



System Security Market Frameworks Review

Directions paper released for consultation

The AEMC is reviewing aspects of system security as new technologies drive a transformation of the National Electricity Market. Its directions paper presents a proposed approach to address current and future challenges to maintaining system security.

Why is the AEMC reviewing market frameworks for system security?

The electricity industry in Australia is undergoing a fundamental transformation. Driven by technological development and climate change policies, the National Electricity Market (NEM) is experiencing a significant shift away from conventional synchronous generators and towards new, non-synchronous technologies, such as wind farms and solar panels.

The Australian Energy Market Commission (AEMC) is undertaking the System Security Market Frameworks Review to consider, develop and implement changes to the market rules to allow the continued uptake of these new forms of generation while maintaining the security of the system.

The review is drawing upon work being undertaken by the Australian Energy Market Operator (AEMO), as part of its Future Power System Security (FPSS) Program, to identify and prioritise current and future challenges to maintaining system security.

The AEMC self-initiated the review to address two key issues highlighted by AEMO: the management of frequency and of system strength in a power system with reduced levels of synchronous generation.

The AEMC has published a directions paper to present its proposed approach to resolving these issues. It builds on the interim report, published in December 2016, which explored the challenges associated with frequency control and set out potential mechanisms for procuring new frequency management services. The directions paper also provides a detailed discussion of system strength and presents a proposed approach for consultation in this regard.

The focus of the review, and the rule changes, on these two issues is consistent with AEMO's prioritisation of the emerging challenges. However, further issues are already being identified, both by AEMO and by stakeholders more broadly, for future consideration. The Commission intends to give consideration as to how this broader work program will be structured and progressed as part of this review.

Approach to frequency control

In the interim report, the Commission set out its preliminary view that frequency control in the NEM would be enhanced by the introduction of both:

- a mechanism to obtain inertia, which would reduce the rate of change of frequency (RoCoF) following a contingency event and extend the time available to restore the frequency; and
- a fast frequency response (FFR) service. This would act to arrest the frequency change more quickly than the current fastest acting contingency frequency control ancillary service (FCAS), which has a response time of up to six seconds.

To some extent, these services would represent substitutes for each other. However, even the fastest frequency response technologies involve a time delay to measure the initial change in frequency and then activate the response. While this delay may only be in the order of hundreds of milliseconds, it does mean that there is a minimum level of inertia that cannot be replaced by FFR.

Two staged packages of measures to address frequency control

Having developed and assessed potential mechanisms to procure inertia and FFR, the Commission is now consulting on its proposed high-level approach to frequency control: the staged implementation of two packages of complementary measures.

In developing a staged approach, the Commission sought to strike a balance between addressing immediate issues related to the management of power system security and developing an efficient and effective framework to address such issues in the medium to longer term. Not only does this approach provide for immediate, practical solutions to key security issues but provides information to market participants that can support investment decisions and signals the proposed transition to markets for evolving technologies that can provide frequency services.

The immediate package contains a number of complementary measures to maintain control of power system frequency following a contingency event.

- *Required inertia operating level* - A requirement on Transmission Network Service Providers (TNSPs) to provide and maintain a defined operating level of inertia at all times. The required operating levels of inertia would be determined through a prescribed process conducted by AEMO, representing a workable level of inertia that would satisfy a range of, but not all, system conditions
- *TNSP procurement of fast frequency response* - An interim measure, TNSPs would be allowed to contract with third party providers of Fast Frequency Response (FFR) services where the TNSP considers, and AEMO agrees, that an FFR service can be used to meet the required operating inertia level. The period of time during which contracts could be entered into would be limited to three years in order to provide for the development and trialling of FFR technologies.
- *Generator obligations for FFR capability* - An obligation on new non-synchronous generators to have the capability to provide FFR services. Generators would not be mandated to provide the service but would be required to install the capability for providing the service at the time of construction. The exact specification of the capability of the FFR service would likely depend upon the type of technology. An obligation of this nature would increase the level of FFR available in the system and would provide a foundation to establish a competitive market for FFR services.

