Australian Energy Market Commission

RULE DETERMINATION

National Electricity Amendment (Emergency frequency control schemes) Rule 2017

30 March 2017

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Reference: ERC0212

Citation

AEMC 2017, Emergency frequency control schemes, Rule Determination, 30 March 2017, Sydney

About the AEMC

The AEMC reports to the Council of Australian Governments (COAG) through the COAG Energy Council. We have two functions. We make and amend the national electricity, gas and energy retail rules and conduct independent reviews for the COAG Energy Council.

Summary

The Australian Energy Market Commission (AEMC or Commission) has made a final rule, which is a more preferable rule, to enhance the frameworks for emergency frequency control in the National Electricity Market (NEM).

Driven by rapid technological change and emissions policy, the 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 is having major impacts on the maintenance of power system security.

The Australian Energy Market Operator (AEMO) is obliged under the National Electricity Law (NEL) to maintain and improve power system security. As part of its obligations under the NEL and National Electricity Rules (NER), it is required to manage the potential impacts on system security of events it considers reasonably possible (called credible contingencies), and re-classify non-credible contingencies to credible ones when, in its discretion, it is appropriate to do so.

The risks associated with some non-credible contingencies have increased in light of the transitioning NEM. In the past, the effects of these events have been mitigated through the use of schemes installed by Network Service Providers (NSPs) designed to quickly respond to changes in frequency where a sudden disturbance has caused an imbalance between load and generation. However, the shifting generation mix means that the frequency of the power system can now change much more quickly, reducing the effectiveness of these schemes.

To ensure that these risks are identified and addressed in a systematic manner, the final rule establishes an integrated, transparent framework for the consideration and management of power system frequency risks arising from non-credible contingency events. By establishing a 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, the final rule also supports security of supply at the lowest costs for consumers.

The Commission has made this final rule determination after carefully considering the arguments and evidence put forward throughout the rule change process, including in submissions to the draft rule determination and the draft rule. The Commission has also developed the final rule determination in coordination with its Review of System Security Market Frameworks (the system security review). A summary of the final rule is provided below.

Summary of the final rule

The final rule is intended to promote the efficient operation of the power system in light of the risks emerging from the NEM's current transition in technologies.

First, the final rule places a clear obligation on AEMO to undertake, in collaboration with Transmission Network Service Providers (TNSPs), an integrated, periodic review of power system frequency risks associated with non-credible contingency events. The purpose of the review (Power System Frequency Risk Review (PSFR review)) is to reveal to AEMO, and the market more generally:

- whether there is a need to introduce, modify or adapt automatic schemes to shed load[1] or generation 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.

In respect of the former, once a need to introduce, modify or adapt such an emergency frequency control scheme is identified through the risk review process, 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.

In respect of the latter, if AEMO identifies one (or more) non-credible contingency events which it considers it may be economically efficient to manage using existing ex-ante operational measures, AEMO would submit a request to the Reliability Panel to have the event declared to be a "protected event". Such ex-ante measures may be intended to be used to manage an event either alone or in combination with a new or modified emergency frequency control scheme.

The Reliability Panel would 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.

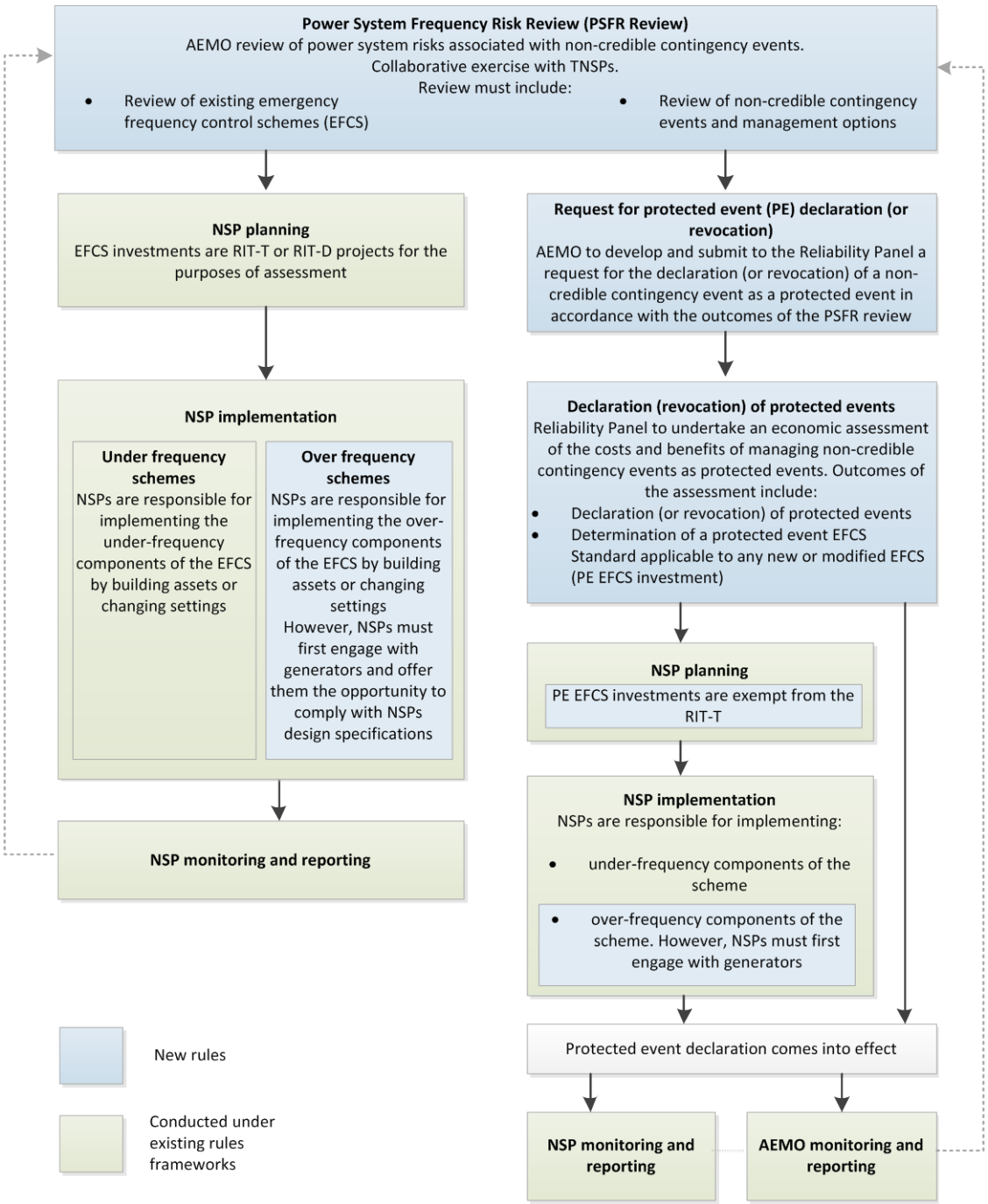
In addition, where the efficient management option includes a new or modified emergency frequency control scheme, the Reliability Panel would set a "protected event EFCS standard", or set of target capabilities, for the scheme. NSPs would then be required to design, implement and monitor the scheme in accordance with the standard. NSPs would be exempt from having to undertake the RIT-T (or RIT-D)

1 The rules currently set out a national framework for controlled under frequency load shedding (UFLS) for the management of under-frequency events following a non-credible contingency event.

where this would otherwise have been applicable because the Reliability Panel would already have undertaken a cost benefit analysis of the recommended option.

An overview of the framework for the management of emergency frequency events is set out in figure 1.

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



Reasons for making the final rule

Having regard to the issues raised in the rule change request and during consultation, the Commission is satisfied that the more preferable final rule will, or is likely to, contribute to the achievement of the NEO for the following reasons:

- The inclusion of an economic assessment framework allows for the severity of the consequences of certain non-credible contingency events to be balanced against the price outcomes associated with managing the event.
- The introduction of a clear and transparent framework around the development of emergency frequency control schemes will enable new technologies and solutions to provide more effective emergency frequency control schemes to be identified and considered, improving the security of electricity services for consumers.
- The introduction of a contingency event classification for protected events will allow for more efficient operation of the power system, providing both security and reliability benefits for consumers.

The governance framework clarifies responsibilities for the review of power system frequency risks, the declaration of a protected event through a robust cost benefit assessment, and the planning and implementation of management solutions for certain non-credible contingency events. This will allow for identification of efficient solutions to emerging risks in the NEM, supporting the long run efficient operation, use and investment in electricity services.

Context for the rule change request

The National Electricity Market operates at a frequency that is kept close to 50 hertz. 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 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 should occur 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 automatic under-frequency load shedding schemes.

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.

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 the transitions underway within the NEM, particularly changes in the generation mix. This mix is changing as new non-synchronous generation technology, such as wind and solar, and the subsequent retirement of older, synchronous generators.

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.

System security work package

The Commission has developed the final rule 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 published its directions paper for the system security review on 23 March 2017. This paper is available at www.aemc.gov.au. Submissions are due on 20 April 2017.

Contents

1 South Australian Minister's rule change request

1.1 The rule change request

On 12 July 2016, the South Australian Minister for Mineral Resources and Energy (the proponent or South Australian Government) made a request to the Australian Energy Market Commission (AEMC or Commission) to make two rules for:

- emergency frequency control schemes for generation deficit events,[2] and
- emergency frequency control schemes for excess generation events.[3]

These two rule changes requests were part of a larger package of rule change requests made by the proponent. This package also included two separate rule changes related to managing the rate of change of frequency (RoCoF) and fault levels. These two rule changes are being considered as part of the AEMC's broader System Security Market Frameworks Review.[4]

1.1.1 Structure of this final determination

1.1.2 Consolidation of the rule changes

On 22 December 2016, the Commission decided to consolidate the Emergency under-frequency control schemes rule change (ERC0212) with the Emergency over-frequency control schemes rule change (ERC0213)[5] under s 93(1) of the National Electricity Law (NEL). The Commission decided that the two rule change requests should be considered together because they both related to the emergency management of frequency disturbances following contingency events in the National Electricity Market (NEM).

1.1.3 System Security Market Frameworks Review

The AEMC commenced its System Security Market Frameworks Review (the system security review) on 14 July 2016, which considers the market frameworks relevant to system security in the NEM. The review is drawing upon work being undertaken by the Australian Energy Market Operator's (AEMO), as part of its Future Power System Security (FPSS) Program to identify and prioritise current and future challenges to maintaining system security. As discussed in section 1.1, the review is also being

2 Referred to in this document as the Emergency under-frequency control schemes rule change request.

3 Referred to in this document as the Emergency over-frequency control schemes rule change request.

4 See www.aemc.gov.au.

5 Under section 93 of the National Electricity Law, the AEMC may consolidate two or more rule changes that it has received.

conducted in parallel with the assessment of a number of rule change requests submitted by AGL and the South Australian Government relating to frequency control and system strength.

On 15 December 2016, the AEMC published an interim report on the system security review. This report set out some of the key aspects of system security being considered and some of the preliminary findings of the Commission. It also set out the options the Commission continued 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 most efficient price for consumers.

On 23 March 2017, the AEMC published a directions paper on the system security review. This report sets out the 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.

The immediate package contains a number of complementary measures to maintain control of power system frequency following a contingency event. These include requirements for a minimum inertia operating level, the ability for TNSPs to procure of fast frequency response (FFR) and generator obligations for FFR capability.

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 Commission is seeking stakeholder feedback on the directions paper. Submissions are due by 20 April 2017.

1.2 Current arrangements

This section describes current National Electricity Rules (NER) arrangements for:

- AEMO's management of power system frequency
- emergency frequency control schemes, and
- processes for contingency event classification and reclassification.

These matters are relevant to both the Commission's consideration of governance arrangements for emergency frequency control schemes and for the development of a new category of protected event.

1.2.1 Management of frequency

In an alternating current power system, generators provide, and consumers use, electricity within a given frequency band. Generating equipment and some loads are finely tuned to operate at specific frequencies and so it is important the entire power system remains within this frequency range.

One of AEMO's key obligations under the NER is to maintain the power system in a secure operating state.[6] This includes keeping system frequency within the normal operating frequency band. The frequency requirements that AEMO must meet are defined in the NER and the power system security standard (known as the frequency operating standard (FOS)) determined by the Reliability Panel.[7]

While AEMO aims to keep power system frequency within this band, actual frequency levels are affected by events that change the supply and demand balance. Increases in supply relative to demand generally increase power system frequency, while decreases in supply relative to demand generally decrease power system frequency. AEMO utilises different tools to maintain or return the system to the normal operating frequency band, depending on the nature of the event that has disturbed the frequency.

Minor disturbances during normal operation

When the power system is operating normally, minor fluctuations in supply and demand occur within each five minute dispatch interval. These variations can move the frequency away from the normal operating frequency by a small amount. To manage this, AEMO procures specific ancillary services from generators and loads, known as "regulation" raise and lower frequency control ancillary services (FCAS), and coordinates their use to maintain the frequency within the normal operating frequency band.

Credible contingency events

From time to time, the power system may experience more significant disturbances, where there is a temporary and unexpected imbalance of supply and demand. These disturbances, which AEMO considers to be reasonably possible in the surrounding circumstances, are known as credible contingency events. They may be caused by

6 Chapter 4 of the NER provides the framework for achieving and maintaining a secure power system.

7 The FOS currently consists of two separate standards: one for the mainland NEM, and one for Tasmania. This reflects the different physical and market characteristics of the Tasmanian region as opposed to the mainland NEM. The frequency operating standard for Tasmania was last reviewed and determined by the Reliability Panel on 18 December 2008. The frequency operating standard for the mainland was last reviewed and determined by the Reliability Panel on 16 April 2009. The review of the Mainland Frequency Operating standard relaxed the operational frequency tolerance band when load is being restored during a time of supply scarcity. The remainder of the Mainland Frequency Operating standard is unchanged since September 2001 when it was determined by the NECA Reliability Panel. On 20 March 2017, the AEMC issued Reliability Panel with terms of reference for a review of the FOS that apply to Tasmania and the mainland NEM.

events such as the loss of a single generator, a single load or a single line in the network.[8]

AEMO is required to maintain the power system frequency within the operational frequency tolerance band when these kinds of events occur, and must return the frequency to the normal operating frequency band within a specified time period.[9] To do so, it procures contingency raise and lower FCAS, which increase or decrease the frequency in response to these more significant frequency variations.[10,11]

Network service providers (NSPs) also face a number of obligations to plan and operate their networks for credible contingency events. In particular, NSPs are required to:

- plan, design, maintain and operate their networks to allow the transfer of power from generating units to customers with all facilities in service, even if a credible contingency event were to occur[12]
- comply with minimum standards for network services within a region including a power transfer capability such that in a satisfactory operating state, the power system is capable of providing the highest reasonably expected requirement for power transfer (with appropriate recognition of diversity between individual peak requirements and the necessity to withstand credible contingency events) at any time[13]
- for power transfers between regions, maintain (with AEMO) a standard of service such that, when in a satisfactory operating state, the network must be planned by the NSP and operated by AEMO to withstand the impact of any

8 NER clause 4.2.3(b) defines credible contingencies as: a *contingency event* the occurrence of which AEMO considers to be reasonably possible in the surrounding circumstances including the *technical envelope*. This definition goes on to describe examples of credible contingencies as: the unexpected automatic or manual *disconnection* of, or the unplanned reduction in capacity of, one operating *generating unit*; or the unexpected disconnection of one major item of *transmission plant* ... other than as a result of a three phase electrical fault anywhere on the *power system*.

