AEMC

INFORMATION

System security market frameworks review final report

The AEMC has published the final report for its *System security market frameworks review*. The report makes nine recommendations for changes to market and regulatory frameworks to support the shift towards new forms of generation while maintaining power system security. Some of the key recommendations can be implemented through rule changes already underway, with two draft rules for consultation also being published.

System security work program

The AEMC initiated the *System security market frameworks review* on 14 July 2016 to consider changes to market and regulatory frameworks to support the on-going shift towards new generation technologies in the National Electricity Market (NEM). The focus of the review has been on addressing priority issues highlighted by the Australian Energy Market Operator (AEMO) to allow it to continue to maintain power system security as the market transitions.

The AEMC's system security work program has comprised the *System security market frameworks review* and five rule change requests received on related matters. These rule change requests have been progressed concurrently and in coordination with the review. Final rules have already been made for two of these proposals, with new arrangements for under- and over-frequency control schemes being introduced on 6 April 2017.

Recommendations

The priorities of the review have been to develop recommendations that will result in:

- *a stronger system*
- a system better equipped to *resist frequency changes*
- *better frequency control*
- action to further *facilitate the transformation*.

The Commission considers that its package of recommendations will achieve these goals, as set out below. Attachment A provides a summary of each recommendation, detail on how it will be given effect, and its interaction with the findings of the *Independent Review into the Future Security of the National Electricity Market* (the 'Finkel review'). The recommendations of the two reviews are, in large part, consistent and the implementation pathways we have identified will allow them to be progressed in a timely manner.

A stronger system

System strength is decreasing as traditional synchronous generators retire and are replaced by increasing numbers of non-synchronous generators. System strength relates to the relative size of the change in voltage for a change in generation or load at a point in the power system, and low levels of system strength can jeopardise the ability of generators to operate properly, threatening system security.

In order to meet this challenge, we are making two recommendations to maintain system strength while minimising the costs that will flow through to consumers:

1. Introduce regulatory arrangements to require network service providers to maintain the system strength at generator connection points above agreed minimum levels, with new connecting generators required to ' do no harm' to previously agreed levels of system strength.
2. Consider requiring inverters and related items of plant within a connecting party's generating system to be capable of operating correctly down to specified system strength levels.

New technologies have the potential to provide new, faster frequency control services, which will become increasingly important

Resist frequency changes

Historically, the large numbers of synchronous generators in the NEM have helped it resist sudden changes in frequency. The physical inertia provided by the large rotating masses in synchronous generators dampen the effects on frequency of any sudden imbalances in supply and demand.

Despite having useful characteristics that many synchronous generators do not have, non-synchronous generators, being connected to the power system through inverters, do not provide inertia, even where the power generation is the result of mechanical movement.

In order for the power system to be able to resist deviations in power system frequency, we are making two recommendations:

3. Place an obligation on transmission network service providers to provide minimum required levels of inertia, or alternative equivalent services, to allow the power system to be maintained in a secure operating state.
4. Introduce a market-based mechanism to realise the market benefits that could be obtained through the provision of inertia above the minimum obligation on transmission network service providers.

Better frequency control

In addition to improving the ability of the power system to resist large changes in frequency, the report recommends further measures to provide for better frequency control. Frequency control services will become increasingly important as a complement to, and partial substitute for, inertia. While inertia only dampens frequency changes, effectively buying time, frequency control services rebalance supply and demand.

Going forward, new technologies have the potential to provide new, faster frequency control services and these will therefore have a more significant role to play in maintaining the security of the power system. The final report recommends four changes in order to implement better frequency control in the NEM:

5. Assess whether mandatory governor response (which control generators' response to frequency changes) requirements should be introduced and investigate any consequential impacts (including on the methodology for determining causer pays factors for the recovery of regulation FCAS costs).
6. Review the structure of frequency control ancillary services (FCAS) markets, to consider:
    - any drivers for changes to the current arrangements, how to most appropriately incorporate fast frequency response (FFR) services, or alternatively enhancing incentives for FFR services
    - any longer-term options to facilitate co-optimisation between FCAS and inertia provision.
7. Assess whether existing frequency control arrangements will remain fit for purpose in light of increased ramping requirements, driven by increases in solar PV reducing operational demand at times and therefore leading to increased demand variation within a day.
8. Consider placing an obligation on all new entrant plant, whether synchronous or non-synchronous, to have fast active power control capabilities.

Facilitate the transformation

As the pace and scope of the transition expands, so will the future needs of the power system. There are a number of power system related issues that are likely to be necessary to further facilitate the transformation.

As such, we recommend that it is necessary to:

9. Continue to scope further power system security issues likely to arise from the on-going transformation of the market, such as:
    - the impact on system restart ancillary services of decreasing levels of synchronous generation
    - the adequacy of current voltage control arrangements.

