequency response capability to provide their primary frequency response. With a goal of 50% renewable energy target by 2050 California ISO is concerned the existing mechanism will not be sufficient to meet the changing needs of the system. They are particularly concerned about the lack of a market signal to incentivize and compensate resources for their frequency response capabilities. They proposed two primary principles for a well-functioning market: "*(1) produce price signals that incentivize capital investments on resources to be capable of primary frequency response and (2) ensure compensation of capital investments made to meet the required capability if frequency response capabilities become an interconnection requirement.*"[2] These fundamental principles should be considered and adapted to the NEM to ensure that the evolving needs of the grid can be met.

Several of the options proposed could provide frameworks for adopting the principles we discussed above and in our response to AEMC Draft Recommendation 8. Each of these send price signals to market participants and enable the most cost-effective resources to provide the service. It is critical that the market signal be clear for resources that provide high quality frequency response. Option D, using a bilateral contract to procure frequency response, could serve as an effective interim measure while a more transparent and flexible market is designed to ensure lower customer costs, increased reliability, and smooth transition to a clean energy future.

Several European countries already use market mechanisms to procure primary frequency response. For example, the Dutch market instituted a change in 2014, when the country's regulator Autoriteit Consument en Markt (ACM) approved the construct for TenneT, the system operator, to procure "Primary Control Reserves" (PCR, an equivalent to primary frequency response) through a market-based mechanism. In response to this development, TenneT decided to join the Regelleistung market, an existing German platform for procurement of PCR capacity. The PCR requirement of Netherlands is 101 MW and TenneT procures 70 MW through participation in the regional Regelleistung market. It relies on local Dutch suppliers for the remaining 31 MW. These procurement mechanisms provide frameworks for the AEMC to consider as new market frameworks are designed.

[1] California ISO is the regional transmission organization (RTO) in California, USA with 50 GW of peak demand.
[2] http://www.caiso.com/Documents/IssuePaper_FrequencyResponsePhase2.pdf

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AEMC Draft recommendation 3

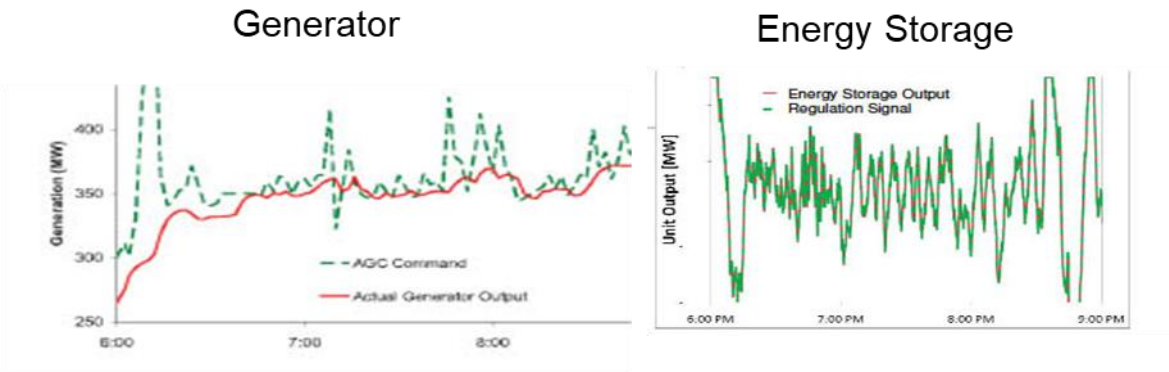
That a rule change request be submitted to amend the NER to require:

(a) AEMO to monitor, and publish reports on, frequency outcomes with respect to the requirements of the frequency operating standard

(b) AEMO to provide information to the AER on the performance of FCAS markets and for the AER to monitor, and report on, the performance of FCAS markets.

Fluence Comment: We agree that transparency is critical to a well-functioning system and to provide effective signals to market participants. We support the AEMC's recommendation and propose the AEMO provide specific details on how individual participants are responding to the frequency signal. This will ensure the resources that are doing most of the work to correct the primary frequency deviations are being compensated fairly. One example of how these data could be displayed are the charts below that were made by PJM, a regional grid operator in the United States.

Figure 1 – Generator and Energy Storage AGC Signal Response



Source: PJM

AEMC Draft recommendation 8

That, in the medium term:

(a) AEMO conduct a broader review of the MASS to recognise the capability, and more accurately value the response profile, of new technologies that are capable of providing frequency control services

(b) the AEMC and AEMO refine the time frames and develop a work program for making

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any substantive changes to FCAS frameworks. This process should be informed by:

(i) an assessment of any consequential impacts arising from the implementation of any revisions to frequency control arrangements in the normal operating frequency band

(ii) investigations to be undertaken by AEMO into:

a. the emerging capabilities of fast frequency response technologies including trials of various technology types, with a view to sharing the outcomes of the trials with relevant stakeholders, and to inform the development of future service specifications

b. the evolving technical and operational requirements of the power system and the inter-relationships between different system services, including frequency response, inertia and system strength

In the short term, the Commission will consider what recommendation it will make, if any, on the receipt of submissions from stakeholders in response to this draft report.