9 Chapter 10 of the NER defines the operational frequency tolerance band as: The range of *frequency* within which the *power system* is to be operated to cater for the occurrence of a *contingency event* as specified in the *power system security standards*. The actual values of this range, and related time periods for restoration, are established in the FOS.

10 These contingency FCAS are measured in terms of how rapidly they respond to restore the system to the normal operating frequency. They include 6 second, 60 second and 5 minute frequency raise and lower services. They are typically provided by dispatchable generators who act independently of AEMO to increase or decrease output in response to frequency changes.

11 The FOS for South Australia following a separation event is 47-52 Hz, based on previous notification by the Jurisdictional System Security Coordinator (JSSC) for South Australia. On that basis, AEMO has determined that no contingency raise FCAS is required for the credible loss of the Heywood Interconnector if flow is towards South Australia, because frequency will be maintained above 47Hz by the operation of UFLS and the 1 HZ/sec RoCoF limit applied under credible contingency events. See AEMO, Final Report – South Australia Separation Event, 1 December 2016, Reviewable operating incident report for the NEM, 28 February 2017, p.4.

12 Clause S5.1.2.1 of the NER.

13 Clause S5.1.2.2(a) of the NER.

single contingency with severity less than the credible contingency events stated in clause S5.1.2.1.[14]

Non-credible contingency events

More rarely, the power system can experience very significant disturbances to the supply/demand balance. These events, which AEMO considers are not reasonably possible in the surrounding circumstances, are known as non-credible contingencies. They may include events such as the simultaneous loss of multiple generators, or the loss of interconnection with a neighbouring region as a result of the loss of multiple transmission circuits.[15]

Currently the rules do not allow AEMO to procure FCAS or constrain generation dispatch for contingency events that AEMO considers to be non-credible. Instead, AEMO and NSPs utilise under-frequency load shedding (UFLS)[16] schemes (and in some instances, special protection schemes) to limit the consequences of a non-credible contingency.[17]

Importantly, AEMO has the discretion to reclassify contingency events from non-credible to credible when it considers that the presence of abnormal conditions means that the non-credible contingency is now more likely to occur. Reclassification is discussed in section 1.2.4.

1.2.2 National emergency frequency control schemes

The rules currently set out a national framework for controlled load shedding for the management of under-frequency events following a non-credible contingency.

UFLS operates only during rare events, usually following a non-credible contingency, where a drop in frequency has not been arrested by FCAS.

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14 Clauses S5.1.2.1 and S5.1.2.3(a) of the NER.

15 NER clause 4.2.3(e) defines a non-credible contingency as: a *contingency event* other than a *credible contingency event*. The definition then describes examples of non-credible contingencies as: three phase electrical faults on the *power system*; or ... simultaneous disruptive events such as: multiple *generating unit* failures; or double circuit *transmission line* failure (such as may be caused by tower collapse).

16 Current load shedding arrangements are sometimes referred to as a UFLS scheme. The word "scheme" in this context means a technical mechanism that is implemented to automatically control equipment, similar to protection schemes on generating plant. It is not a "scheme" in the more general sense of the word, in that it does not involve any payments made to participants to provide specific services.

17 This obligation is set out in NER clause 4.2.6(c), which describes the power system security principles, being the principles that AEMO must consider in its management of power system security. NER clause 4.2.6(c) states that: Adequate *load shedding* facilities initiated automatically by *frequency* conditions outside the *normal operating frequency excursion* band should be available and in service to restore the *power system* to a *satisfactory operating state* following significant multiple *contingency events*.

UFLS is facilitated through a distributed series of relays linked to circuit breakers, which progressively disconnect blocks of load in response to a frequency drop. This disconnection occurs in a coordinated and automatic manner to arrest a fall in frequency. This allows for the process of frequency restoration to the normal operating frequency band. Typically, relays in the scheme will be set to open at a range of frequency levels in order to manage a range of different contingency events. AEMO also coordinates these schemes across jurisdictions, so that load is shed in an even manner between the different regions of the NEM.[18]

Importantly, the settings of these relays are coordinated across the NEM. This is because frequency is the same across a synchronised system and moves in the same way when there is a disturbance anywhere in the system. For example, the loss of a generator in Queensland will result in a drop in frequency across the whole of the mainland NEM. Because frequency moves in this way, this drop can be arrested effectively by opening relays in South Australia, Victoria, New South Wales or Queensland, if the frequency has moved outside of the operational frequency tolerance band.

The design of current UFLS arrangements reflects this outcome, with the settings of relays coordinated across the NEM to:

- help maintain the frequency within the extreme frequency tolerance band as defined by the frequency operating standard in the event of a sudden and significant non-credible contingency,[19] and
- to distribute the load-shedding between the NEM regions to minimise the impact of the load-shedding on any one part of the NEM transmission network.[20]

The NER includes a framework that sets out some responsibilities for different parties regarding the design and implementation of load shedding. These high level obligations include:

- The jurisdictional system security coordinator (JSSC) is required to establish a schedule of sensitive loads and a schedule setting out the order in which loads may be shed by AEMO.[21]
- AEMO must develop, update and maintain a set of procedures for each participating jurisdiction under which loads will be shed and restored in accordance with the schedules prepared by the JSSC for that jurisdiction.[22]

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18 This applies when the frequency in all mainland NEM regions is synchronised and there is no separation of regions. Tasmania operates as a separate, non-synchronised part of the NEM.

19 The extreme frequency tolerance band is defined in the current FOS for Tasmania as 47.0 to 55.0 Hz and in the current FOS for the mainland NEM as 47.0 to 52.0 Hz.

20 The individual UFLS relays respond to the frequency at their location and are unaware of the location of the contingency causing the under-frequency. Therefore, the load-shedding is distributed evenly throughout the interconnected power system.

21 Clause 4.3.2(f) of the NER.

- NSPs and market customers have a series of obligations including the following:[23]

  - NSPs are required to ensure that sufficient load is under the control of under-frequency relays at the frequency settings developed by AEMO, to ensure that in the event of the sudden, unplanned simultaneous occurrence of multiple contingency events, the power system frequency does not move outside of the extreme frequency tolerance limits.

    During an under-frequency event, these loads are automatically disconnected in accordance with the procedures established by AEMO. The primary obligation on NSPs is to ensure that sufficient load is available for shedding.

  - Market customers with expected peak demand at their connection point in excess of 10MW are required to provide automatic interruptible load. The level of this interruptible load is required to be a minimum of 60 percent of their expected demand, or at a level determined by the Reliability Panel.[24]

1.2.3 Manual load shedding and localised emergency schemes

The NER also set out other schemes for the shedding of load to manage supply or reserve shortfalls or localised power system stability issues. These include:

- **Manual load shedding:** Manual load shedding is typically used to manage a supply or reserve shortfall and is triggered by AEMO issuing a direction after it has identified projected specific low reserve system conditions.

- **Localised emergency stability control schemes:** Localised emergency stability schemes are used to manage specific emergency events. These schemes are required to be implemented under clause S5.1.8 of the NER and typically address power system stability issues within a region, such as voltage, transient and oscillatory stability, or to provide network support.

Both of these arrangements are different to the national emergency load shedding schemes described above.

Manual load shedding

AEMO has the ability to undertake manual rotational load shedding for the purposes of system security and reliability.[25]

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22 Clause 4.3.2(h) of the NER.

23 Various NER clauses including 4.3.4, 4.3.5, S5.1.10.1, S5.1.10.2, S5.1.10.3, S5.3.10 and S5.6.

24 Clause 4.3.5 of the NER.

25 NER clause 4.3.2. More detail is also available in AEMO's Power System Security Guidelines, see: AEMO, *Power System Security Guidelines*, September 2016, p.16.

This load shedding is initiated by AEMO through directions to NSPs to shed blocks of load. This kind of load shedding is usually undertaken where AEMO has identified a lack of reserve in its projected assessment of system adequacy or in pre-dispatch and that lack of reserve means that a supply shortfall may take place.

This manual rotational load shedding differs from emergency load shedding schemes in that it is manually initiated rather than automatically triggered. It is also usually manually rotated across load blocks to deliver an equitable outcome.

NSP instigated emergency control schemes

NSPs are required to establish localised emergency control schemes for the purposes of maintaining system stability.[26]

Specifically, NSPs must consider the potential consequences of various non-credible contingency events, and to install emergency controls to minimise disruption and the risk of a cascading failure.[27]

These schemes are typically localised in nature and may deal with matters unrelated to frequency, such as voltage stability and power system oscillations. They may also provide network protection, to prevent overloading and damage to the network following a non-credible contingency event.

For example, SP Ausnet has proposed two such emergency control schemes in its 2014-17 revenue proposal to the Australian Energy Regulator (AER). These consisted of emergency control schemes for the non-credible loss of several major transmission lines, to avoid subsequent tripping of other lines and major load lost within Victoria. These schemes involved load shedding and some generator tripping.[28]

These schemes differ from national emergency load shedding schemes in that they are typically designed by a regional NSP, primarily for the purposes of managing intra-regional issues. However, they may be relevant to the management of frequency and stability across the whole of the NEM.

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26 System stability refers to the management of voltage, transient and oscillatory stability in the power system. This is separate to the management of frequency that is currently provided by UFLS.

27 Clause S5.1.8 of the NER requires NSPs, when planning their networks to: consider *non-credible contingency events* such as *busbar* faults which result in tripping of several circuits, uncleared faults, double circuit faults and multiple contingencies which could potentially endanger the stability of the *power system*. In those cases where the consequences to any *network* or to any *Registered Participant* of such events are likely to be severe disruption a *Network Service Provider* and/or a *Registered Participant* must install emergency controls within the *Network Service Provider's* or *Registered Participant's* system or in both, as necessary, to minimise disruption to any *transmission* or *distribution network* and to significantly reduce the likelihood of cascading failure.

28 SP Ausnet, *Revised Appendix 6B Network Capability Incentive Parameter Action Plan 2014-17*, December 2013, pp. 9-10. See: www.aer.gov.au.

1.2.4 Event reclassification

Current NER obligations

AEMO operates the power system and relies on a variety of ex-ante and ex-post tools to manage the consequences of different contingency events. As discussed in section 1.2.1, the rules describe two different kinds of contingency events, credible and non-credible contingency events.

AEMO classifies an event as credible if it considers that the occurrence of the event is reasonably possible in the surrounding circumstances.[29] By default, any other kind of contingency event is classified as a non-credible contingency event.[30]

AEMO has the discretion to reclassify contingency events from non-credible to credible. This discretion allows AEMO to reclassify a non-credible contingency event when it considers that the presence of abnormal conditions means that the non-credible contingency is now more likely to occur.[31] The NER set out the following obligations on AEMO in regard to the reclassification of events:[32]

- AEMO must publish the criteria that it will use as the basis of its reclassification of events. These criteria must be developed in consultation with market participants, NSPs, JSSCs and emergency services agencies.
- When reclassifying an event, AEMO must provide market participants with a notification that a non-credible contingency event has been reclassified as a credible contingency event, describing the abnormal conditions, the relevant non-credible contingency event and other information relevant to AEMO's reclassification.
- AEMO must continue to update any notification as new information arises, until such time as the abnormal conditions have ceased to have a material effect on the likelihood of the relevant contingency event that has been reclassified as credible. AEMO may then reclassify the event back to non-credible.
- AEMO must report every six months setting out its reasons for all instances of reclassification that have occurred in that time.

29 Clause 4.2.3(b) of the NER.

30 Clause 4.2.3(e) of the NER describes a non-credible contingency event as: a *contingency event* other than a *credible contingency event*.

31 Abnormal conditions are defined in NER clause 4.2.3A as: conditions posing added risks to the power system including, without limitation, severe weather conditions, lightning, storms and bush fires.

32 Clause 4.2.3A of the NER.

AEMO's current approach to reclassification

AEMO publishes power system security guidelines, which set out its approach to the reclassification of credible and non-credible events.[33]

These guidelines define two scenarios that AEMO has considered for reclassification, being the presence of bushfires and lightning near transmission assets. The guidelines then set out detailed decision making processes that AEMO will follow in these scenarios. The guidelines also allow for reclassification for other threats, including multiple generation unit disconnection, impact of pollution on insulators and protection system malfunction, however they do not set out the same detailed decision making processes.

AEMO is able to change the content of these procedures as it sees fit, subject to consultation with NSPs, JSSCs and market participants. This includes the detailed scenarios and decision making processes that it will follow when different events occur.

1.3 Rationale for the rule change request

1.3.1 Frameworks for emergency frequency control

The ability of the power system to resist changes in frequency is determined by the inertia of the power system. Inertia is provided as a consequence of having spinning generators, motors and other devices synchronised to the frequency of the system.

Historically, the NEM has had plentiful inertia 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 (PV) panels, are not synchronised to the grid, have low or no physical inertia. This decrease in the level of inertia in the power system means that the consequences of certain larger contingency events are likely to be much greater for a given level of frequency change.[34]

In the rule change request, the South Australian Minister for Mineral Resources and Energy stated that a number of emerging power system issues were reducing the effectiveness of existing load shedding mechanisms in the NER. In addition to the above, these included:[35]

- **Increases in rate of change of frequency**: in the event of a separation of South Australia from the rest of the NEM, there was an increased risk that existing

33 AEMO, *Power system security guidelines - SO_OP_3715*, 26 September 2016.

34 The frequency change, or RoCoF, determines the amount of time that is available to arrest the decline or increase in frequency before it moves outside of the permitted operating bounds. As RoCoF increases, the ability of the power system to arrest the decline in frequency also decreases, meaning the system is more susceptible to cascading outages, major supply disruptions and potentially a black system.

35 South Australian Minister for Mineral Resources and Energy, *Rule change submission*, 12 July 2016.

under-frequency load shedding schemes in South Australia would not work effectively. This was due to the high rates of RoCoF following these events.

- **Increased distributed energy resources (DER):** insufficient amounts of load could be shed during low frequency events, due to the impact of DER resources, such as rooftop PV in the distribution system.

- **Increased risk and consequence of over-frequency events:** growth of DER and wind generation in South Australia may substantially increase the likelihood of exports to Victoria, in turn increasing the possibility of an over-frequency event following a non-credible trip of the Heywood interconnector.

