

## New rules for emergency frequency control schemes

**The AEMC has made a final rule to allow emergency frequency control schemes, which are ‘last line of defence’ mechanisms, to adapt to the changing power system and to introduce a new category of contingency event, the Protected 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 final rule to establish an integrated, transparent framework for the consideration and management of power system frequency risks arising from non-credible contingency events in the National Electricity Market. The final rule includes:

- a clear framework to regularly review current and emerging power system frequency risks, and then identify and implement the most efficient means of managing emergency frequency events;
- an enhanced process to develop emergency frequency control schemes 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; and
- a new classification of contingency event, the protected event, that will allow the Australian Energy Market Operator (AEMO) to manage the system at all times by using some ex-ante operational solutions, as well as some limited generation or load shedding, to limit the consequences of the protected event.

This integrated framework for emergency frequency control schemes and protected events will support security of supply for consumers 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 final rule therefore sets out clear governance arrangements, including the requirement for 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 cycles per second (hertz). It's important to keep the frequency stable and close to this level, as generators and loads operate most efficiently within a narrow frequency range. The Australian Energy Market Operator (AEMO) manages the power system frequency by balancing supply and demand at all times within the power system.

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.

AEMO is currently required to operate 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.

An integrated EFCS and protected events framework 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.

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.

### **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.

### **The final rule**

The AEMC has made a final rule to establish an integrated, transparent framework for the consideration and management of power system frequency risks arising from non-credible contingency events in the NEM. The new rule will be in place by **6 April 2017**.

The final rule is a more preferable rule, but is broadly consistent with the intention of the proposals put forward by the South Australian Minister for Minerals Resources and Energy.

The framework established by the final rule is illustrated in figure 1 and can be considered as comprising three main parts.

#### **1. Power System Frequency Risk Review**

The final rule places a clear obligation on AEMO to undertake, in collaboration with TNSPs, an integrated, periodic review of power system frequency risks associated with non-credible contingency events – the Power System Frequency Risk Review (PSFR Review) as part of a governance framework for emergency frequency control.

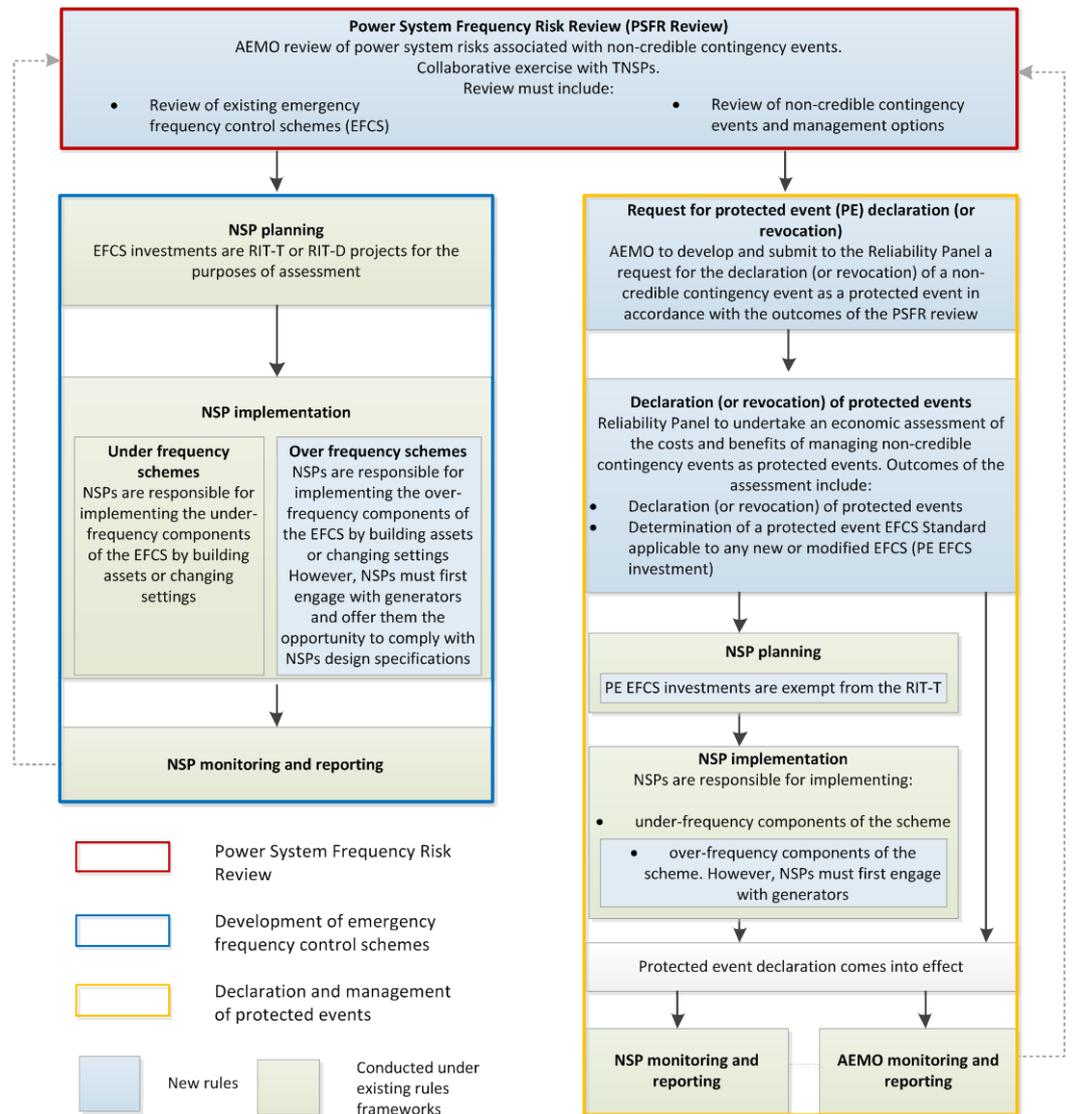
The PSFR Review will consider:

