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CLEAN ENERGY COUNCIL

Tuesday, 14 February 2017

John Pierce
Chairman
Australian Energy Market Commission
Lodged Electronically

Dear Mr Pierce,

RE: EPR0053 System Security Market Frameworks Review, Consultation Paper Submission

The Clean Energy Council (CEC) is the peak body for the clean energy industry in Australia. We represent and work with hundreds of leading businesses operating in solar, wind, energy efficiency, hydro, bioenergy, energy storage, geothermal and marine along with more than 4,000 solar installers. We are committed to accelerating the transformation of Australia's energy system to one that is smarter and cleaner.

As noted in previous submissions the CEC supports the work that both the Australian Energy Market Operator (AEMO) and the Australian Energy Market Commission (Commission) in this and related work streams. Given the extent of technological change, this forward-looking work plan should examine and create appropriate market and technical frameworks which encourage new technologies to support a secure power system.

Governor response utilisation in the NEM

The CEC notes an underlying premise of this review that the NEM is designed appropriately and well-situated to support power system security. This assertion should be challenged where necessary. It has become apparent that the market's reliance on Frequency Control

Ancillary Services (FCAS) has delivered incentives to de-tune the power system's frequency control, (both in a contingency-response and steady-state sense)[1].

As prescribed by the National Electricity Rules' related Automatic Access Standard the range at which governors are set to respond is either side of the normal operating frequency bands[2] of 49.85 to 50.15 Hz. This defines a governor 'deadband' at a minimum of +/- 0.15 Hz although some generators may have negotiated for broader settings with AEMO. During normal operation only regulation frequency control is in place which relies on slow-acting Automatic Generator Control (AGC). This is activated by the FCAS market in lieu of primary generator governor control. As a result the frequency tends to wander within this 0.3 Hz range around 50 Hz rather than lock tightly to the nominal reference[3].

The frequency response of the power system should, for power system security, keep the frequency within the normal operating frequency band of 49.85 to 50.15 Hz and following a credible contingency event arrest the frequency within 49.5 to 50.5 Hz.

The need for governor response increases in importance under high rates of change of frequency (in situations where inertia is low for example) where the speed of actioning this response is critical to arresting the frequency change. Delaying or even disabling the governor response risks a collapsing system.

Using the Commission's stylised example of a rate of change of frequency of 3 Hz per second hitting the extreme frequency bounds within one second will estimate that generator governors would not respond until at least 50 ms – a significant delay when the system only has one second. Of course this is a stylised example that ignores the actuating steps which delay the time it takes to reaccelerate the generating unit to increase electrical output (such as generator fuel system and drive train responses which differ across the thermal generator fleet).

Indeed, 50 ms is only the point at which the unit controls are triggered. Wider deadbands actually allow more deceleration, requiring more energy and a longer delay to reaccelerate the unit. Under a high rate of change of frequency situation delays in response due to the physical plant properties compound the challenge of arresting the change in frequency.

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[1] K. Summers, Fast Frequency Service – Treating the symptom not the cause, February 2017.
[2] NER, cl. S5.2.5.11.
[3] A broad operating range of frequency around 50 Hz can have an effect on advanced manufacturing processes.

Inertia is the system's initial response to changes in frequency. However this response must be supported immediately by primary control response provided by generator governors. Other markets have recognised this and generally have very tight governor control settings. For example the National Energy Regulatory Council (NERC) advises market operators in North America to ensure that deadband do not exceed +/- 0.036 Hz[4], ERCOT requires a maximum deadband of between +/- 0.017 Hz and +/- 0.036 Hz depending on generator types[5], and EirGrid applies a mandatory deadband within +/- 0.015 Hz in Ireland[6] as does the United Kingdom[7].

Revisiting the Commission's stylised example and applying settings in line with NERC's recommendations a governor control response *within* 5.5 ms (as compared to the NEM's response *after* 50 ms) would be elicited. In other words a change in governor control settings could achieve a significant improvement in performance under high RoCoF conditions at a time when every millisecond counts.

Comparing these international grid codes to the NEM's specifications (i.e. a *maximum* range of +/- 0.015 to +/- 0.036 Hz as compared to a *minimum* range of +/- 0.15 Hz) is alarming and should bring this issue into question given they vary up to a factor of 10. Prior to the creation of the FCAS market the market rules restricted governor deadbands to a *maximum* of +/- 0.05 Hz (or 49.95 to 50.05 Hz)[8].

Given the above it appears that the likelihood for increased extreme frequency events is now a design aspect of the NEM. The FCAS market's causer pays arrangements have led to a significant de-tuning of the power system. As a result the need for additional inertia has been perceived to be the critical aspect of debate in the Commission's work. However, this overlooks what are considered necessary control practices in overseas markets. Indeed the premise that current market frameworks are delivering efficient or even appropriate outcomes should be brought into question.

The current design of the FCAS market creates incentives for a poorly-tuned power system. Inertia is not the only consideration, and in an environment where inertia is decreasing the current design of the FCAS market is untenable.

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[4] PJM, Manual 14D: Generator Operational Requirements, cl. 7.1.1, January 2017.
[5] ERCOT, Nodal Operating Guides, cl. 2.2.7(3), June 2014.
[6] EirGrid, Grid Code v6, cl. OC4.3.4.1.2, July 2015.
[7] National Grid, Guidance Notes – Synchronous Generating Units, September 2012, p. 14.
[8] NECA, Review of Market Ancillary Services – Final Report, June 2004.

Further, throughout the Interim Report the Commission states that the creation of any new mechanism for inertia would lead to an increase in the system's overall inertia. This outcome is not clear. Inertia only contributes to resisting the initial rate of change. Primary governor response is recognised in other markets as being the next critical contributing factor in resisting the change and needs to come online rapidly to do so[9]. If the NEM was well tuned with appropriate frequency control the view that further inertia services are required should also be questioned. It is likely that sufficient synchronous inertia exists to manage system security if it is subject to appropriate control schemes.

The current arrangements are not delivering a secure power system in the long term interests of consumers and should be revisited. The slow acting nature of frequency control in the NEM leads to inefficient outcomes for customers because more service is needed due to slow governor and physical plant responses. FCAS causer pays arrangements incentivise poor frequency control, where efficient power system operation requires a scheme that rewards good, fast acting frequency control. The FCAS regime requires fundamental reconsideration to deliver on the National Electricity Objective.

The need to bring new technologies online

As previously noted the CEC supports frameworks that encourage new technologies to provide essential services to the power system given the increasingly important role they will play. However, the poor outcomes created by the current market must be addressed in order to move forward. Introducing new mechanisms on top of a regime that is already delivering poor outcomes would likely be at the expense of a secure power system.

Given the above, the CEC believes that the focus of this review should be on revising the current FCAS arrangements and removing incentives for poor frequency control. In doing so the redesigned FCAS arrangements should look to implement fast frequency response capability in the sub-one second timeframe as a means to bring new technologies online through the revised FCAS regime. Further, given the ever-present and ready requirements of fast acting frequency control it is possible that the dispatch arrangements cannot guarantee availability and may not be the appropriate solution.

The long-term interests of consumers would be best met where by resolving issues in the existing regime and expanding this regime to deliver advanced technological solutions.

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[9] Kou, G. et al., IEEE, Primary Frequency Response Adequacy Study on the US Easetrn Interconnection Under high-Wind Penetration Conditions, December 2015, IEEE Power and Energy Technology Systems Journal.

Please contact the undersigned for any queries regarding this submission.

Sincerely,

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