  The proponent stated this could be exacerbated by high RoCoF due to low levels of online synchronous generation. This could result in an uncontrolled tripping of generation, in turn lowering frequency and triggering uncontrolled load shedding.

The proponent suggested the existing NER frameworks may impede the use of new technologies that could address these issues. This includes the fact that existing frameworks make no allowance for a scheme to manage the coordinated shedding of generation in response to an over-frequency event.

More generally, the proponent claimed the NER framework do not include any process for the review and development of emergency frequency control schemes (EFCS), which could result in a failure to adapt these schemes quickly enough to remain effective in a rapidly changing power system.

1.3.2 AEMO responsibilities to manage non-credible contingencies

The proponent also stated that the current NER and frequency operating standards does not provide AEMO with sufficient guidance regarding the nature of the contingency events for which it must maintain the frequency of the power system.

The proponent argued that under current definitions, AEMO is effectively required to maintain power system frequency for all potential multiple contingency events.[36]

It was argued that this is not a realistic requirement, as this could include highly improbable events for which it would be impossible to maintain frequency, such as the simultaneous trip of all generation in a region.

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36 This obligation is established in the NER and the FOS. This includes NER clause 4.3.2, which places an obligation on AEMO to: achieve the AEMO *power system security responsibilities* in accordance with the *power system security principles*. NER clause 4.2.6(c) then sets out these principles, which include a requirement that: Adequate *load shedding* facilities initiated automatically by *frequency* conditions outside the *normal operating frequency excursion* band should be available and in service to restore the *power system* to a *satisfactory operating state* following significant multiple *contingency events*. Part B of the FOS require AEMO to maintain the frequency of the power system within the extreme frequency excursion tolerance limits, for any multiple contingency event.

1.4 Solution proposed in the rule change request

The proponent suggested several solutions to address these issues. The key components of that solution are:

- **Under-frequency:** Clarification of the responsibilities of different parties for the management of under-frequency events to facilitate the use of new technologies and solutions.
- **Over-frequency:** Development of a new framework for an over-frequency generation shedding scheme.
- **Event classification:** Introduce a framework in the NER to allow an independent body, such as the Reliability Panel, to nominate specific system events (such as non-credible loss of interconnectors) for which the FOS should be maintained.

1.4.1 Emergency under and over-frequency control schemes

The proponent suggested a number of potential changes to establish a more effective framework for the management of under-frequency events. These included the following:

- A framework to require NSPs to monitor the ongoing efficacy of load shedding schemes and EFCS and make investments as necessary to maintain their capability.
- A new obligation for AEMO and JSSCs to direct NSPs to undertake necessary investments, where NSPs have not done so.
- Changes to network planning, performance and reporting obligations.
- A review of NER Chapter 6A to ensure that the AER approve all necessary investments by NSPs, assuming they are justified by the NSP or if it is directed to undertake the expenditure by AEMO or the jurisdictional system security coordinator.
- A review and amendment of current NER clause 4.3.5, which requires that market customers with expected peak demand of more than 10MW at a connection point should make up to 60% of their load available for automatic load shedding.
- A new framework for the development of an over-frequency generator shedding (OFGS) scheme to maintain the FOS should a non-credible excess generation event occur. This framework would include the following:
  - AEMO would be required to prepare, maintain and update scheme guidelines that set out how the OFGS would work, including how generation will be shed.

- When designing the OFGS, AEMO would be required to minimise the amount of generation tripped to arrest over-frequency.
- Criteria should be established to determine which generation should be shed and when, including that any generators included in the scheme should have high availability factors.
- Any OFGS should contain sufficient redundancy to be effective under a range of operating conditions.
- Clear obligations for generators to participate in any OFGS.

1.4.2 Event classification

The proponent suggested a new framework to allow for the nomination of specific system events for management by AEMO. Specifically, the proponent suggested that the Commission should add flexible provisions to the Rules that would allow an independent body, such as the Reliability Panel, to nominate specific system events, such as the non-credible loss of interconnectors under particular conditions, for which the FOS should be maintained.

The objective of these provisions would be to provide clarity as to which multiple contingency events should be managed and define acceptable levels of consequence in mitigating the most severe outcomes of the specific events.

1.5 The rule making process to date

On 8 September 2016, the Commission published a notice advising of its commencement of the rule making process and consultation in respect of the rule change request.[37] A consultation paper identifying specific issues for consultation was also published. The Commission received seven submissions from stakeholders.[38] A summary of the issues raised in submissions and the Commission's response to each issue is contained in Appendix A of the draft rule determination.[39]

On 22 December 2016, the Commission published a draft rule determination making the draft rule as proposed.[40] The Commission received eleven submissions on the draft rule determination from a range of stakeholders.[41] A summary of the issues

37 This notice was published under s. 95 of the NEL.

38 Submissions closed on 13 October 2016 and were received from AEMO, ENA, Hydro Tasmania, SA Department of State Development, Clean Energy Council, Energy Australia and RES Australia.

39 See AEMC 2016, Emergency frequency control schemes, Draft Rule Determination, 22 December 2016, Sydney, Appendix A.

40 The draft rule determination was published under s. 99 of the NEL.

41 Submissions on the draft rule determination closed on 16 February 2017 and were received from SACOSS, Australian Energy Council, Energy Australia, Engie, ENA, Energy Queensland, AGL, AEMO, SA Department of State Development, Origin and ElectraNet.

raised in submissions and the Commission's response to each issue is contained in Appendix A of this final rule determination.

2 Final rule determination

The Commission has determined to make a final rule which is a more preferable final rule. The final rule establishes an integrated, transparent framework for the consideration and management of emergency power system frequency events in the NEM.

This chapter outlines:

- the rule making test for changes to the NER
- the assessment framework for considering the rule change request
- an overview of the final rule
- the consideration of the final rule against the National Electricity Objective (NEO)
- how the final rule contributes to the AEMC's strategic priority of market arrangements that encourage efficient investment and flexibility.

Further information on the legal requirements for making this final rule determination is set out in Appendix B.

2.1 Rule making test

Under the NEL the Commission may only make a rule if it is satisfied that the rule will, or is likely to, contribute to the achievement of the national electricity objective (NEO).[42] This is the decision making framework that the Commission must apply.

The NEO is:[43]

> "to promote efficient investment in, and efficient operation and use of, electricity services for the long term interests of consumers of electricity with respect to:
>
> (a) price, quality, safety, reliability and security of supply of electricity; and
>
> (b) the reliability, safety and security of the national electricity system"

The Commission can make a rule that is different (including materially different) to the proposed rule if it is satisfied that, having regard to the relevant issues in the rule change request, the more preferable rule will or is likely to better contribute to the

42 Section 88 of the NEL.

43 Section 7 of the NEL.

NEO.[44] Using the assessment framework set out in section 2.2, the Commission has determined that the more preferable final rule is likely to better contribute to the achievement of the NEO than the proposed or draft rules. The reasons for this are set out in section 2.3.

2.2 Assessment framework

In assessing the rule change request against the NEO the Commission has considered the following principles:

- **Proportionality**: When considering the development of new regulatory frameworks for EFCS and protected events, we first considered the materiality of current and potential issues and whether they can be adequately addressed under existing frameworks. In doing so, we considered the extent of potential changes underway in the NEM and the ability of current frameworks to adapt and address the consequences of those changes. Changes were made to the frameworks where we considered it was likely that continuing with existing arrangements would not be in the long term interests of consumers.

- **Efficient framework design**: When assessing new regulatory frameworks for EFCS and protected events, we considered whether these frameworks will be able to identify and balance all costs and benefits to determine the most efficient outcome. In doing so, we considered whether the proposed frameworks would be able to:

  - clearly identify and assess all of the potential consequences that would need to be addressed, in order to deliver outcomes that are in the long term interests of consumers

  - clearly identify and assess the full range of potential solutions to mitigate these potential consequences. This should include the ability to recognise and assess new technologies and services that could provide solutions at lowest cost, and

  - weigh the costs of these different solutions, including any capital and operational costs, against the materiality of the uncontrolled extreme frequency event they are designed to mitigate. This should include efficient allocation of costs and risks between parties under different solutions.

- **Effective governance**: When assessing new regulatory frameworks for EFCS and protected events, we considered whether these new frameworks adhered to good governance principles, including:

  - *Stability and flexibility*: Efficient investment and operational decisions are supported by confidence in the maintenance of a secure and safe power system. This confidence will be maintained where the regulatory

44 Section 91A of the NEL.

frameworks for power system security are predictable and transparent. Equally however, these frameworks must be sufficiently flexible to adjust to changing market conditions.

— *Appropriate allocation of responsibilities*: Roles and responsibilities should be allocated on the basis of experience of organisations. Allocation of responsibilities should also reflect the primary function of the organisation, whether that be of an operational or economic analytical nature.

— *Clear and transparent objectives*: Organisations should have clearly defined objectives and adequate operational scope to meet those objectives within the overarching governance framework.

— *Accountability*: Organisations should be accountable for how they have met their objectives. This should be enabled through obligations to consult and regular reporting obligations.

2.3 Overview of the final rule

The final rule is intended to promote the efficient operation of the power system in light of the risks emerging from the NEM's current transformation. It does so by establishing an integrated, transparent framework for the consideration and management of emergency power system frequency events in the NEM.

First, the final rule places an obligation on AEMO to undertake, in consultation with transmission network service providers (TNSPs), an integrated, periodic review of power system frequency risks associated with non-credible contingency events. The purpose of the review (Power System Frequency Risk Review (PSFR review)) is to reveal to AEMO, and the market more generally:

- whether there is a need to modify or adapt an existing emergency frequency control scheme designed to limit the consequences of some non-credible contingency events, to ensure it is able to operate as intended in light of changing market and power system conditions, and

- the potential opportunities for efficiency gains from enabling AEMO to operate the power system at all times to limit the consequences of certain high consequence non-credible contingency events, should they occur.

In respect of the former, once a need to modify or adapt an existing emergency frequency control scheme is identified by AEMO through the risk review process, the assessment, design, implementation and monitoring will largely proceed through the existing framework for NSP planning in the NER.

In respect of the latter, once AEMO identifies one (or more) non-credible contingency events for which it considers it may be economically efficient to utilise some ex-ante measures (such as the purchase of frequency control ancillary services (FCAS) or constraining generation dispatch), in addition to some limited load or generation

shedding, to limit the consequences of an event should it occur, AEMO would submit to the Reliability Panel a request for the declaration of a "protected event".

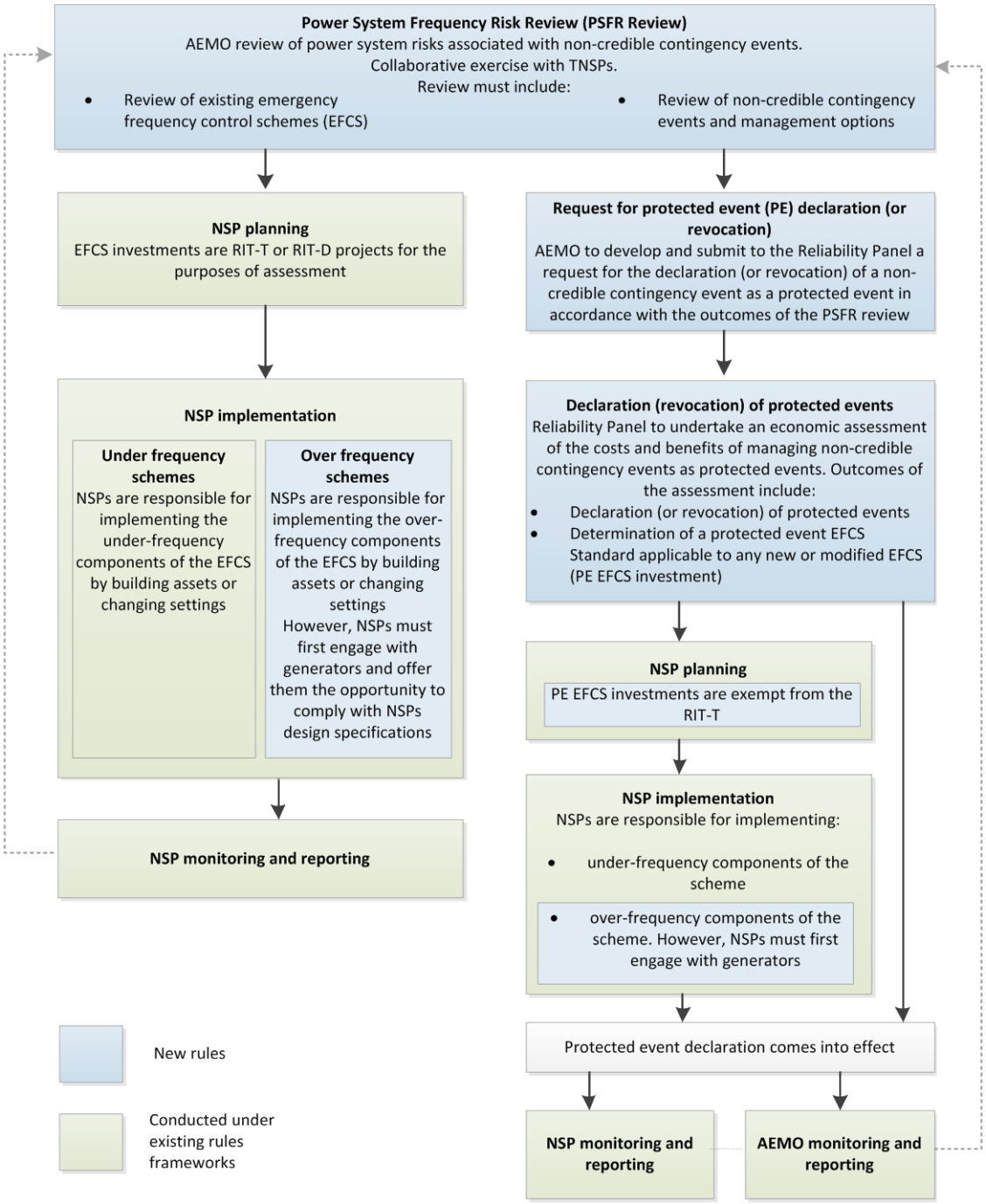
The Reliability Panel would undertake an economic assessment of the options put forward by AEMO to manage the relevant non-credible contingency event. Given that a new or modified emergency frequency control scheme would be progressed through existing planning processes, to be considered by the Reliability Panel, at least one management option for an event would include the use of some degree of ex-ante measures, either alone or in combination with a new or modified emergency frequency control scheme.

The Reliability Panel would assess the costs of the management options (including the costs to the market of any load shedding associated with the option) 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.

In addition, where the efficient management option includes a new or modified emergency frequency control scheme, the Reliability Panel would set a "protected event EFCS standard", or set of 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 Regulatory Investment Test for Transmission (RIT-T) (or Regulatory Investment Test for Distribution (RIT-D) where this would otherwise have been applicable because the Reliability Panel would already have undertaken a cost benefit analysis of the recommended option (including the EFCS).