- whether there is a need to introduce, modify or adapt automatic emergency frequency control schemes (including existing under frequency load shedding) that are designed to limit the consequences of some non-credible contingency events; and/or
- whether it would be economic for AEMO to operate the power system in a way that limits the consequences of certain high consequence non-credible contingency events, should they occur.

The outcomes on the PSFR Review may be a recommendation for a new or improved emergency frequency control schemes and/or a proposal for the declaration of a protected event by the Reliability Panel.

**Figure 1 Overview of the framework for the management of emergency frequency events**

The final rule facilitates the identification of efficient solutions to emerging risks in the NEM, supporting the long run efficient operation and use of, and investment in, electricity services.



## 2. New and Improved emergency frequency control schemes

Where a new or modified emergency frequency control schemes is an outcome of the PSFR Review, in the absence of the need for a protected event, the assessment, design, implementation and monitoring of the scheme will largely proceed through the existing framework for NSP planning in the National Electricity Rules (NER).

In particular, the Regulatory Investment Test for Transmission (RIT-T) or Distribution (RIT-D) will be used to assess the economic case for the change. The final rule clarifies and enhances the arrangements for load shedding schemes used to manage under-frequency events and, for the first time, establishes in the rules a governance framework for the implementation of schemes to shed generation to manage over-frequency events.

## 3. The declaration and management of a Protected Event

Where the PSFR Review identifies one (or more) non-credible contingency events which AEMO considers it may be economically efficient to manage using ex-ante operational measures in addition to some limited load or generation shedding, AEMO will submit a request to the Reliability Panel to have the event declared to be a “protected event”.

The Reliability Panel will undertake an economic assessment of the request by weighing the costs of the options for managing the event (including the costs to the market of any load shedding) against the avoided cost of the consequences of the non-credible contingency event should it occur and not be managed. Where the benefits of managing the event outweigh the costs of doing so, the Reliability Panel would declare the event a protected event.

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

A directions paper for the system security review was published on 23 March 2017.

AEMO will then operate the power system so that it will be in a configuration that enables the power system security standards to be maintained, if the protected event were to occur.

Where the efficient management option for a protected event includes a new or modified emergency frequency control scheme, the Reliability Panel would also set a "protected event EFCS standard", which defines the target capabilities for the scheme. NSPs would then be required to design, implement and monitor the scheme in accordance with the standard.

NSPs would be exempt from having to undertake the RIT-T (or RIT-D) where this would otherwise have been applicable because the cost benefit assessment would have already been undertaken by the Reliability Panel.

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 which often require considering the trade-off between costs and security or reliability benefits.

### Part of the broader system security work package

The Commission has developed the final 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 final 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 Directions Paper for the system security review on 23 March 2017. This report is available at [www.aemc.gov.au](http://www.aemc.gov.au).

### Who is the Reliability Panel?

The 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.

As the final rule raises issues relevant to the NEM's frequency operating standard, the AEMC has also requested that the Reliability Panel undertake a review of these standards. This review is related to and is intended to complement the on-going work program that the AEMC is undertaking to enable the maintenance of power system security in the NEM, including this rule change. The terms of reference can be found at [www.aemc.gov.au](http://www.aemc.gov.au).

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

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