The Commission is also proposing that two additional mechanisms should be subsequently implemented to enhance the immediate package. These mechanisms would aim to improve the overall effectiveness and efficiency with which inertia and FFR services are procured in the long term.

The obligation on TNSPs to provide a required operating level of inertia and the obligation on new non-synchronous generators to have FFR capability would both remain from the immediate package.

For additional inertia provided by the TNSP above the minimum operating level, an incentive framework would be developed to guide the inertia provided towards the most efficient level. Under the incentive framework, TNSPs would be rewarded for the delivery of market benefits from a project to provide additional inertia that allowed for greater power transfer capability in the network.

The interim framework for TNSPs to contract with third party providers of FFR services would be replaced by a market for FFR services to optimise the FFR quantity consistent with system security requirements and levels of system inertia and other FCAS.

Both of these measures are likely to require considerable work to develop and implement. More importantly, the fledgling state of FFR technologies and the current small number of potential providers of FFR services means that it would be premature to define FFR services and seek to procure these through a market sourcing approach at this time.

There is equally a risk that, given the current lack of FFR alternatives, incentivising TNSPs to seek market benefit opportunities might "lock-in" the provision of inertia from network investments over the long term. Consequently, the Commission considers it appropriate that the subsequent package is developed and implemented over the medium term, which might represent a period of three or more years.

Approach to system strength

System strength is an inherent characteristic of a power system and it relates to the size of the change in voltage for a change to the load (or generation) at a connection point. Recently, system strength in some parts of the power system has been decreasing as a number of synchronous generators are operating less or are being decommissioned. Low levels of system strength can cause a number of issues, including a reduction in:

- the capability of some transmission and distribution network protection systems, which rely on a high fault current to operate effectively;
- the ability of network operators to manage voltages within their networks; and
- the ability of generators to operate correctly such that they can meet their technical performance standards, as failure to do so can increase the risk of cascading outages leading to major supply disruptions.

The existing rules place the obligation for maintaining the operation of network protection systems and the control of network voltage on the relevant Network Service Providers (NSPs). However, responsibility for ensuring that system strength is maintained such that generators can meet their technical performance standards appears less clearly defined. This is particularly the case when the short circuit ratio (the ratio of the system strength measured in MVA and the size of the generating unit) is effectively decreased by the connection of a new, non-synchronous generator or the fault current reduced by the retirement of a synchronous generator.

The Commission's proposed approach is to amend the rules to clarify that NSPs should be responsible for maintaining an agreed minimum short circuit ratio to connected generators. Generators would continue to be required to meet their registered performance standards above this agreed level.

Where the entry of a new generator would cause minimum short circuit ratios to be breached for one or more existing generators, the NSP would be entitled to recover the costs of the remedial actions from the connecting generator on a "causer-pays" basis. However, the Commission considers it unworkable to seek to recover any costs caused by a generator retirement from the exiting generator. Any resulting works would instead be undertaken by the NSP as a prescribed service, which is to say that they would ultimately be funded by consumers.

The Commission notes that the allocation of the above role to NSPs is consistent with its preferred approach for frequency control. Managing inertia and managing system strength are likely to be highly complementary activities, as similar equipment can be used to resolve both issues. Therefore, investment and operational decisions would be able to be made together in a way which allowed effective and efficient outcomes, particularly in respect of the locational dimension to service provision.

Next steps

The Commission is seeking stakeholder feedback on the contents of this directions paper, particularly in regards to the proposed approaches to addressing frequency control and system strength issues. Submissions are due by 20 April 2017.

The AEMC's System Security Work Program comprises the System Security Market Frameworks Review and a number of related rule change requests. The Commission has also been considering a rule change relating to emergency frequency control schemes, and is due to make a final determination on this rule change on 30 March 2017. Three further rule changes relating to frequency control and system strength raise more complex and involved matters, and these are consequently being canvassed through the review. Draft determinations on these rule changes are currently due by 29 June 2017.

The Commission's preliminary view is that the measures set out in the immediate frequency control package and the proposed approach to system strength could be implemented through the existing rule changes. A final report for the review would be published at the same time as the draft rule determinations, setting out how the subsequent frequency control package and any broader issues identified for further consideration would be progressed.

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