An overview of the framework for the management of emergency frequency events is set out in figure 2.1.

Figure 2.1 Overview of the framework for the management of emergency frequency events



A more detailed description of the final rule, including the Commission's reasons, is set out in chapters 4-7.

2.4 Summary of reasons

The final rule made by the Commission is attached to and published with this final rule determination. The key features of the final rule include:

- A transparent, integrated review of power system frequency risks associated with non-credible contingency events in the NEM, including the arrangements for managing these events. The purpose is to identify the need for a new or modified emergency frequency control scheme, and to identify certain non-credible contingency events for which it may be economically efficient to manage the power system to limit the consequences of the event, should it occur.

- A process for developing new, or modifying existing, emergency frequency control schemes which are not required to manage a specific non-credible contingent event and which have been identified through the power system frequency risk review. This process utilises existing NSP planning process to the extent possible.

- A process for the request, declaration and management of certain non-credible contingency events as protected events, where these have been identified through the power system frequency risk review.

Having regard to the issues raised in the rule change request and during consultation, the Commission is satisfied that the more preferable final rule will, or is likely to, contribute to the achievement of the NEO than the proposed rule for the following reasons:

- The inclusion of an economic assessment allows for the severity of the consequences of certain non-credible contingency events to be balanced against the price outcomes associated with managing the event.

- The introduction of a clear and transparent framework around the development of emergency frequency control schemes will enable new technologies and solutions to provide more effective emergency frequency control schemes to be identified and considered, improving security of supply for consumers.

- The introduction of a contingency event classification for protected events will allow for more efficient operation of the power system, providing both security and reliability benefits for consumers.

- The governance framework establishes clear responsibilities for the review of power system frequency risks, the declaration of a protected event through a robust cost benefit assessment, and the planning and implementation of management solutions for certain non-credible contingency events. This will allow for identification of efficient solutions to emerging risks in the NEM, supporting the long run efficient operation, use and investment in electricity services.

Further, the Commission considers that the more preferable final rule is likely to better contribute to the achievement of the NEO than the draft rule for the following reasons:

- By assigning responsibility for the identification, declaration and management of protected events to those parties whose existing functions support these roles.
- By providing a regular, public process for AEMO to work with TNSPs and stakeholders to identify and determine the efficient options for limiting the risks associated with certain high consequence non-credible contingency events.
- By including a regular, iterative power system frequency risk review process which allows for the management of certain non-credible contingency events, and emergency frequency control schemes, to be adaptive to changing market and power system conditions.
- By aligning the framework with existing NSP planning processes to allow for technology alternatives and ancillary benefits to be considered.

2.5 Strategic priority

This rule change request relates to the AEMC's strategic priority relating to markets and networks.

This strategic priority relates to the flexibility and resilience of energy market frameworks to respond to changes in technology and new business models. This includes changes in the generation mix, such as the increased penetration of non-synchronous generation and the subsequent retirement of large synchronous units. This links to the development of a robust framework to govern consideration and assessment of power system frequency management in the NEM. This framework is designed to support the maintenance of a resilient and secure power system as the generation mix changes.

2.6 Northern Territory legislative considerations

From 1 July 2016, the Commission assumed rule making responsibility for parts of the National Electricity Rules (NER) adopted by the Northern Territory. In addition, from this date, the NER, as amended from time to time, apply in the Northern Territory (NT), subject to derogations set out in Regulations made under the NT legislation adopting the NEL.[45] Under those Regulations, only certain parts of the NER have been adopted in the NT.[46]

45 National Electricity (Northern Territory) (National Uniform Legislation) (Modifications) Regulations.

46 For the version of the NER that applies in the Northern Territory, refer to: http://www.aemc.gov.au/Energy-Rules/National-electricity-rules/National-Electricity-Rules-(Northern-Territory).

The final rule amends parts of the NER that currently do not apply in the Northern Territory with the exception of the new definitions inserted into Chapter 10 of the NER. These definitions have no practical effect in the Northern Territory however, because they relate to parts of the rules that do not apply in the Northern Territory. Therefore, the Commission has not assessed the proposed rule against additional elements required by Northern Territory legislation.[47]

47 National Electricity (Northern Territory) (National Uniform Legislation) Act 2015.

3 Summary of the draft rule determination

This chapter sets out the consultation on the rule change request and the Commission's draft rule determination, including a summary of the draft rule determination.

This chapter:

- sets out the proponent and stakeholder views on the rule change request
- describes the components of the EFCS governance framework as described in the draft rule determination
- provides a summary of stakeholder views expressed in response to the draft rule determination
- discusses some of the key issues the Commission considered in developing the enhanced EFCS governance framework in the draft rule.

3.1 Rule proponent's view

The proponent's proposed solutions to the issues raised in the rule change request are described in section 1.4.

3.2 Stakeholders' views on the rule change proposal

A number of stakeholders commented on the issues raised by the proponent and identified a number of others. Key issues addressed by stakeholders included:

- Whether the issues identified by the proponent justified revision of the NER.
- Adequacy of current governance arrangements and potential new responsibilities for parties.
- How the revised framework accommodates new technologies to provide emergency frequency control.
- The regulatory framework for over-frequency generation shedding (OFGS).
- The consideration of costs associated with a new or modified EFCS.

3.2.1 Materiality of the issues identified by the proponent

A number of stakeholders agreed with the proponent that changes in the power system were likely to have a material impact on the ability of existing UFLS to maintain power system security.

The Energy Networks Association (ENA), South Australian Government and AEMO considered that UFLS may become less effective over time due to the exit of

synchronous generation and resultant increases in RoCoF. This was exacerbated by the fact that DER also reduces the assumed size of load blocks. Furthermore, there was an increased risk of uncoordinated loss of generation if an over-frequency event occurred. The materiality of these issues was expected to increase over the medium term.[48] The South Australian Government stated that limitations on the size of contingency events will help to manage RoCoF.

3.2.2 Adequacy of current governance arrangements and new responsibilities

The ENA and AEMO stated that current regulatory arrangements would be significantly improved if there was greater clarity of the respective roles and obligations for all parties. Clear oversight of the effectiveness of EFCS was important, given the rapidity of energy sector transformation. AEMO also stated that greater clarity was required over roles and responsibilities, and that current frameworks do not allow for consideration of all physical solutions.[49]

The South Australian Government proposed a series of responsibilities for parties under a new governance framework, including:[50]

- AEMO and the JSSC should have the ability to direct NSPs to invest in new technologies.
- NSPs should have planning and reporting obligations with respect to load shedding and EFCS.

3.2.3 New technologies to provide emergency frequency control

RES Australia, Hydro Tasmania and the South Australian Government stated that current frameworks are not sufficient to consider all cost effective physical solutions to deliver emergency frequency control.[51]

The ENA stated that while current frameworks do not preclude new technology, they do not adequately consider DER or storage options.[52]

The Clean Energy Council (CEC) suggested that an over-reliance on load shedding could underplay the efficient use of DER and called for a more integrated approach to DER.[53]

48 Consultation paper submissions: Energy Networks Australia, p. 3; South Australian Government, pp. 1, 4; AEMO, p. 12.

49 Consultation paper submissions: ENA, p.4; AEMO, p.12.

50 South Australian Government, Consultation paper submission, p. 9.

51 Consultation paper submissions: RES Australia, p. 3; Hydro Tasmania, p. 3; South Australian Government, p. 9.

52 ENA, Consultation paper submission, p. 5.

53 CEC, Consultation paper submission, p. 1.

Hydro Tasmania also stated that current relay based technologies may no longer be effective. It suggested that emergency special control schemes are more effective and less expensive.[54]

AEMO also stated that the NER should be amended to generalise the description of EFCS so they are not prescriptive as to how they can be operated and at what frequency range they may be expected to trigger.[55]

3.2.4 Over-frequency emergency control schemes

The ENA and RES stated that under-frequency and over-frequency emergency control should be considered together.[56]

The CEC questioned the need for an over-frequency EFCS. It also suggested that tripping entire wind farms was not an acceptable solution for managing over-frequency, as wind farms can respond to over-frequency through fast ramping. The CEC also stated that AEMO already has powers to set generator responses to over-frequency events in performance standards.[57]

The CEC noted that, in its view, the introduction of an over-frequency EFCS could provide negative investment signals for renewable energy investment. The CEC stated that the over-frequency EFCS as proposed would be arbitrary and would not provide compensation arrangements for semi-scheduled generators. It was also argued this would also reduce the value of frequency lower services.[58]

3.2.5 Costs associated with EFCS

RES Australia noted there were costs to participants if they were required to provide elements of an EFCS.[59]

The South Australian Government stated that the cost of new or updated EFCS should be assessed together with the cost of procuring services to manage high RoCoF, as any RoCoF standard could affect the cost of upgrading existing UFLS arrangements. It argued that the calculation of costs should include the cost of load shedding as an economic cost to consumers.[60]

AEMO stated that AEMO and NSPs would expect to face design costs, while NSPs would likely be subject to costs for new assets and ongoing maintenance. AEMO stated that the NER should provide for clear, timely and economically efficient mechanisms

54 Hydro Tasmania, Consultation paper submission, p. 1.

55 AEMO, Consultation paper submission, p. 12.

56 Consultation paper submissions: ENA, p. 3; RES, p. 4.

57 CEC, Consultation paper submission, p. 2.

58 CEC, Consultation paper submission, p. 2.

59 RES Australia, Consultation paper submission, p. 4

60 South Australian Government, Consultation paper submission, pp. 10.

for NSPs to recover the costs of implementation and on-going operation and maintenance of network and communications infrastructure to allow operation of adaptive EFCS.[61]

3.3 Draft rule determination

The Commission's draft rule determination made the draft rule as proposed by the proponent. The draft rule included separate governance frameworks for:

- the development of enhanced emergency frequency control schemes
- the identification and application of a new category of contingency event, the protected event.

While the Commission recognised that these two elements are both related to the management of frequency and protection of the power system, the draft rule determination noted functional differences between how the Commission interpreted the role of EFCS and protected events:

- An EFCS was seen as a "last line of defence" emergency mechanism, designed to minimise the risk of a cascading failure following a severe disturbance on the power system. It allows load and generation to be shed in a controlled manner following a non-credible contingency event to prevent or arrest a sudden change in frequency that could lead to a cascading outage and potentially a black system. The determination of an EFCS standard would not enable AEMO to use ex-ante mechanisms to limit the consequences of non-credible contingencies, such as buying FCAS or constraining the power system.
- Under the draft rule, once AEMO had decided that a specific non-credible event should be a protected event, and the Reliability Panel had determined a post-contingency operating state for that protected event, AEMO would then constantly operate the power system so that it could meet the post-contingency operating state, if the protected event were to occur. The post-contingency operating state would have allowed some controlled load shedding, if the protected event were to occur, and AEMO would be able to use ex-ante mechanisms in conjunction with this load shedding to meet the post-contingency operating state for that protected event.

Given these differences in function, the draft rule determination considered each of these components separately.

3.3.1 Emergency Frequency Control Schemes

The draft rule set out a governance framework for the determination, design, implementation and monitoring of a national emergency frequency control scheme. This framework built on existing NER arrangements for UFLS. The Commission

61 AEMO, Consultation paper submission, pp. 12, 17.

proposed changes to some of these arrangements to modify roles and responsibilities. Some new roles and responsibilities were also proposed. The key elements of the draft rule that related to emergency frequency control schemes were:

- Inclusion of an EFCS objective in the NER to guide the development of the emergency frequency control scheme.
- AEMO, in consultation with network service providers, to propose an emergency frequency control scheme, including estimates of potential scheme capabilities and costs to deliver those capabilities.
- The Reliability Panel to undertake a cost benefit assessment of the proposal and to develop an emergency frequency control scheme standard.
- AEMO to develop an emergency frequency control scheme functional design specification to meet the emergency frequency control scheme standard, and an implementation schedules.
- NSPs to install and/or replace equipment that can meet these functional design specifications.
- AEMO and NSPs to monitor and report on EFCS operation.

EFCS objective

The Commission proposed the following EFCS objective in the draft rule:

> "The objective for *emergency frequency control schemes* is for these schemes to be available and in operation to the extent appropriate having regard to the *national electricity objective*, to prevent or arrest *cascading outages, major supply disruptions* and uncontrolled increases or decreases in *frequency* (alone or in combination)."

The EFCS objective was intended to inform AEMO's EFCS proposal and the Reliability Panel's determination of the EFCS standard under the framework described in the draft rule.

EFCS proposal

Under the draft rule, AEMO would, as it considered appropriate, develop and submit an EFCS proposal to the Reliability Panel. In preparing the EFCS proposal, AEMO would be required to consult with relevant NSPs.

The EFCS proposal would set out a range of proposed potential scheme capabilities and an estimate of the cost of delivering each of these potential capabilities.

An EFCS proposal submitted to the Reliability Panel would contain the following elements:

- the proposed target capabilities for the EFCS, or sets of proposed target capabilities and corresponding expected power system security outcomes, which would include:
  - how quickly the scheme can respond
  - the power system conditions within which the scheme is capable of responding
  - the nature of the scheme's response (an under-frequency scheme for load shedding or an over-frequency scheme for generation shedding)
  - the amount of load shedding or generation shedding that may occur
  - the scheme's capability to dynamically sense power system conditions
- an estimate of the costs for each of the proposed target capabilities, including costs to procure and commission the scheme and maintain its availability and performance, including upfront costs and ongoing maintenance costs
- a general description of the scheme including its functionality, the NSPs and generators likely to be affected, and the assets that AEMO considered would be used to deliver the EFCS. This could include technologies such as relays, communications enabled relays, or special protection schemes.[62]

In the draft rule determination, the Commission considered that only AEMO should be able to propose an EFCS proposal, as AEMO is best positioned to understand overall power system conditions, both within and across regions.

EFCS standard

Under the draft rule, once AEMO had submitted an EFCS proposal, the Reliability Panel would assess the proposal and determine the EFCS standard in accordance with the EFCS objective.

The EFCS standard would have set the target capabilities for the EFCS. The EFCS target capabilities were the high level technical parameters that define the service provided by the scheme. They formed the basis of AEMO's EFCS design specifications. They included, but were not limited to:

- the power system conditions within which the scheme is capable of responding

62 A special protection scheme allows for the controlled tripping of generation or load to limit the frequency consequences following specific contingency events, such as the loss of an interconnector between two regions. Currently, special protection schemes have been implemented in Tasmania to account for the contingent loss of the Basslink DC interconnector and subsequent under or over-frequency events. More information can be found at: Tasmanian Department of State Growth, Tasmania Delivers: Many reasons to invest in renewable energy, August 2016, p.4. Available at http://www.stategrowth.tas.gov.au/__data/assets/pdf_file/0010/138727/Tasmania_Delivers_-_Renewable_Energy.pdf.

