INFORMATION

System Security Market Frameworks Review

Interim report released for consultation

The AEMC is reviewing aspects of system security as new technologies drive a transformation of the National Electricity Market. Its report sets out a range of options to deliver secure energy at the best price for consumers.

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 generators, powered by coal and gas, and towards new technologies, such as wind farms and solar panels.

Due to their different technical characteristics, the widespread deployment of these new technologies has the potential to have major impacts on the operation of the power system. The Australian Energy Market Commission is consequently reviewing aspects of NEM system security, working closely with the Australian Energy Market Operator, to consider, develop and implement changes to market frameworks to allow the continued uptake of these new generating technologies while maintaining the security of the system.

The AEMC has published an interim report on the System Security Market Frameworks Review which was initiated by the Commission in July 2016. This report sets out some of the key aspects of system security being considered and some of the preliminary findings.

The report also sets out the options the Commission will continue to develop in conjunction with stakeholders for new market frameworks that will facilitate the transition of the market and the entry of new technologies and new participants in a manner that delivers secure energy at the best price for consumers.

New approaches to managing system security may be required

In order to allow a reliable supply of electricity to customers, the power system must be operated in a secure manner. The system is secure when technical parameters such as power flows, voltage, and frequency are maintained within defined limits.

Maintaining the frequency at a constant level is a key challenge in power system operations. Large deviations from the normal frequency level (50 Hertz in Australia) or rapid changes in frequency can lead to instability in the system and cause the disconnection of generation or load. Uncontrolled disconnections have the potential to lead to cascading failures and, ultimately, a “black system”.

The ability of the system to resist changes in frequency is determined by the inertia of the power system. Inertia is naturally provided by spinning generators, motors and other devices that are synchronised to the frequency of the system. Historically, in the NEM, plentiful inertia has been provided by conventional generators, such as coal and gas-fired power stations and hydro plant.

However, many new generation technologies, such as wind turbines and photo-voltaic panels, are not synchronised to the grid, have low or no physical inertia, and are, therefore, currently limited in their ability to dampen rapid changes in frequency.

Non-synchronous generators also do not contribute to system strength as much as synchronous generators. System strength relates to the size of the change in voltage for a change to the load or generation at a connection point. Reduced system strength in certain areas of the network may mean that generators are no longer able to meet technical standards and may be unable to remain connected to the power system at certain times.

The shift in the generation mix towards non-synchronous generation consequently gives rise to increasing challenges in maintaining the system in a secure operating state.

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The National Electricity Market is undergoing fundamental change and new approaches to maintaining system security may be required

Preliminary findings

The Commission has set out the following three-part framework in considering the ability to maintain control of power system frequency following a contingency event, such as the loss of a large generator, load or transmission line:

1. *The initial rate of change of frequency (RoCoF)*

   The rate at which the frequency changes determines the amount of time that is available to arrest the decline or increase in frequency before it moves outside of the permitted operating bands. AEMO may constrain the power system to reduce the size of a potential contingency and minimise the resulting initial frequency change. Alternatively, an increase in the level of inertia in the power system would permit the occurrence of larger contingencies for a given level of initial RoCoF.

   The Commission has reached a preliminary view that the ability to maintain power system security in an efficient manner would be enhanced by the development and introduction of a mechanism to obtain inertia.

2. *The capacity to restore the stability of the system*

   Limiting the initial rate of change of frequency will only act to increase the amount of time before frequency moves outside of acceptable bands. To permit a greater level of RoCoF would require the development of a "fast frequency response (FFR) service", which can arrest changes in frequency faster than existing frequency control services and revert frequency back to normal operating levels.

   The Commission has reached a preliminary view that the development of an FFR service would be beneficial in that it would provide greater flexibility in the level of RoCoF that could be permitted and a more efficient amount of inertia to be procured.

3. *The ability of generators and loads to withstand changes in frequency*

   In designing a framework for inertia and FFR services, and consequently a RoCoF limit, it will be important to understand the tolerance of the system to that level of RoCoF. In practice, generators and loads will have a range of withstand capabilities.

   Over the remainder of the review, the Commission anticipates giving further consideration to these issues, in particular the appropriateness of the current generator performance standards and whether it is necessary for work to be undertaken to better understand the withstand capability of generating units.

Potential options for the provision of new services

In light of its preliminary finding that there are two distinct new services required to enhance NEM system security, the Commission has identified a suite of potential mechanisms for provision of these services, including:

1. *Generator obligation* – A minimum technical standard on generators to physically provide the services or enter into an agreement with another provider of the services.
2. *AEMO contract process* – AEMO procures services via contracts with market participants through a competitive tender process or bilateral negotiated process.
3. *Provision by network businesses* – The direct provision of services by network businesses or the procurement of services by network businesses under a modified Network Support and Control Ancillary Service (NSCAS) framework.
4. *Five-minute dispatch* – Prices are set for the services on a five-minute basis, similar to the existing energy market dispatch process.

As the next stage of the System Security Market Frameworks Review, the AEMC intends to refine the range of potential options to deliver the new services. The different characteristics of these services may mean different procurement paths are taken for each.

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