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Australian Energy Market Commission
PO Box A2449
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Re: *EPR0053 – System Security Market Frameworks Review* *(Submitted Electronically)*

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Infigen Energy appreciates the opportunity to comment and makes this submission in response to the **AEMC's Interim Report System Security Market Frameworks Review** (**Report**) dated 15 December 2016.

The related bodies corporate of Infigen Energy Limited that are registered market participants in the NEM are Renewable Power Ventures Pty Ltd, Woodlawn Wind Pty Ltd and Lake Bonney Wind Power Pty Ltd, but for convenience we will simply refer to "Infigen" in this submission.

The AEMC's report presents a thorough analysis from both a technical and economic perspective for managing the gradually increasing penetration of non-synchronous generators in the NEM. The discussion around the requirements for inertia and fast frequency are needed and the careful planning of how such services can be introduced into the current market are of fundamental importance.

The proposed creation of value for a service that up to now has been a by-product of synchronous generation (inertia) and the proposed creation of a new service altogether (fast frequency response) come with many challenges and questions. The solutions will require an examination of the system from all perspectives. Infigen is of the view that research, industry consultation, cost/benefit analysis, and international best practice will contribute to defining and establishing the most appropriate mechanism to ensure system security and strength. However, the primary action should be critically analysing the performance of existing system security markets. Where they are found to be deficient, measures to rectify market failures and maximise the efficiency of their operation should be taken before the introduction of new system security services. This will ensure that countervailing incentives don't exist.

Current methods for maintaining system security

The AEMC outlines and describes several power system security issues within the NEM related to the change in generation mix seen over the last decade. What the report fails to identify and review are the current market system structures such as the frequency control ancillary services (FCAS) that support and deliver much of the power system security requirements in the NEM today. It is essential to understand how well the existing framework is delivering what should be "good power system security" services. By examining the FCAS market it becomes apparent that there are several shortfalls in

market design that are beginning to cause power system security issues. These include a change in synchronous generator behaviours over the last 15 years, and the increased incentive to prioritise dispatch target conformance over frequency support under the Causer Pays compensation structure[1]. These inefficiencies should be addressed before looking to quantify additional solutions that may have the potential of exacerbating pre-existing problems.

Long-term decline of frequency support from synchronous generators

The introduction of the FCAS markets in the NEM back in 2001 resulted in significant changes to how frequency was formerly managed. It widened the normal frequency operating bands from 49.9 to 50.1 Hz to 49.85 to 50.15 Hz and removed generator mandatory frequency deadband requirements. It also established that regulation FCAS would be the prime source of maintaining frequency within the normal operating band. Regulation services are designed to act within this band for minor frequency deviations and time error correction and are a second order control of frequency enabled via the Automatic Generation Control (AGC). The AGC is a slow control loop which sends the appropriate signal to the generator for higher or lower power injection based on the calculated area control error of system frequency measurements. It acts much slower than the primary order of control executed by the generator governors.

Governor response is the primary control of frequency of a power system. It provides the fast acting arresting energy required during sudden frequency deviations and assists in halting generation deceleration during contingency events. Without the governor enablement in the range where smaller disturbances happen (within the normal operating band), the response time and effectiveness of arresting the decline in frequency is deeply compromised. The widening of the frequency normal operating band and the removal of the tight deadband requirements has resulted in a weakening of frequency control in the system and raises the risk of worsening the impact of a contingency event or not being able to survive it[1].

Market structures that don't encourage efficient outcomes

Perverse outcomes between energy market and ancillary service markets are becoming more apparent now. Increasing FCAS costs have resulted in participants directing more focus to the regulation FCAS Causer Pays system. The misalignment of objectives in each of these markets is creating an alarming power system security issue.

Central dispatch mandates a scheduled generator to closely follow dispatch instructions and as such, can be deemed non-conforming if it considerably deviates from the target. This can have the effect, at certain times, of penalising a generators' good power system performance because of deviation from dispatch target due to governor control response within the normal operating band. This has led to synchronous generators turning off

[1] Summers, K., Miller, B., (2017) 'Fast Frequency Service – Treating the symptom not the cause?'

their governors within the normal operating band range to avoid penalties and lower their regulation FCAS costs.