- the nature of the scheme's response (load shedding or generation shedding for the purposes of managing frequency)
- the speed of the response
- the amount of load shedding or generation shedding that may occur when the scheme responds
- the capability to dynamically sense power system conditions.

The Reliability Panel would consult on the determination of the EFCS standard in accordance with the rules consultation procedures and publish a report setting out the reasons for its determination.

EFCS design specification and implementation schedules

Once the Reliability Panel had determined the EFCS standard, AEMO would develop the EFCS design specification and EFCS implementation schedules. These documents would describe how an EFCS would operate in accordance with the EFCS standard.

When developing these documents, AEMO would have been required to consult with affected NSPs for an EFCS, and with affected generators when the EFCS includes an over-frequency control scheme component.

The EFCS design specification was intended to set out the detailed functional design requirements and target capabilities of an EFCS.

The EFCS implementation schedules would specify how loads and generation were to be shed by under-frequency schemes and over-frequency schemes, respectively. For an under-frequency scheme the relevant JSSC would continue to provide to AEMO schedules of the priority order of sensitive loads and other loads.

Implementation process

Under the draft rule, NSP's responsibilities for implementation of an EFCS would be to build assets and/or change settings on existing assets, to comply with the functional design requirements set out in AEMO's EFCS design specification.

For any over-frequency scheme, NSPs would be required to:

1. engage in good faith with generators and offer generators the option of building assets or changing settings on existing assets to comply with the EFCS design specifications
2. if a generator elected not to undertake the actions referred to above, or good faith negotiations did not result in agreement being reached in reasonable time, build assets and/or change settings on existing assets to comply with the EFCS design specifications.

Monitoring and reporting

Under the draft rule, NSPs would have been required to develop and administer testing arrangements that comply with the testing regime established in AEMO's EFCS design specifications.

NSPs would be required to report to AEMO periodically, on the matters defined by AEMO in its EFCS procedures and AEMO would, in consultation with relevant NSPs, prepare and publish a report on the operation and efficacy of the EFCS.

3.3.2 Protected Events

The draft rule set out a separate framework for the declaration of a protected event to increase the range of tools available to AEMO to limit the consequences of specific contingency events.

Under the draft rule, a protected event would have incorporated the following features:

- the event would be a sub-category of non-credible contingency events. Protected events would be differentiated from non-credible contingency events in that AEMO would be able to take some ex-ante actions to limit their potential consequences
- the occurrence of the event would be reasonably plausible. This means that while the event was not reasonably likely to occur in the surrounding circumstances (and was therefore not a credible contingency event) it could still conceivably occur in the surrounding circumstances
- the event would have significant consequences, such as cascading outages and/or a major supply disruption if it were to occur
- the protected event could be reclassified as a credible contingency event, as per the arrangements established in NER clause 4.2.3A
- AEMO would have been able to use a combination of ex-ante solutions with some controlled load shedding, to limit the consequences of protected events
- AEMO's management of the protected event would be consistent with a post-contingency operating state determined by the Reliability Panel which may have included guidance on:
  - the frequency bands the system must meet following the event
  - the time taken for the system to reach each frequency bands following the event
  - the extent of any load shedding allowed following the event.

Roles and responsibilities under the draft rule

Under the draft rule, AEMO would have been responsible for the declaration of a protected event, along with submitting a request to the Reliability Panel to determine a post-contingency operating state for any protected events. Following the determination of a post-contingency operating state, AEMO would then have been responsible for operating the system in such a way that if the protected event were to occur, its consequences would be limited to those defined in the post contingency operating state. This would be achieved through a combination of ex-ante measures such as FCAS or constraining generation dispatch, and ex-post measures such as load or generation shedding.

Under the draft rule, the Reliability Panel was responsible for determining a post-contingency operating state for any protected events at the request of AEMO. This determination of the post-contingency operating state would include a cost-benefit assessment which would take account of:

- The estimated cost of ex-ante solutions, including the cost of procuring FCAS from generators, or the market costs associated with imposing constraints on the dispatch process. These are costs that will be incurred up-front on an ongoing basis, regardless of whether the protected event occurs.
- The cost of controlled load shedding, being the cost to the community of interruptions to electricity supply if under-frequency schemes are triggered. These were expected costs that would only be incurred if the protected event occurred; its value is a function of the possibility that the protected event would occur.
- The avoided cost of the consequences of the protected event itself. This could include the costs of a cascading outage and/or a black system event. These were expected costs that would only be incurred if the protected event occurred; its value is a function of the possibility that the protected event would occur.

3.4 Stakeholders views on the draft rule determination

The Commission received eleven submissions in response to the draft determination; these submissions were all supportive of enhancing the frameworks for EFCS and contingency events, including the creation of the "protected event" as a new class of contingency event. A number of the submissions suggested one or more amendments to the draft rule to further strengthen the governance arrangements.

AEMO and the South Australian Government each suggested alternative arrangements for the EFCS policy framework. These alternative frameworks are discussed in section 3.4.3.

3.4.1 Emergency Frequency Control Schemes

While the majority of submissions were in general agreement with the draft rule framework for EFCS, stakeholders did raise areas for improvement relating to:

- roles and responsibilities
- improved guidance for the performance of UFLS
- integration of the South Australian OFGS.

These issues are discussed in further detail below.

Roles and Responsibilities

The ENA expressed the view that the EFCS framework should empower NSPs to work in conjunction with AEMO to develop the EFCS proposal and EFCS design specification. This view was supported by AEMO, which suggested that the EFCS risk assessment should be a collaborative exercise between NSPs and AEMO.[63]Engie and the South Australian Government expanded on this theme by suggesting that the process for identification of issues that a potential EFCS may address should allow input from stakeholders other than AEMO and NSPs.[64]

A number of submissions raised concerns relating to the appropriateness of TNSPs holding the responsibility for performance of over-frequency generation shedding schemes in the event that the scheme capability is delivered by equipment installed and maintained by the generator.[65]

As a safeguard that additional costs incurred as a result of an EFCS are delivering the expected capabilities, the AEC suggested that an audit of EFCS effectiveness be undertaken by the AER.[66]

Improved guidance on the performance targets for UFLS

AEMO and the South Australian Government each requested that the final rule provide further clarification in relation to the high level performance target for existing under-frequency load shedding facilities which provide general protection from non-credible contingency events.[67]

63 Draft Determination submissions: AEMO, pp. 18, 24-25; ENA, p. 2.

64 Draft Determination submissions: South Australian Government, p. 4; Engie, p. 2.

65 Draft Determination submissions: ElectraNet, p. 4; Energy Queensland, p. 2; ENA, p. 3.

66 AEC, Draft Determination submission, p. 1.

67 Draft Determination submissions: AEMO, pp. 10, 14; Energy Markets and Programs Division, Department of State Development, South Australia, p. 4.

Integration with SA OFGS scheme

The submissions by AGL and ElectraNet expressed the view that the final rule should be drafted to incorporate the over-frequency generation shedding scheme under development by ElectraNet and AEMO in South Australia.[68]

3.4.2 Protected Events

The majority of submissions supported the introduction of the protected event as a new class of contingency event to address the changing risk profile of the power system. Key themes in the stakeholder feedback on the protected events were the critical importance of the regulatory change and comments relating to roles and responsibilities under the draft rule.

Support for this critical development

A number of stakeholders suggested that the introduction of this new classification was of critical importance to address the current power system risks in South Australia.[69]

While being in support of the enhancement of the regulatory frameworks relating to EFCS, Energy Australia expressed a cautious view in relation to protected events, noting the potential for significant price impacts from the introduction of a new contingency event classification. In its submission, Energy Australia stated that:

> "The cost versus benefit evaluation would need to be compelling to consider the introduction of a new event category, particularly in the context of the additional procedural complexity a new category would introduce."[70]

Roles and responsibilities

The majority of submissions received were in general agreement with AEMO having the responsibility for the development of protected events with the exception of the AEC, who suggested that jurisdictions and market participants also be able to request the Reliability Panel to assign the status of protected event to a section of the network.[71]

The majority of submissions agreed with the Commission's assessment that the Reliability Panel is the appropriate body to undertake the cost-benefit trade-off in relation to protected events. The ENA proposed that the Reliability Panel's

68 Draft Determination submissions: AGL, p. 1; ElectraNet, p. 3.

69 Draft Determination submissions: South Australian Government, p. 3; SACOSS, p. 1.

70 Energy Australia, Draft Determination submission, p. 2.

71 AEC, Draft Determination submission, p. 2.

responsibility be expanded from determining a post-contingency operating state, to include the declaration of the protected event in response to a proposal by AEMO.[72]

However a number of submissions raised concerns relating to the potential number of protected events and the potential for unnecessary complexity of defining multiple post-contingency operating states under the draft rule.[73]

3.4.3 Alternative EFCS frameworks

Two alternative frameworks were proposed by AEMO and the South Australian Government:

- AEMO proposed a risk-based framework for the integrated consideration and management of EFCSs and Protected Events.
- The South Australian Government requested that the process for the implementation of the EFCS framework be accelerated to facilitate the delivery of solutions to improve power system security following a major disturbance in the power system.

AEMO's alternative EFCS framework

AEMO's submission to the draft rule determination proposed a risk-based framework for the integrated consideration and management of EFCSs and Protected Events.[74]

The key elements of the AEMO proposal were that:

- The policy framework should recognise the linkages between the management of protected events and emergency frequency control schemes.
- Greater emphasis should be placed on monitoring and disclosing power system risks in planning timeframes with NSPs playing an active role in identifying and addressing risks through a periodic risk assessment process.
- The frequency standards for protected events should be included in the frequency operating standards, in place of the development of a separate post-contingent operating state for each protected event.
- The concept of a special EFCS could be added into the framework as an additional targeted measure that can be used to manage a protected event (PE).
- No change to current role of general purpose EFCS (that is, UFLS), but the Reliability Panel would develop guidelines to ensure general EFCS performance criteria are adequately maintained.

72 ENA, Draft Determination submission, p. 4.

73 Draft Determination submissions: Engie, p. 3; AEMO, pp. 5, 27.

74 AEMO, Draft Determination submission, p. 4.

- The process for managing protected events and emergency frequency control schemes should be coordinated within a reporting and consultation cycle consistent with existing network planning processes.

The South Australian Government's alternative EFCS framework

The South Australian Government expressed strong support for the draft rule while stressing the urgent need to implement the framework sooner rather than later.[75]

It therefore proposed a revision to the draft rule in respect of the governance framework for emergency frequency control schemes. Specifically, it proposed removal of the Reliability Panel from the process of determining an EFCS standard, and instead proposed that AEMO and the JSSC would be responsible for determining the high level design capabilities of the scheme, in consultation with the relevant NSP.[76]

In relation to protected events, the South Australian Government supported the allocation of responsibility for the declaration of protected events to AEMO and for the determination of a post-contingency operating state to AEMO. However, in order to expedite this process, the South Australian Government proposed that AEMO and the Reliability Panel would undertake these processes in parallel and prior to the final rule for this rule change request being made. The post-contingent operating state could then be included within the final rule such that AEMO would be in a position to operate the system in order to maintain that standard immediately following commencement of the rule. [77]

3.5 Commission's analysis

Based on views of stakeholders and our own analysis, the Commission considers there are a number of improvements that could be made to the frameworks for emergency frequency control schemes, and protected events, as set out in the draft rule.

First, there is no explicit recognition in the draft rule that an emergency frequency control scheme encompasses both "general purpose" emergency frequency control schemes, which are applicable to non-credible contingency events, and "special protection schemes" which are event specific emergency frequency control schemes applicable to protected events and some credible contingency events.[78]

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75 South Australian Government, Draft Determination submission, p. 3.

76 South Australian Government, Draft Determination submission, p. 4.

77 South Australian Government, Draft Determination submission, p. 5. In its submission, the South Australian Government did not provided details about how this parallel assessment by AEMO and the Reliability Panel would work in practice.

78 The current UFLS scheme is nationally focused and is used as the last line of defence against wide spread collapse of the system. This is an example of a general purpose emergency frequency control scheme. A special protection schemes may, for example, use sensors to detect specific events (such as breakers opening on a specific transmission line) and send a signal via a devoted communications system to circuit breakers that shed a designated load. In effect, these schemes can act to shed load before a significant drop in frequency occurs across the system.

Further, the draft rule makes no explicit link between the emergency frequency control scheme and protected events frameworks, even though the management of protected events may include new or modified special and/or general emergency frequency control scheme capability. As noted by AEMO in its submission to the draft rule determination, a properly designed emergency frequency control scheme is likely to represent the least cost mitigation pathway for the management of a protected event.

The draft rule did not recognise that there is limited scope for a hi-fidelity approach to setting various post contingency operating states for each protected event. In other words, AEMO is unlikely to be able to fine-tune its management of the system following a protected event in such a way that it is necessary to define different post-contingency operating states for each protected event.

In relation to identifying protected events and reviewing emergency frequency control schemes, the draft rule did not explicitly require cooperation between AEMO and NSPs. In addition, the frameworks did not include a specific link to the planning processes and cycles applicable to NSPs and AEMO in the rules. This means that opportunities to explore alternative means of managing protected events, or of addressing a need to modify existing emergency frequency control schemes (for example, through network or non-network options), were not explicit catered for within the draft frameworks.

Finally, the draft rule did not include an overarching process for monitoring or reporting on power system frequency risks associated with non-credible contingency events.

To address these issues, the Commission has established an integrated, transparent framework for the consideration and management of emergency power system frequency events in the NEM. The final more preferable rule incorporates the following changes with respect to frameworks set out in the draft rule:

- Inclusion of a periodic, iterative review of protected events and emergency frequency control scheme capabilities to improve transparency and formalise a collaborative approach between NSPs and AEMO in identifying and managing power system risks.
- Recognition that general purpose emergency frequency control schemes and special emergency frequency control schemes are functionally different and treating them so through different processes:
  - Special emergency frequency control schemes are linked to the mitigation of one or more protected events and credible contingency events
  - General purpose emergency frequency control schemes are linked to the mitigation of non-credible contingency events.
- The Reliability Panel is the primary decision maker in respect of declaring a non-credible contingency event a protected event and identifying the efficient management option based on an economic assessment and advice from AEMO.

The Commission remains of the view that the Reliability Panel is the appropriate body to assess the cost-benefit trade-off associated with declaring a protected event.

- Removal of the Reliability Panel from the development and implementation process for emergency frequency control schemes which are not linked to the management of a specific protected event – this process will follow existing NSP planning processes.
- Inclusion of a single post contingent operating state for protected events in the frequency operating standards (to be determined by the Reliability Panel).

A summary of the final rule was provided in chapter 2, with a more detailed description of the final rule, including the Commission's reasons, set out in chapters 4-7.