Implementation

The three outstanding rule change requests already received and under consideration by the Commission will provide the means for three of our recommendations to be put in place without the need for further implementation processes. Other recommendations are likely to be the subject of a rule change request expected from AEMO in July 2017, while the Commission will progress a further tranche though a targeted review it will self-initiate, also in July 2017.

Rule change requests already under assessment will allow key recommendations to be put in place without the need for further implementation processes

Managing power system fault levels **draft rule determination**

Concurrent with the publication of the final report, the Commission has released for consultation a draft determination for the *Managing power system fault levels* rule change request proposed by the South Australian government.

To implement recommendation 1 from the review, the draft rule proposes to introduce a regulatory requirement on NSPs to maintain the system strength at generator connection points above agreed minimum levels. NSPs are best placed to develop solutions in this regard, as they will already have to consider low system strength protection and voltage control issues. Where new entrant generators would degrade the level of system strength provided to other generators, they will be required to meet the costs of remedying this.

Submissions on the draft determination are due by 8 August 2017, with the final rule scheduled to be published on 19 September 2017.

Managing rates of change of power system frequency **draft rule determination**

The Commission has also released a draft rule determination for the *Managing rates of change of power system frequency* rule change request proposed by the South Australian government. This seeks to implement recommendation 3 from the review, again with submissions due by 8 August 2017 and the rule to be finalised on 19 September 2017.

By placing on obligation on transmission network service providers (TNSPs) to provide inertia, or alternative equivalent services, the draft rule aims to offer certainty that the minimum required levels would be made available, either through investment in network equipment or by contracting with third party providers such as generators.

Under network regulation requirements, TNSPs have financial incentives to minimise the costs associated with meeting their obligation, with the benefits of this flowing through to consumers. They would also be able to coordinate inertia provision with the more locational requirements of maintaining system strength.

AEMO would play an important role under the arrangements in the draft rule, undertaking real time enablement of the inertia services provided by the TNSPs and assessing the amount of the services required to be provided in each NEM region. AEMO would only declare a requirement where a shortfall in the amount of inertia provided through the generation market was expected. In the immediate future, such a shortfall is only anticipated in South Australia.

Recommendation 4 acknowledges that there will be market benefits associated with levels of inertia provision over and above the minimum level associated with maintaining system security, but also that such levels will be highly variable. A market-based mechanism to realise these benefits is likely to be more flexible than TNSP provision, and we have begun to develop a candidate mechanism. This will be subject to consultation through the *Inertia ancillary service market* rule change requested by AGL. To allow the mechanism to be further developed and its impact on the market assessed, the Commission has extended the period of time to make draft rules, with these now due by 7 November 2017.

Technical standards rule change request

The Commission has made two recommendations (2 and 8) regarding technical standards to be applied to new plant. Where they do not impose undue costs, such technical obligations can act as a useful complement to service procurement mechanisms.

We note that these recommendations are consistent with advice provided by AEMO to ESCOSA in respect of South Australia. In its advice, AEMO noted that it intends to submit a rule change to the AEMC by July 2017 proposing revisions to the national standards. The rule change process will consequently allow the Commission to further consider, and potentially implement, these recommendations.

The *Frequency control frameworks review* will allow immediate concerns with NEM frequency performance to be addressed, and robust arrangements developed for the longer term

Frequency control frameworks review

To progress the bulk of the remaining recommendations (5-7), in July 2017 the Commission will initiate a review into market frameworks necessary to support better frequency control: the *Frequency control frameworks review*. We intend to publish terms of reference for the review shortly, which will continue to be co-ordinated with the on-going technical work being undertaken by AEMO.

The review will allow the Commission to consider how new, faster frequency control services can best be integrated into existing market frameworks for the procurement of frequency control ancillary services (FCAS). However, a number of stakeholders have expressed concerns that, before additional services are designed and implemented, the existing arrangements for frequency control need to be reviewed.

Prior to 2001, all generating units in the NEM over 100MW were obliged to have governors in operation that controlled the speed of the machines in response to changes in system frequency. With the introduction of spot markets for FCAS in 2001, this requirement was removed. It has been suggested that this change has contributed to a recent decline in frequency control performance in the NEM.

AEMO is currently undertaking work to further investigate the issue, which should be progressed as a matter of priority. The *Frequency control frameworks review* will provide a vehicle for any framework changes required to address these immediate issues to be progressed, as well as the opportunity to develop robust market arrangements for the longer term.