Fluence Comment: We fully agree with the AEMC "*that the gradual shift towards more non-synchronous and variable sources of electricity generation and consumption is expected to continue, and that difficulties in predicting this variability are likely to increase the potential for imbalances between supply and demand that can cause frequency disturbances*." The new energy storage system that Fluence is building in Victoria will address these issues and help integrate variable renewable energy sources. We appreciate the AEMC's effort to create a future FCAS Framework that accounts for the changing needs of the system and new technologies that can address the needs in a competitive and cost-effective manner.

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Rendering of 30 MW, 30 MWh Energy Storage System in Late Stage Development in Warrenheip, Ballarat

Energy storage resources provide high quality frequency response to grid systems and improve reliability. For example, in the PJM[3] regulation market, each MW of energy storage provides regulation service (equivalent to FCAS) that is the equivalent to more than 2MW of traditional generation based on accuracy and performance. Fluence energy storage projects in PJM have provided substantial savings to customers and relieved thermal generators from providing frequency regulation. The energy storage projects that Fluence has developed throughout the world over the past decade provide autonomous contingency response to enhance grid reliability while lowering overall system costs. Energy storage is a transformative solution for achieving higher levels of frequency response capability.

Energy storage resources also provide high quality digital inertia to the grid and increase the

[3] PJM is the regional transmission organization (RTO) in the United States that coordinates the movement of wholesale electricity in 13 eastern states with 150 GW of peak demand

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ability of generators to tolerate high Rate of Change of Frequency (RoCoF). For example, in a study using data from our Killroot Energy Storage Array in Northern Ireland researchers from the Queen's University Belfast found "*360MW of batteries could have provided the same amount of power after 0.1 secs as the inertial response of 3,000 MW of synchronous generators*."[4] The study calculated that in Ireland using batteries for digital inertia could result in up to €19 (AUD$ 30) million in annual savings and 1.4 million metric tons of CO_2 by replacing the inertia typically provided by thermal power plants. This high quality digital inertia will help support the Northern Ireland grid as it increases the instantaneous proportion of power being delivered by non-synchronous generation sources, such as wind and solar to 75% by 2020.

We propose the AEMC to require the AEMO to consider the accuracy and speed of response when determining both the compensation and the supply requirement for frequency regulation as part of the MASS review and the substantive changes to the FCAS framework. The basic principle is that fast/accurate resources reduce the total MWs required and procured for balancing each hour, and thus should be paid more for that additional value provided. Assuming the additional compensation paid to higher performing resources matches the additional value in the market, this will reduce customer costs because the overall supply requirement is lower.

As part of the review of the MASS and FCAS framework we suggest the following language could be used as a framework:

The new market rules shall be developed to require accuracy, speed of response, and substitution factors between fast and slow responding resources to be part of both the compensation formula and the supply requirement for frequency control service each hour. This market structure is expected to reduce overall cost by reducing the total amount of frequency regulation that is required in the market when faster and more accurate resources participate.

The market structure should be based on the principle that resources that have faster ramp rates and can follow control signals accurately should be compensated for the performance that they provide. In particular, such fast-responding resources provide significant benefits to the system by reducing the overall control error and thereby reducing the total requirement for frequency regulation service. Performance can be measured by an accuracy score, speed of response, and ramp rate capability.

[4] http://s2.q4cdn.com/601666628/files/doc_presentations/2017/Everoze-Batteries-Beyond-the-Spin.pdf

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Detailed implementation will be done through a stakeholder process. Market structure features should include:

- *A mechanism whereby the MWs regulation supply requirement each hour is defined in terms of a new Adjusted MWs requirement, where the performance of each participating resource will determine the Adjusted MWs that it provides toward the supply requirement.*
- *Formulas that determine how the Adjusted MWs provided by each resource toward the regulation supply requirement are based on its performance, where resources with higher signal-following accuracy, faster response, and faster ramping capability are calculated to contribute more Adjusted MWs per nominal MW toward the regulation supply requirement.*
- *A unit selection and clearing process where the $ per MW cost offer of each resource is converted to $ per Adjusted MW to account for the value provided by each resource, units are then selected based on the lowest $ per Adjusted MW, and the market price is set in terms of $ per Adjusted MW*
- *A settlement mechanism where each resource is compensated based on the Adjusted MWs it provides toward the regulation supply requirement and the $ per Adjusted MW price.*

The result of these mechanisms is that unit selection, prices, and compensation are all based the value provided by each resource toward meeting the frequency regulation requirements of the system

COMMUNICATIONS

Fluence requests that service be made upon and communications directed to the following:

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