4 Power System Frequency Risk Review

The Commission has determined to make a final rule which is a more preferable rule. The final rule is different to the draft rule. The final rule is intended to address the issues identified with the draft rule in submissions, and following the Commission's own further analysis.

The final rule will promote the efficient operation of the power system in light of the risks emerging from the NEM's current transformation. It does so by establishing an integrated, transparent framework for the consideration and management of emergency power system frequency events in the NEM. A detailed description of the final rule, including the Commission's assessment, is set out in chapters 4-7. These chapters are structured as follows:

- Chapter 4 (this chapter) describes the first stage of the process, which involves a transparent, integrated review of power system frequency risks associated with non-credible contingency events in the NEM, including the arrangements for managing these events. The purpose of this review is for AEMO to identify the need for a new or modified emergency frequency control schemes, and to identify certain non-credible contingency events in relation to which it may be economically efficient to manage the power system to limit the consequences of the event should it occur. This component of the final rule is shown by the red box in figure 4.1.

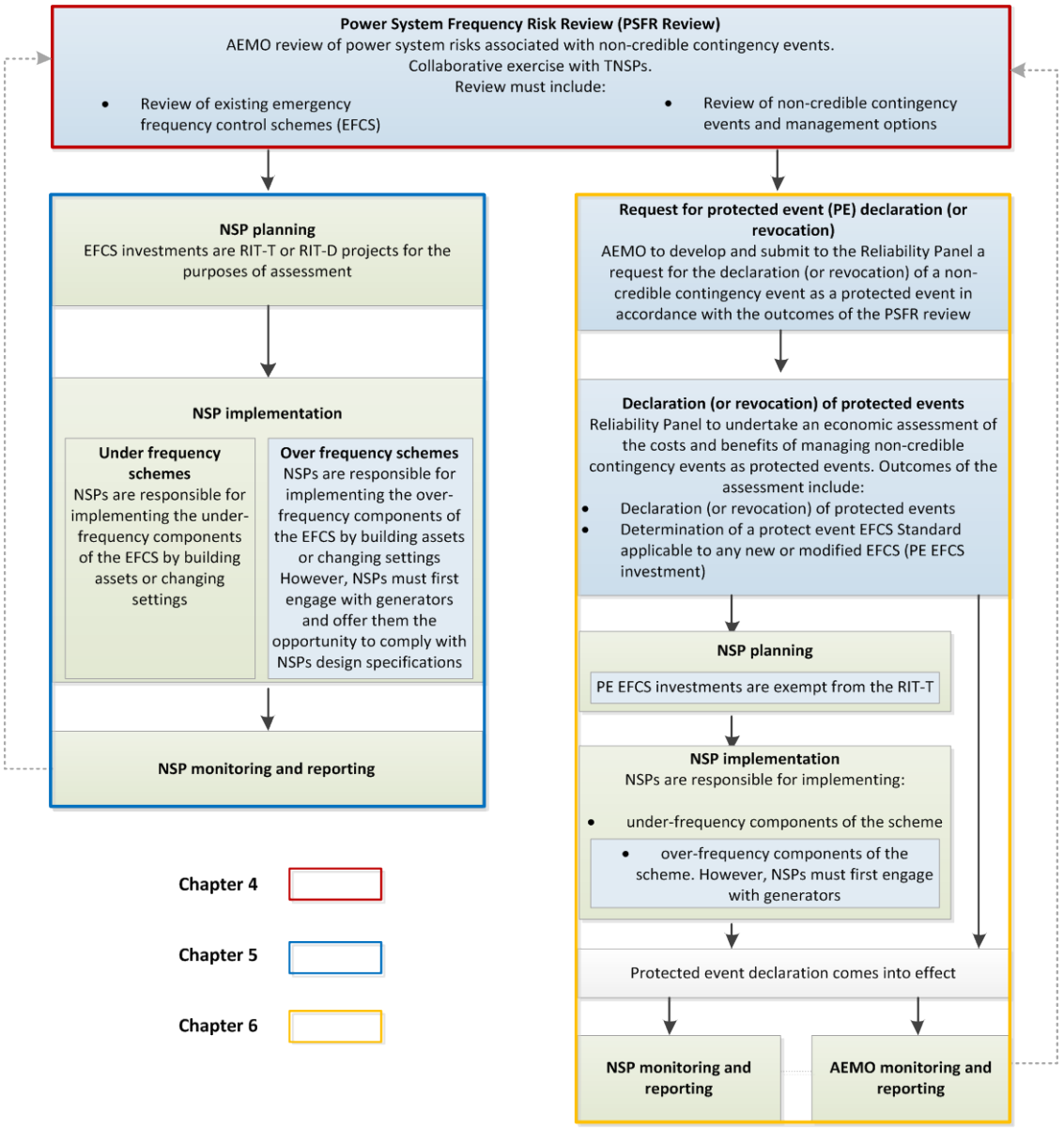
- Chapter 5 sets out the process for developing new, or modifying existing, emergency frequency control schemes which are not required to manage a specific non-credible contingent event and which have been identified through the power system frequency risk review. This process is shown by the blue box in figure 4.1.

- Chapter 6 sets out the process for the request, declaration and management of certain non-credible contingency events as protected events, where these have been identified through the power system frequency risk review. This process is shown by the yellow box in figure 4.1.

- Chapter 7 sets out the Commission's views on a number of other matters relevant to the final rule, including the new arrangements for over-frequency generation shedding schemes, the review of the frequency operating standards to be undertaken by the Reliability Panel following commencement of the rule and the transitional arrangements applicable to the final rule.

The remainder of this determination is therefore structured as illustrated in figure 4.1.

Figure 4.1 Structure of the final rule determination



This chapter sets out the Commission's views in relation to the introduction of a review of power system frequency risks associated with non-credible contingency events in the NEM. The chapter is structured as follows:

- Section 4.1 provides a description of the key features of the final rule in respect of the power system frequency risk review.
- Section 4.2 sets out the Commission's assessment of the key matters associated with the power system frequency risk review, including the matters which the review must consider, the review process and the review reporting requirements.

4.1 Description of the final rule

The key features of the final rule in respect of the power system frequency risk review associated with non-credible contingency events are described in Box 4.1.[79]

Box 4.1 Power System Frequency Risk Review

Power system frequency risk (PSFR) review[80]

- AEMO must undertake a power system frequency risk review which considers:
  - non-credible contingency events the occurrence of which AEMO expects would be likely to involve uncontrolled increases or decreases in frequency (alone or in combination) leading to cascading outages, or major supply disruptions
  - current arrangements for management of non-credible contingency events (that is, existing emergency frequency control schemes)
  - options for future management of those events.
- The options for managing non-credible contingency events may include:
  - new or modified emergency frequency control schemes
  - declaration of the event as a protected event
  - the use of ex-ante operational tools such as FCAS or dispatch constraints (following the declaration of a protected event)
  - network augmentation, or non-network alternatives to augmentation.

As part of the review, AEMO must:

- identify non-credible contingency events that AEMO considers should be priorities for assessment having regard to:
  - the likely power system security outcomes
  - the likelihood of the event occurring
  - whether there are likely to be options for managing the event which are technically feasible, and (on the basis of AEMO's preliminary assessment of the estimated costs and benefits of that option) are

79 Box 4.1 does not include an exhaustive list of the changes made to the NER to incorporate the final rule. It is intended to highlight the key features of the final rule relevant to the discussion in section 4.2.

80 Clause 5.20A.1 of the NER.

economically feasible

  - other factors that AEMO considers relevant.

- for the events identified above:

  - assess the options for future management of the event that are technically and economically feasible

  - assess the expected costs and time for implementation of each option and any other factors that AEMO considers should be taken into account in selecting a recommended option and

  - identify the recommended option or range of options.

- for non-credible contingency events declared as protected events:

  - assess the adequacy and costs of the current arrangements for management of the event

  - consider whether to recommend a request to the Reliability Panel to revoke the declaration of the event as a protected event and

  - where relevant, identify options for change to the arrangement for managing the event, and in relation to each option, assess the expected costs and time for implementation and identify the recommended option or range of options

- assess the performance of existing emergency frequency control schemes and identify any need to modify these schemes.

PSFR review process[81]

- AEMO must undertake a power system frequency risk review at least every two years, and must complete the first review by 6 April 2018.

- AEMO must put in place arrangements it considers appropriate to consult with and take into account the views of TNSPs in the conduct of a power system frequency risk review.

- When considering the development of a new, or modification of an existing, emergency frequency control scheme, AEMO must consult with DNSPs whose networks are likely to be affected by the scheme.

- When undertaking a power system frequency risk review, AEMO may consult with any other parties it considers appropriate, including without limitation, JSSCs.

81 Clause 5.20A.2 of the NER.

PSFR review report[82]

- On completion of a power system frequency risk review, AEMO must publish a draft report setting out its findings and recommendations.
- AEMO must, at the same time as it publishes its draft report, invite written submissions to be made within a period of at least 10 business days. AEMO must then publish a final report as soon as reasonably practicable following the receipt of submissions.
- Where a PSFR review identifies the need for a new or modified emergency frequency control scheme (alone or in combination with the declaration of a protected event) the report must:
  - specify the areas of the power system to which the emergency frequency control scheme will apply and whether it is an over frequency scheme, under frequency scheme, or both
  - include the anticipated time required to design, procure and commission the new or modified scheme.
- Where AEMO recommends seeking declaration of a non-credible contingency event as a protected event, the report must include the proposed timetable for submission of a request to the Reliability Panel.

4.2 Commission's assessment

The Commission has analysed and assessed the issues arising from the rule change request and the draft rule in respect of the consideration of non-credible contingency events and the adequacy of existing emergency frequency control schemes. Outlined below is the Commission's assessment of this matter, including the reasons why it considers the introduction of a periodic, integrated, power system frequency risk review in the final rule better meets the NEO than the draft rule.

4.2.1 Power system frequency risk review

The establishment of a periodic, integrated, power system frequency risk review framework in the rules is intended to identify the risks for which a new or modified emergency frequency control scheme may be necessary, and to identify certain non-credible contingency events for which it may be economically efficient to manage the power system to limit the consequences of the event, should it occur. These matters are discussed below.

82 Clause 5.20A.3 of the NER.

Non-credible contingency events

As discussed in chapter 1, while AEMO is required to take ex-ante action necessary to contain the impacts of credible contingency events to within the parameters defined by the frequency operating standards, the only option available to AEMO to limit the consequences of a non-credible contingency event is through controlled load shedding triggered by existing emergency frequency control schemes. When AEMO reclassifies non-credible contingency events to credible contingency events, AEMO's reclassification must be made on the basis of increased likelihood of occurrence - AEMO is unable to reclassify an event on the basis of increased consequence, or to apply a flexible approach to determining the level of response and associated cost.

To address this issue, the final rule provides a formal and transparent process through which AEMO, in collaboration with TNSPs, can consider and manage the impacts of certain potentially high consequence non-credible contingency events.[83] Through the power system frequency risk review process, AEMO is required to identify whether there are any non-credible contingency events for which it may be technically and economically feasible to take ex-ante action to limit the consequences of the event, should it occur.[84] In considering whether an option is economically feasible, AEMO will undertake a preliminary assessment of the estimated costs and benefits of that option.[85]

As part of this process, AEMO may consider option(s) which allow it to achieve the following:

- Mitigation of the consequences of a non-credible contingency event, through options such as modifications to existing emergency frequency control schemes, the development of new emergency frequency control schemes or the development and implementation of network and/or non-network options.[86]
- Management of a non-credible contingency event with the aim of maintaining the power system standards applicable to the event (in this case, the frequency

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83 High consequence non-credible contingency events are those events the occurrence of which would be likely to involve cascading outages or major supply disruptions.

84 The terms technically feasible and economically feasible are not defined in the NER. As general guidance, an event that is technically and economically feasible to manage would be one where (1) AEMO and TNSPs reasonably consider that, if developed, the option would achieve the intended outcomes and (2) AEMO reasonably considers that the benefits of managing the event are likely to outweigh the costs of doing so.

85 The alternative proposal put forward by AEMO in its submission to the draft rule determination required the Reliability Panel to prepare guidelines to help guide AEMO in its assessment of potential protected events. While the final rule differs in some respects to AEMO's alternative proposal, it nevertheless attempts to address some of AEMO's concerns through the drafting of the final rule - specifically, by clarifying that AEMO must undertake a preliminary assessment of the costs and benefits of managing a contingency event as a protected event when conducting its review. The final rule also gives the Reliability Panel the power to make guidelines if it considers this necessary or desirable. See clause 8.8.2(a)(2d) of the NER.

86 In this scenario, AEMO would not be required to operate the power system at all times to maintain frequency to within the applicable frequency operating standards as set out in the FOS.

operating standards applicable to protected events),[87] should it occur. The option(s) for managing the event to maintain the FOS may include a new or modified emergency frequency control scheme, and must include the use of some level of ex-ante measures.

An outcome of this component of the review may be the identification of a non-credible contingency event (or set of events) and a recommended option (or set of options) for management of that event, which AEMO may submit to the Reliability Panel to consider whether these events should be declared as protected events (this process is considered in section 6.2.1 and 6.2.2).

In the context of non-credible contingency events, the final rule provides AEMO with a flexible framework within which to consider and assess these events with the aim of requiring it to identify and pursue focussed actions to limit the consequences where it is efficient to do so. By requiring AEMO to consider both the likelihood of occurrence and consequence of an event (rather than only the likelihood of occurrence of an event), some risks which would otherwise have been left unidentified or unmitigated[88] may now be formally identified and managed through a combination of measures developed to deliver the most efficient outcome to consumers.

Capabilities of emergency frequency control scheme

AEMO notes in its submission to the draft rule determination, there is currently a lack of clarity regarding how the capability of emergency frequency control schemes should be assessed, including how to understand the performance capability of the schemes, how to identify the need for enhancements sufficiently early to address them and how to ensure a sufficient level of EFCS capability is maintained within the power system.[89]

While such matters are clearly relevant to power system management more generally, to put this issue beyond doubt, the final rule also provides a formal and transparent process within which AEMO and TNSPs will consider the capability of existing emergency frequency control schemes in order to assess:

- the ability of each scheme to be available and in operation (to the extent appropriate) in order to prevent or arrest cascading outages, major supply disruptions and uncontrolled increases or decreases in frequency (alone or in combination)[90] and

87 The framework established by the final rule is premised on the Reliability Panel carrying out a review of the frequency operating standards to set a frequency operating standard applicable to protected events. Until such time as this occurs, the final rule includes an interim frequency operating standard applicable to protected events. This is discussed further in Chapter 7.

88 For example, where the likelihood of an event is not increasing but the nature and extent of its impacts are.

89 AEMO submission to the draft rule determination, p. 14.

90 This is consistent with the definition of emergency frequency control scheme introduced by the final rule.

- where a scheme is linked to a protected event, the ability of the scheme to continue to meet the protected event EFCS standard determined by the Reliability Panel for the protected event. The protected event EFCS standard will set out the target capabilities for the scheme (this is discussed further in section 6.2.2 and 6.2.3).