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Attachment A: Summary comparison table of AEMC and Independent Review into the Future Security of the National Electricity Market recommendations

AEMC recommendation	How our recommendation will be implemented or further progressed	Independent Review into the Future Security of the National Electricity Market recommendation
A stronger system		
1 **Introduce regulatory arrangements to require network service providers to maintain the system strength at generator connection points above agreed minimum levels, with new connecting generators required to 'do no harm' to previously agreed levels of system strength.**	Draft arrangements published for consultation on **27 June 2017** as part of the draft determination made on the Managing power system fault levels rule change proposed by the South Australian government. Arrangements are scheduled to be finalised on **19 September 2017**.	No specific recommendation, but notes that the Panel agrees with the AEMC's approach (p. 58).
2 **Consider requiring inverters and related items of plant within a connecting party's generating system to be capable of operating correctly down to specified system strength levels.**	AEMO intends to submit a rule change to the AEMC by **July 2017** requesting revisions to the generator performance standards consistent with advice it has provided regarding South Australian generator licence conditions. This recommendation will be considered for implementation through the AEMO rule change request and is consistent with AEMO's advice provided in respect of South Australia.	2.1 As part of a package of Energy Security Obligations, by **mid-2018** the AEMC should review and update the connection standards in their entirety, which would include addressing system strength.
Resisting frequency changes		
3 **Place an obligation on transmission network service providers to provide minimum required levels of inertia, or alternative equivalent services, to allow the power system to be maintained in a secure operating state.**	Draft obligations published for consultation on **27 June 2017** as part of the draft determination made on the Managing the rate of change of power system frequency rule change proposed by the South Australian government. Arrangements are scheduled to be finalised on **19 September 2017**.	2.1 As part of a package of Energy Security Obligations, by **mid-2018** the AEMC should require transmission network service providers to provide and maintain a sufficient level of inertia for each region or sub-region, including a portion that could be substituted by fast frequency response service.
4 **Introduce a market-based mechanism to realise the market benefits that could be obtained through the provision of inertia above the minimum obligation on transmission network service providers.**	Draft mechanism to be published for consultation on **7 November 2017** as part of the draft determination to be made on the Inertia ancillary service market rule change proposed by AGL.	No specific recommendation.

AEMC recommendation	How our recommendation will be implemented or further progressed	Independent Review into the Future Security of the National Electricity Market recommendation
Better frequency control		
5 **Assess whether mandatory governor response requirements should be introduced and investigate any consequential impacts (including on the methodology for determining causer pays factors for the recovery of regulation FCAS costs).**	In **July 2017** the AEMC will initiate a review into market frameworks necessary to support better frequency control: Frequency control frameworks review. AEMO has commissioned expert advice on the causes and impacts of deteriorating frequency control performance, for consideration by its Ancillary Services Technical Advisory Group in **July 2017**. The Commission will consider the outcome of this work and its implications through the review.	2.3 By **mid-2018**, AEMO and the AEMC should investigate and decide on a requirement for all synchronous generators to change their governor settings to provide a more continuous control of frequency with a deadband similar to comparable international jurisdictions.
6 **Review the structure of FCAS markets, to consider:** • **any drivers for changes to the current arrangements, how to most appropriately incorporate FFR services, or alternatively enhancing incentives for FFR services, within the current six second contingency service; and** • **any longer-term options to facilitate co-optimisation between FCAS and inertia provision.**	Further consideration through the AEMC's Frequency control frameworks review (commencing **July 2017**) and AEMO's future work program.	2.2 A future move towards a market-based mechanism for procuring fast frequency response (as proposed as in the System security market frameworks review) should only occur if there is a demonstrated benefit
7 **Assess whether existing frequency control arrangements will remain fit for purpose in light of likely increased ramping requirements, driven by increases in solar PV reducing operational demand at times and therefore leading to increased demand variation within a day.**	Further consideration through the AEMC's Frequency control frameworks review (commencing **July 2017**) and AEMO's future work program.	No specific recommendation, but notes that AEMO has recommended a requirement in South Australia for active power control facilities to be fitted to all variable renewable electricity generators. Among other things, this would require the control of ramp rates. It is suggested that AEMO should monitor the effectiveness of this new requirement and assess its application more broadly (p. 101).
8 **Consider placing an obligation on all new entrant plant, whether synchronous or non-synchronous, to have fast active power control capabilities.**	This recommendation will be considered for implementation through the AEMO rule change request to be submitted to the AEMC in **July 2017**, and is consistent with a recommendation made by AEMO in respect of South Australia.	2.1 As part of a package of Energy Security Obligations, by **mid-2018** the AEMC should require new generators to have fast frequency response capability.
Facilitating the transformation		
9 **Continue to scope further power system security issues likely to arise from the ongoing transformation of the market, such as:** • **the impact on system restart ancillary services of decreasing levels of synchronous generation; and** • **the adequacy of current voltage control arrangements.**	AEMO to further scope these issues.	No specific recommendation, but notes that it is important to maintain sufficient black start services as the generation mix changes (p. 61).