AEMC

INFORMATION

Emergency frequency control

New rules to enhance emergency frequency control schemes

The AEMC has made a draft rule to facilitate enhanced emergency frequency control schemes and to introduce a new category of protected contingency event. These changes are designed to help deliver a secure supply of electricity at the lowest possible cost to consumers in a changing power system environment.

Enhanced emergency frequency control to deliver a secure supply of energy

The Commission has made a draft rule to enhance the frameworks for emergency frequency control in the National Electricity Market. The draft rule includes:

- an enhanced emergency frequency control scheme framework to allow for the efficient use of all available technological solutions to limit the consequences of emergency frequency events, including a formalised arrangement for the management of over-frequency events.
- a new classification of contingency event, the protected event, that in the circumstances defined by such an event, will allow power system security to be managed by using a combination of ex-ante solutions, as well as load shedding.

An enhanced emergency frequency control scheme and the category of protected events will support security of the power system as the generation mix changes and technology evolves. However, it is important these measures are delivered efficiently, so that costs for consumers are as low as possible. The draft rule therefore sets out clear governance arrangements, including robust cost benefit processes.

Frequency control in the NEM

What is frequency and how is it managed?

The National Electricity Market operates at a frequency that is kept close to 50 hertz per second.

The frequency can change if sudden disturbances cause an imbalance between load and generation. For example, the sudden loss of a generator will cause the frequency to fall, while the loss of a large load will cause the frequency to rise.

The Australian Energy Market Operator (AEMO) operates the power system to manage the frequency following these kinds of disturbances. For events that AEMO considers are reasonably possible (called credible contingencies) such as the loss of a generator, AEMO manages the system at all times so that the frequency will stay within defined limits, if the event were to occur. AEMO does this by buying ancillary services and constraining the power system. No load shedding occurs for these events.

For events that AEMO considers are not reasonably possible (called non-credible contingencies) such as the simultaneous loss of multiple generators, AEMO doesn't manage the system at all times to limit the frequency consequences of these events. Instead, the frequency fall is stopped by controlled shedding of load, through under frequency load shedding.

AEMO can reclassify a non-credible event as a credible event, if it considers that abnormal conditions mean the event is now reasonably possible in the surrounding circumstances. AEMO has discretion to decide whether these abnormal conditions exist and whether the event is now reasonably possible.

AUSTRALIAN ENERGY MARKET COMMISSION LEVEL 6, 201 ELIZABETH STREET SYDNEY NSW 2000
T: 02 8296 7800 E: AEMC@AEMC.GOV.AU W: WWW.AEMC.GOV.AU

An enhanced EFCS and protected events will support security of supply for consumers.

However, it is important these measures are delivered efficiently, so that costs for consumers are as low as possible.

Emergency frequency management in a changing power system environment

The consequences of non-credible contingency events are currently limited through under frequency load shedding schemes. These schemes utilise a series of relays that automatically shed load in a controlled manner in response to a drop in frequency caused by a non-credible contingency, such as the loss of multiple generators. This is intended to arrest the fall in frequency by rebalancing load and generation.

The effectiveness of current load shedding schemes may be reduced by a number of changes currently underway within the National Electricity Market, particularly changes in the generation mix. This mix is changing as older, synchronous generators retire and are replaced with new non-synchronous generation technology, such as wind and solar.

Synchronous generators provide a degree of physical "inertia" in the system, which slows the rate at which frequency can change following a contingency event. Non-synchronous generators provide less physical inertia in the system. This means that frequency can now change more rapidly following a contingency event.

These changes may reduce the effectiveness of existing under frequency load shedding schemes. In particular, these schemes may not be able to act fast enough to arrest the fall in frequency following a contingency event. This could result in a cascading failure of other generators, potentially causing a major black out.

These under frequency control schemes therefore need to be adapted and enhanced so they remain effective and capable of supporting the secure supply of energy to consumers as this transition continues.

Emergency frequency control schemes

The draft rule establishes a governance framework for emergency frequency control.

This framework will enable the use of all available technologies, where these technologies represent the most efficient way of delivering emergency frequency control. It also includes a formal framework for generation shedding schemes to manage over-frequency events.

It's important an emergency frequency control scheme can utilise all available technologies as they evolve, in order to develop to meet future power system conditions. However, it must also be delivered at an efficient cost to consumers. The draft rule therefore sets out a governance framework in which:

- AEMO, in consultation with network service providers, will propose an emergency frequency control scheme, including estimates of potential scheme capabilities and costs to deliver those capabilities
- The Reliability Panel will undertake a cost benefit assessment of the proposal and will develop an emergency frequency control scheme standard
- AEMO will develop an emergency frequency control scheme functional design specification to meet the emergency frequency control scheme standard
- Network service providers will install and/or replace equipment that can meet these functional design specifications.

This framework allows for the efficient assessment of costs and benefits by the Reliability Panel. This is consistent with the Reliability Panel's broader role in setting various power system standards.

Protected events

The draft rule establishes the new category of protected contingency event and a governance framework for identifying specific protected events.

For a protected event, AEMO will be able manage the system at all times so that the frequency will stay within defined limits, if the protected event were to occur. This may include ex-ante actions, such as procuring ancillary services and constraining the dispatch of generation in the system. Some load shedding will also be allowed to limit the expected consequences of the protected event, if it occurs.

This will deliver efficient outcomes where the costs of managing the system, as well as the costs of any load shed, are less than the avoided expected consequences of the protected event.

The Commission has developed the Emergency frequency control schemes rule change in coordination with its review of System Security Market Frameworks.

An interim report for the system security review was published on 15 December 2016.

There could be significant costs associated with managing the system to limit the expected consequences of a protected event. The draft rule therefore sets out a governance framework in which:

- AEMO will decide when an event should be classified as a protected event
- The Reliability Panel will determine a post-contingency operating state for the protected event. This may include specific bands for frequency following the event, times for frequency restoration, or maximum amounts of load that can be shed
- AEMO will then operate the power system so that it will be in a configuration that matches the post-contingency operating state, if the protected event were to occur

As with an emergency frequency control scheme, this framework allows for the assessment of the costs and benefits of the protected event by the Reliability Panel. This is consistent with the Reliability Panel's broader role in setting various power system standards.

Part of the broader system security work package

The Commission has developed the draft determination in coordination with its Review of System Security Market Frameworks (the system security review).

The system security review is developing mechanisms that will be used to manage the more day to day aspects of the security of the power system. This includes consideration of market based mechanisms to provide inertia and fast frequency response, to manage the frequency on an on-going basis.

The draft rule establishes mechanisms for protecting against extreme emergency events that occur rarely. As such, it has focused on regulatory solutions to deliver robust and clearly defined emergency mechanisms.

The AEMC has published its Interim report for the system security review on 15 December 2016. This report is available at www.aemc.gov.au.

Who is the Reliability Panel

The AEMC's Reliability Panel defines the power system security and reliability standards necessary to provide a reliable and secure electricity market - against which the NEM's performance is measured and reported.

Consultation

The Commission has allowed an 8 week consultation period, to account for the 2016/17 holidays. Submissions are due **16 February 2017** and should quote reference ERC0212.

For information contact:
AEMC Chairman, **John Pierce** (02) 8296 7800
AEMC Chief Executive, **Anne Pearson** (02) 8296 7800

Media: Communication Director, Prudence Anderson 0404 821 935 or (02) 8296 7817

22 December 2016