An outcome of the second component of the review may be the identification of a need to modify an existing emergency frequency control scheme to ensure it is able to achieve what is intended, in light of current and expected future power system and market conditions.

The inclusion of existing emergency frequency control schemes within the broader power system frequency risk review framework will allow AEMO to consider whether a sufficient level of automatic load or generation shedding capability is available and able to be maintained in light of current and future expectations of power system conditions in the NEM.

In order to provide guidance to AEMO and TNSPs in considering whether a modification to an existing scheme is appropriate, the final rule defines an emergency frequency control scheme as "facilities for initiating automatic load shedding or automatic generation shedding to prevent or arrest uncontrolled increases or decreases in frequency (alone or in combination) leading to cascading outages or major supply disruptions."[91] There are three main components related to the function of an emergency frequency control scheme:

- *Arrest or prevent:* Existing UFLS arrangements utilise relays that are triggered by a fall in frequency. As such, these arrangements can only act to arrest a fall in frequency once this fall in frequency has already begun. Different technologies, such as special protection schemes, are not triggered by a change in frequency. Instead, these technologies may allow for load to be shed in response to a specific event, prior to any major increase or decrease in frequency.[92] The definition of an emergency frequency control schemes therefore refers to preventing, as well as arresting, a change in frequency.

- *Uncontrolled increase or decrease in frequency (alone or in combination)*: An emergency frequency control scheme may be an over-frequency scheme (to arrest an increase in frequency) and/or an under-frequency scheme (to arrest a decrease in frequency). Emergency frequency control schemes should act to dampen movements of frequency in either direction, where they may occur in

91 Definitions, Chapter 10 of the NER.

92 These special protection schemes use sensors to detect specific events (such as breakers opening on a specific transmission line) and send a signal via a devoted communications system to circuit breakers that shed a designated load. In effect, these schemes can act to shed load before a significant drop in frequency occurs across the system.

combination.[93] As such, these components should be designed to act in coordination.

- *Cascading outages, major supply disruptions*: Ultimately, an emergency frequency control scheme is the last line of defence to stop the power system from collapsing to a black state following a major disturbance. However, it may also address less severe events, such as preventing a major supply disruption from getting any worse, through a cascading outage.[94] The Commission has chosen this wording in the emergency frequency control scheme definition to reflect the fact that these schemes can be used to address events of different severity.

The new definition of an emergency frequency control scheme is expected to provide both AEMO and TNSPs with high level guidance to inform the development of new, or modifications to existing, emergency frequency control schemes.[95]

The final rule also requires AEMO to consider, as part of meeting the power system security principles whether emergency frequency control schemes are available and in service to:[96]

- restore the power system to a satisfactory operating state following protected events, and

- significantly reduce the risk of cascading outages and major supply disruptions following significant multiple contingency events.

Where this is no longer the case, AEMO in consultation with TNSPs should consider options for modifying existing emergency frequency control schemes to ensure they can continue to meet was is intended.

4.2.2 Integration of the protected event and emergency frequency control scheme frameworks

A matter that was not explicitly recognised in the draft rule determination was the link between non-credible contingency events (including protected events) and emergency frequency control schemes.[97] As noted by AEMO in its submission, emergency

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93 A major power system disturbance may result in sudden increases and decreases in frequency in rapid succession, reflecting fluctuations in the power system. An EFCS must be able to dampen these extreme swings in frequency, by combining load and generation shedding in a coordinated manner.

94 The NER define a major supply disruption as "the unplanned absence of voltage on a part of the transmission system affecting one or more power stations and which leads to a loss of supply to one or more loads". The Commission notes that this term includes both relatively minor and more severe incidents.

95 The definition of an emergency frequency control scheme in the final rule is consistent with the EFCS objective that was included in the draft rule.

96 Clause 4.2.6(c) of the NER.

97 As discussed in Chapter 3, the draft rule proposed two separate frameworks for the development of a national emergency frequency control scheme and the classification of certain non-credible

frequency control schemes are likely to be the preferred means of managing protected events.[98] As such, the framework supporting emergency frequency control schemes should integrate with the framework established to support the determination of protected events, and consideration of ex-ante options to manage protected events.

Integration of the frameworks in the final rule allows all possible mitigation and management measures for certain non-credible contingency events to be considered, costed and assessed together, with a direct route provided to existing network planning processes where this is appropriate.

4.2.3 PSFR review process

AEMO is required to conduct a power system frequency risk review at least every two years, with the first risk review due to be completed by 6 April 2018.[99] The requirement for a regular review means that AEMO and TNSPs will be required to identify and monitor the risks of changing power system conditions in relation to the likelihood and consequence of non-credible contingency events, and the performance of emergency frequency control schemes. This will enable AEMO and TNSPs to address any issues as they emerge, to ensure non-credible contingency events continue to be managed appropriately, and that the existing emergency frequency control schemes remain capable of achieving what is intended.

An important feature of the final rule is the obligation on AEMO to consult with, and take into account the views of, TNSPs in carrying out the review.[100] This obligation recognises that there are currently obligations on NSPs to consider non-credible contingency events in network planning.[101] Importantly, it also recognises that collaboration between AEMO and TNSPs will:

- in the context of non-credible contingency events, support consideration of the optimal mix of measures to mitigate the impacts of certain non-credible contingency events, or to manage certain non-credible contingency events to maintain the frequency operating standards applicable to protected events; and

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contingency events as protected events. The draft rule made no explicit link between emergency frequency control schemes being one means of managing protected events.

98 AEMO noted that, in general, properly designed emergency frequency control schemes are likely to represent the least-cost mitigation pathway for management of the impacts of particular non-credible contingency events that would be declared protected events. The extent of ex-ante intervention required to avoid the worst impacts of a non-credible contingency is determined by the operational capability of emergency frequency control schemes in managing these events. As such, an assessment of the costs and benefits of schemes and ex-ante options for management of non-credible contingency events are fundamentally connected and inform one another. See AEMO submission to the draft rule determination, p. 14.

99 Note that this requirement mirrors AEMO's current practice of reviewing the existing UFLS settings every two years.

100 While the final rule requires AEMO to "consult with and take into account the views of" TNSPs in the conduct of a power system frequency risk review, the AEMC envisages that this would be a collaborative process between both parties, given their respective general, and power system security, responsibilities in respect of emergency frequency control schemes (see Box 5.1).

- in the context of emergency frequency control schemes, support consideration of a range of feasible solutions to modify existing schemes to deliver the desired outcome at least cost.

The final rule also requires that AEMO consult with distribution network service providers (DNSPs) where the development of a new, or modification of an existing, emergency frequency control scheme is likely to affect the DNSP's network.

4.2.4 PSFR review report

Before publishing a final report for the power system frequency risk review, the final rule requires AEMO to publish, for consultation, a draft report setting out the findings and recommendations of the review. Broadly, publication of these reports will improve the level of transparency around AEMO's consideration and assessment of power system frequency risks and plans for mitigation or management of non-credible contingency events (which may include new or modified emergency frequency control schemes).

More specifically, by requiring AEMO to publish a draft report, and to consult on this for a period of at least ten business days,[102] parties other than NSPs will be provided with a formal opportunity to comment on all aspects of the power system frequency risk review, including the need to modify emergency frequency control schemes and the options for managing or mitigating the impacts of some non-credible contingency events. Among other things, a formal industry consultation process will allow an opportunity for industry participants to identify other potentially more cost effective means of managing or mitigating the consequences of an event, for consideration by AEMO.

101 See NER clause S5.1.8.

102 10 business days seeks to balance the review being completed in a timely manner while still allowing stakeholders with the opportunity to comment.

5 Development of new or existing emergency frequency control schemes

This chapter sets out the Commission's views in relation to the process for developing new, or modifying existing, emergency frequency control schemes which are not required to manage a specific non-credible contingent event and which have been identified through the power system frequency risk review as being necessary.[103] The chapter is structured as follows:

- Section 5.1 provides a description of the key features of the final rule in respect of the development of emergency frequency control schemes.
- Section 5.2 sets out the Commission's assessment of the key matters associated with this process, including the arrangements for planning, implementation and monitoring and reporting of emergency frequency control schemes by NSPs.

5.1 Description of the final rule

The key features of the final rule in respect of the process for developing new[104], or modifying existing, emergency frequency control schemes which are not required to manage a specific non-credible contingent event are described below.[105]

Box 5.1 Development of existing emergency frequency control schemes

NSP planning

- Each TNSP must conduct an annual planning review which must (among other things) take into account the most recent power system frequency risk review.[106]

103 As explained in section 3.5, emergency frequency control schemes encompass both "general purpose" and "special" emergency frequency control schemes. General EFCS are used to mitigate the consequences of non-credible contingency events by automatically shedding load and/or generation in a controlled manner in response to an increase or decrease in frequency across the system. In contrast, special EFCS are event specific schemes, applicable to protected events and some credible contingency events. In effect, special EFCS can shed load or generation before a significant increase or decrease in frequency occurs across the system.

104 A new emergency frequency control scheme in the context of this chapter (and the process illustrated by the blue box in figure 4.1) is one that is not linked to the management of a specific protected event. Importantly, a new emergency frequency control scheme developed specifically to help manage a protected event would not be subject to the same NSP planning processes. This is explained further in Chapter 6.

105 Box 5.1 does not include an exhaustive list of the changes made to the NER to incorporate the final rule. It is intended to highlight the key features of the final rule relevant to the discussion in section 5.2.

106 Clause 5.12.1 of the NER.

- The Transmission Annual Planning Report (TAPR) must (among other things) set out:[107]
  - for proposed new or modified emergency frequency control schemes, the manner in which the project relates to the most recent power system frequency risk review
  - emergency controls in place under clause S5.1.8, including the NSP's assessment of the need for new or altered emergency controls under that clause
  - relevant load, generation and network control facilities in place under clause S5.1.10.
- NSPs must cooperate with AEMO in relation to the design, procurement, commissioning, maintenance, monitoring, testing, modification and reporting in respect of each emergency frequency control scheme applicable to the NSP's system.[108]

General responsibilities regarding emergency frequency control schemes (NSPs)

In respect of emergency frequency control schemes generally:[109]

- An NSP must:
  - cooperate with AEMO in the conduct of power system frequency risk reviews and provide to AEMO all information and assistance it reasonably requests, and
  - provide AEMO with all the information and assistance it reasonably requests for the development and review of EFCS settings schedules.
- NSPs must use reasonable endeavours to achieve commissioning of a new or upgraded emergency frequency control scheme within the time contemplated by the relevant power system frequency risk review.

In respect of over-frequency schemes specifically:

- For an over frequency scheme, an NSP must identify which elements of the scheme (if any) can be implemented by facilities provided by a generator for the generator's generating unit, or by modification to the facilities of the generator, or by changes to the settings of protection systems or control systems for the generator's generating units.

107 Clause 5.12.2 of the NER.

108 Clause 4.3.4 of the NER.

109 Schedule 5.1.10.1a of the NER.

- Where those opportunities are identified, the NSP must notify the generator of the opportunity and must request the generator to negotiate to reach agreement on the modifications to be made and the other arrangements required by the NSP to comply with its obligations with respect to the scheme (including commissioning, testing, monitoring and future modification).

- If the generator declines the request, or if the generator agrees to the request but good faith negotiations do not result in agreement being reached in a reasonable time (having regard to the implementation timetable for the scheme), the NSP may make other arrangements to implement the relevant elements of the scheme.

- If the generator accepts the request, the generator and the NSP must each negotiate in good faith with respect to the matters referred to above.

Power system security responsibilities regarding emergency frequency control schemes (AEMO)[110]

A modified responsibility on AEMO in respect of the power system is to:

- coordinate the provision of emergency frequency control schemes by NSPs and to determine the settings and intended sequence of response by those schemes.

EFCS settings schedule (AEMO)[111]

- AEMO must develop, update and maintain (among other things) schedules for each participating jurisdiction specifying, for each emergency frequency control scheme affecting each region in that participating jurisdiction, settings for operation of the scheme ("EFCS settings schedule").

- In developing and updating EFCS settings schedules, AEMO must consult with:

  - affected NSPs

  - the relevant JSSCs, in the case of information in the schedule relating to an under frequency scheme

  - affected Generators, in the case of information in the schedule relating to an over frequency scheme.

110 Clause 4.3.1 of the NER.

111 Clause 4.3.2 of the NER.

- Among other things, AEMO must seek the approval of the relevant JSSC for the order in which a sensitive load is to be shed and restored under an EFCS settings schedule (which approval must not be unreasonably withheld).
- For each under frequency scheme, the applicable EFCS settings schedule must set out the manner in which loads are to be shed and restored.
- For each over frequency scheme, the applicable EFCS setting schedule must set out the manner in which generating units will be interrupted or have output reduced and the frequency at which this will occur in relation to each generating unit.
- AEMO must determine the above in a manner it considers is best calculated to be consistent with the power system security principles in clause 4.2.6. To that end, AEMO may determine a sequence and settings that will
  - first, restore the power system to a secure operating state, and
  - then, restore the power system to a reliable operating state.
- EFCS settings schedules are confidential information.

EFCS settings schedule (NSPs)[112]

- Where an EFCS settings schedule applies to an emergency frequency control scheme, an NSP must only apply, or allow the application of, settings for the emergency frequency control scheme that are consistent with the EFCS settings schedule.

5.2 Commission's assessment

The Commission has analysed and assessed the issues arising from the rule change request and the draft rule in respect of the development of new and existing emergency frequency control schemes. Outlined below is the Commission's assessment of this matter, including the reasons why it considers the existing NSP planning frameworks in the NER is the most appropriate means of progressing the development of these schemes and hence why the final rule better meets the NEO than the draft rule.

5.2.1 NSP planning

As set out in section 4.2.2, an outcome of the power system frequency risk review may be the identification of the need for a new emergency frequency control scheme (not linked to the management of a specific protected event) and/or the need to modify an existing emergency frequency control scheme to ensure it is able to achieve what is

112 Clause 4.3.2 of the NER.

intended, in light of current and expected future power system and market conditions. Where a network planning issue is identified through this process, NSPs would then proceed through the existing network planning process.

The key aspects of the planning process require NSPs to publish an annual planning report as part of their annual planning review, and to progress network planning projects through the RIT-T (or the RIT-D) assessment and consultation process, where applicable. These frameworks are designed to promote efficient investment in, and use of, transmission and distribution networks across the NEM and in this regard would be expected to:

- optimise the decision making process and promote efficiency in relation to planning associated with emergency frequency control schemes
- provide increased consultation on the options that are available to address a network planning issue identified through the power system frequency risk review
- apply rigor and greater consistency to the analysis of costs and benefits of developing a new, or modifying an existing, emergency frequency control scheme before any investment is undertaken.