Under the Causer Pays system, a generator is expected to achieve its dispatch target in a linear trajectory. This system can result in generators that may ultimately be providing FCAS services or delivering good frequency service (according to the governor response) incurring higher causer pays factors (and costs) because of a non-linear trajectory. Poor market design is having a detrimental effect on good power system security and detuning the frequency response of the NEM.

Furthermore, the Causer Pays methodology does not measure real performance according to real time system frequency – it is measured against a Frequency Indicator calculated by AEMO not available to participants. In the current structure, participants have no ability to improve their performance according to what is beneficial for system frequency in real time. The signal to which they are measured against is not readily available and does not represent pure frequency. There are also significant time delays in SCADA data and signals which mean the measured performance is not accurate. Until such time participants can have the ability to actively and positively respond to frequency and be assessed according to actual performance, system security will continue to be at risk.

The system security objective needs to be defined and then proposed solutions can be developed. It appears we are trying to put in place a fix for an impending problem that is somewhat caused by existing system security inefficiencies, without addressing the root cause.

Feedback on the Interim Report: Potential procurement options

The four procurement options in relation to Inertia and Fast Frequency Response (FFR) have been given balanced consideration in the interim report all reflect best practice currently seen in international markets.

In the NEM, operation and investment decisions are primarily motivated by the outcomes of the multitude of spot markets that currently ensure security and reliability in electricity supply. The ability of individual market participants to routinely exert market power should be considered a market failure. The introduction of new inertia and FFR services should use market based procurement and pricing mechanisms, however along with existing frequency markets, should be critically assessed for market failures and inefficiencies as a first step measure.

Long-term procurement options, whether through a contracting process by AEMO or transmission network services providers, will not allow for participants to be flexible and make investment decisions that react to the changing nature of the system. Opportunities in these markets will advantage participants that already have assets and don’t have to

take on development and deployment risk. While technology neutral, putting up such barriers would likely discourage the entrance of new, increasingly efficient technologies.

The procurement of inertia and FFR through generator obligation would likely provide a high guarantee of system security, however this centralised planning approach would be a stark contrast to current practice in the NEM. Risks would be placed upon central planners and operators to ensure there's not an over or under supply of services. The approach would likely be the least efficient economically as all participants attempt to enter a service market that they may not have expertise in. Additionally, there would be a distinct lack of short or long-term signaling to the market concerning the improvement or deterioration of system security through time. Only further interventions would be available to rectify future shortcomings.

The use of five-minute dispatch that will allow inertia and FFR to be provided more cost effectively in the future as the requirements of the system change. It is important that the new framework over time continues to meet its objective in the most cost effective manner. If technological developments removes or reduces the need for the framework, or market for these services, then it must be adaptable enough to be phased out or altered. The use of a centralised contract process may also be able to achieve this outcome if participants were tendering for short-term contracts, no longer than one to three months at a time.

Infigen finds it imperative that the final framework will be able to replace market interventions currently being used at the 'end' of the grid. The use of energy market constraints that limit the rate of change of frequency, and the use of localised regulation requirements within the synchronised network has led to a substantial financial cost and impact to market participants. These increased and significant costs, as discussed above, have done little to (and are unlikely to) encourage capital investments that will provide system security during periods when non-synchronous generation is providing a large proportion of a region's load.

Final consideration

The report suggests that increasing levels of non-synchronous generators (typically renewable energy such as wind and solar) are causing the need for the system security market framework review. Importantly to highlight however is that in fact 94% of the generation in the NEM is synchronous and only the remaining 6% is made up of non-synchronous generators[2] (mostly renewables). This means there is an underlying assumption that 94% of the system is performing as desired and the liability lies in the 6%.

The issues in the report certainly propose to solve and address future problems in our evolving and changing market, but already today some of these problems exist and need to be responsibly managed for any future system to successfully operate. The loss of

[2] Finkel, A., 2016. 'Independent Review into the Future Security of the National Electricity Market', pp. 20.

frequency control from synchronous generators and deterioration of frequency performance is the immediate issue today. Until such time that the fundamental frequency control of the system is regained, any new market or service will encounter the same problems time and time again.

Should you have any queries regarding this submission, please do not hesitate to contact me directly by telephone (02) 8031 9971 or email niva.lima@infigenenergy.com.

Yours sincerely,

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