Progressing modifications to emergency frequency control schemes through existing planning frameworks will promote greater consistency, transparency and predictability in transmission (and distribution) planning decision making.

A key feature of the framework proposed by AEMO in its submission to the draft rule determination was the ability for AEMO to declare an "EFCS Need" following a risk assessment, which NSPs would then be required to respond to through a collaboration with AEMO.[113] In contrast to AEMO's proposal, the final rule does not place a formal obligations on NSPs to either address the need to modify an existing emergency frequency control scheme if such a need is identified through the risk review process, or to modify a scheme in accordance with the design specifications (or capabilities) favoured by AEMO. There are a number of reasons for this.

First, the introduction of a power system frequency risk review to be conducted by AEMO in consultation with NSPs formalises joint planning between AEMO and TNSPs in relation to power system frequency. The intention is for these parties to cooperate and collaborate to develop appropriate solutions and optimise the design of any new or modified emergency frequency control scheme to deliver the desired outcome at least cost. A number of new obligations have been included in the final rule to support this outcome.

Second, in addition to NSP's existing responsibilities and obligations in the NER in respect to power system security[114], the final rule includes an obligation on NSPs (in accordance with clause S5.1.10.1a) to cooperate with AEMO in relation to the design,

113 AEMO submission to the draft rule determination, p. 25.

114 Clause 4.3.4 of the NER.

procurement, commissioning, maintenance, monitoring, testing, modification and reporting (to AEMO) in respect of any emergency frequency control scheme applicable to its network.[115] This will encourage ongoing communication between AEMO and NSPs from the planning and design stages, through to the implementation and monitoring of a new or modified emergency frequency control scheme.

Further, the final includes a number of new obligation on TNSPs in respect of their annual planning process to:[116]

- first, take into account the most recent power system frequency risk review when conducting their own annual planning reviews, and
- second, for any proposed new or modified emergency frequency control scheme, report in its annual planning report on the manner in which the project relates to the most recent power system frequency risk review.

To the extent NSPs were not otherwise considering power system frequency risks and the implications for their networks on a regular basis, these obligations will now require NSPs to do so as part of their annual planning processes. Clearer obligations and greater transparency around how NSPs consider and assess the capabilities of existing emergency frequency control schemes should facilitate more efficient planning and investment decisions.

5.2.2 NSP implementation

Once the relevant NSP has designed a new or modified emergency frequency control scheme and completed the necessary and applicable network planning processes, it will proceed with implementation of the scheme. Consistent with existing obligations, NSPs are expected to cooperate with all other relevant NSPs to agree arrangements for implementing load shedding (which includes through emergency frequency control schemes).[117]

Broadly, NSPs' responsibilities for implementation are to build assets, or to change settings on existing settings, to comply with its obligations with respect to the scheme (including commissioning, testing, monitoring and future modification). However, NSPs responsibilities differ in respect of implementing under-frequency schemes and over-frequency schemes:

- For under-frequency schemes,[118] NSPs must install equipment and/or change equipment settings as needed, to meet the scheme's design requirements.

115 Clause 4.3.4(b1) of the NER.

116 Rule 5.12 of the NER.

117 Schedule S5.1.10.1 of the NER.

118 Under frequency scheme means an emergency frequency control scheme with capability to respond when power system frequency is below or falling below the normal operating frequency band.

- For over-frequency schemes,[119] NSPs must:[120]
  - engage in good faith with generators and offer generators the option of building assets or changing settings on existing assets to comply with the EFCS design specifications; and
  - if a generator elects not to undertake the actions referred to above, or good faith negotiations do not result in agreement being reached in reasonable time, build assets and/or change settings on existing assets to comply with the EFCS design specifications.

Further details on the Commission's reasons for establishing these arrangements for over-frequency control schemes are set out in Chapter 7.

The Commission will be recommending to the Council of Australian Governments (COAG)that the clause which addresses NSP responsibilities relating to the design, procurement, commissioning, maintenance, monitoring, testing and modification of each EFCS should be designated as a systems operation function in the National Electricity (SA) Regulations.[121] This is so that the relevant NSP will be covered by the immunity in s 119(2) of the NER from civil monetary liability for its performance of this function (unless the NSP's act or omission is done in bad faith or through negligence). This should address the concerns of a number of NSPs who considered NSPs should not be responsible or liable for any actions associated with the implementation of an over-frequency scheme which they would be unable to control.[122]

5.2.3 EFCS settings schedule

To help guide the implementation of any new or modified emergency frequency control scheme, the final rule requires AEMO to develop, update and maintain schedules for each participating jurisdiction specifying the settings for operation of each emergency frequency control scheme in a region.

For an under frequency scheme, the current arrangements for the determination of the order of load will continue to apply. That is, the relevant JSSC will continue to provide to AEMO schedules of the priority order of sensitive loads and other loads.[123] AEMO will then set out in the EFCS settings schedule, the manner in which loads will be shed

119 Over frequency scheme means an emergency frequency control scheme with capability to respond when frequency is above or climbing above the normal operating frequency band.

120 Schedule S5.1.10.1a(d).

121 Clause 4.3.4(b1) of the NER.

122 Submissions to the draft rule determination from the ENA, Energy Queensland and Electranet.

123 Clause 4.3.2(f) of the NER.

and restored, in accordance with the priority order established by the JSSC.[124] As under current arrangements, these settings schedules will remain confidential.[125]

For an over-frequency scheme, the JSSC will not have a role in determining any priority orders. Instead, the NER will now include two principles around which AEMO will determine the manner in which generators will be interrupted or have output reduced. These two principles, in priority order, are:[126]

- that AEMO should determine a manner in which generation will be interrupted or have output reduced that is best calculated to achieve the power system security principles
- to that end may determine a sequence and settings that will:
  - first, restore the power system to a secure operating state, and
  - then, restore the power system to a reliable operating state.

The Commission's reasons for developing these principles are also explained further in section 7.1.2.

AEMO will then set out in the EFCS settings schedule, the manner in which generating units will be interrupted or have output reduced, and the frequency at which this will occur in relation to each generating unit.[127]

In developing and updating EFCS settings schedules, AEMO must consult with affected NSPs, the relevant JSSC (in the case of information relating to an under-frequency scheme) and affected generators (in the case of information relating to over-frequency schemes).

Separate to the EFCS settings schedule which focus on automatic load and generation shedding, the rules will still require AEMO to develop, update and maintain a set of procedures for each jurisdiction under which loads will be shed and restored by means other than an emergency frequency control scheme, consistent with the priority order established by each jurisdiction.[128] These procedures will continue to be known as the "load shedding procedures" but will focus on manual, rotational load shedding only. On the commencement of the final rule, AEMO will be required to review and update its existing load shedding procedures.

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124 Clause 4.3.2(m) of the NER.

125 The JSSC provides AEMO with a schedule of sensitive loads, setting out the order in which the sensitive loads can be shed, and any loads for which AEMO must get JSSC approval for before shedding. AEMO must seek approval from a JSSC to shed the sensitive loads identified as needing JSSC approval in the schedules.

126 Clause 4.3.2(o) of the NER.

127 Clause 4.3.2(n) of the NER.

128 Clause 4.3.2 (g)(1) of the NER.

5.2.4 Monitoring and reporting

The final rule places a number of new reporting obligations on NSPs in respect of load, generation and network control facilities in place under clause S5.1.10, and localised emergency stability control schemes in place under clause S5.1.8. This information must be included by NSPs in their annual planning reports. The purpose of the new reporting requirements is to improve the level of transparency around NSPs consideration and planning of emergency control schemes generally, including emergency frequency control schemes. As noted in section 4.2.4 of this final rule determination, this will assist NSPs and AEMO in conducting the power system frequency risk review where these schemes fall within the scope of that review.

6 Request, declaration and management of protected events

This chapter sets out the Commission's views in relation to the process for the request, declaration and management of protected events following the outcome of the power system frequency risk review. The chapter is structured as follows:

- Section 6.1 provides a description of the key features of the final rule in respect of the request, declaration and management of protected events.
- Section 6.2 sets out the Commission's assessment of the key matters associated with this process, including the arrangements for requesting and declaring a protected event and the subsequent planning, implementation and monitoring and reporting arrangements in respect of emergency frequency control schemes required to manage a specific protected event.

6.1 Description of the final rule

The key features of the final rule in respect of the process for the request, declaration and management of protected events following the outcome of the power system frequency risk review, are described below.[129]

Box 6.1 Request, declaration and management of protected events

Request for the declaration of a protected event[130]

- Where the an outcome of the power system frequency risk review is the identification of a potential protected event, AEMO must develop and submit to the Reliability Panel a request for declaration of a non-credible contingency event as a protected event. In doing so, AEMO must take into account any guidelines issued by the Reliability Panel regarding the timing and content of such a request.
- A request for declaration of a protected event must include:
  - information explaining the nature and likelihood of the non-credible contingency event and the consequences for the power system if the event were to occur (this would include an estimate of unserved energy associated with the occurrence of the event)

129 Box 6.1 does not include an exhaustive list of the changes made to the NER to incorporate the final rule. It is intended to highlight the key features of the final rule relevant to the discussion in section 6.2.

130 Clause 5.20A.4.

- options for managing the non-credible contingency event, including a recommended option (or range of options) and AEMO's rationale for the recommendation
- for each recommended option, an estimate of the additional costs to operate the power system in accordance with the power system security principles in clause 4.2.6 if the event is declared a protected event (this would include a description of the mechanisms that may be used, for example, the purchase of FCAS or the use of dispatch constraints)
- where a recommended option for managing the non-credible contingency event includes a new or modified emergency frequency control scheme:
  - the target capabilities for the scheme, the rationale for those target capabilities and the corresponding expected power system security outcomes (this would include an estimate of unserved energy associated with operation of the scheme)
  - an estimate of the costs to procure and commission the scheme and maintain its availability and performance, including upfront costs and ongoing maintenance costs
- other information AEMO considers reasonably necessary to assist the Reliability Panel to consider the request.

Request to revoke a protected event declaration[131]

- If AEMO recommends in a power system frequency review that a non-credible contingency event should no longer be managed as a protected event, AEMO must submit to the Reliability Panel a request to revoke the declaration of a non-credible contingency event as a protected event.
- A request for revocation must include:
  - information explaining the nature of the non-credible contingency event and the consequences for the power system if the event were to cease to be managed as a protected event
  - other information AEMO considers reasonably necessary to assist the Reliability Panel to consider the request.

131 Clause 5.20A.5 of the NER.

Determination of protected events

- Only AEMO may submit a request for declaration of a non-credible contingency event as a protected event, or the revocation of such a declaration, to the Reliability Panel.
- The Reliability Panel must comply with the rules consultation procedures when determining a request for declaration or revocation of a protected event.
- In determining the request, the Reliability Panel must have regard to the information provided by AEMO in its request. However, the Reliability Panel may request additional information from AEMO or obtain technical advice or assistance from a body other than AEMO, as appropriate.
- In determining the request, the Reliability Panel may undertake its own assessment of the costs and benefits of managing the non-credible contingency as a protected event, including:
  - the costs to operate the power system in a secure operating state if the event is declared (that is, the cost of ex-ante measures)
  - the costs associated with any proposed new or modified emergency frequency control scheme
  - the benefits of mitigating the consequences of the event by managing it as a protected event.
- In making a determination that declares a non-credible contingency event to be a protected event (or revokes that declaration), the Reliability Panel must have regard to the national electricity objective.
- In making a determination, the Reliability Panel may, as necessary or appropriate, also determine:
  - that the declaration only come into effect when the conditions specified in the determination are satisfied
  - matters relating to the availability and operation of an emergency frequency control scheme
  - matters relating to AEMO's operation of the power system for that protected event (that is, to the use of ex-ante measures).
- When the Reliability Panel makes a determination that includes a new or modified emergency frequency control scheme in connection with a protected event, the Reliability Panel must determine the protected event EFCS standard applicable to the scheme.

- The Reliability Panel's final report must include:
  - if the Reliability Panel has determined to make a declaration, the terms of the declaration and any conditions applicable to it, including details of the protected event EFCS standard
  - the rationale for the determination and for any protected event EFCS standard, including the costs and benefits that the Reliability Panel has considered
  - any other options considered and the corresponding expected power system security outcomes and costs and benefits
- The Reliability Panel must maintain and publish a list of all protected events (including events that will be protected events when the relevant declaration comes into effect) and each protected event EFCS standard.

Functions of the Reliability Panel[132]

The new functions of the Reliability Panel are to:

- on the advice of AEMO, determine which non-credible contingency events are to be protected events and any conditions applicable to the determination.
- if the Reliability Panel considers it necessary or desirable, determine guidelines for:
  - power system frequency reviews conducted by AEMO
  - requests for protected events declaration by AEMO, or
  - the Reliability Panel's determination of protected events.

General responsibilities regarding emergency frequency control schemes (NSPs)[133]

- NSPs must use reasonable endeavours to achieve commissioning of a new or upgraded emergency frequency control scheme within the time contemplated by, where applicable, the decision of the Reliability Panel with respect of a declaration of a non-credible contingency event as a protected event.

132 Clause 8.8.1 of the NER.

133 Schedule 5.1.10.1a of the NER.

Regulatory Investment Test for Transmission and Distribution[134]

- The RIT-T must be applied to a project except in circumstances where (among other things) the proposed expenditure relates to protected event EFCS investment and is not intended to augment the transmission network.[135]
- The RIT-D must be applied to a project except in circumstances where the proposed expenditure relates to protected event EFCS investment and is not intended to augment a network.

6.2 Commission's assessment

The Commission has analysed and assessed the issues arising from the rule change request and the draft rule in respect of the request, declaration and management of protected events. Outlined below is the Commission's assessment of this matter, including the reasons why it considers the declaration of a protected event by the Reliability Panel as specified in the final rule better meets the NEO than the draft rule.

6.2.1 Request for the declaration (and revocation) of a protected event

As set out in section 4.2.2, an outcome of the power system frequency risk review may be the identification of one (or more) non-credible contingency events for which AEMO considers it may be economically efficient to maintain the power system within the frequency operating standards applicable to protected events, should the event occur.[136]

In this case, the final rule requires AEMO to develop and submit to the Reliability Panel a request for the declaration of a protected event. This request must be developed in accordance with any guidelines the Reliability Panel may have issued in respect of the timing and content of any such request[137] and must include key information necessary to enable the Reliability Panel to undertake its assessment of the event(s). Specifically, AEMO's request must include:

- information explaining the nature and likelihood of the event and the consequences for the power system if the event were to occur (including AEMO's estimate of unserved energy)

134 Rules 5.16 and 5.17 of the NER.

135 The final rule includes a new local definition in chapter 5 for "protected event EFCS investment". This term means investment by a TNSP or a DNSP for the purposes of installing or modifying an emergency frequency control scheme applicable in respect of the NSPs transmission or distribution system in accordance with a protected event EFCS standard.

136 To be considered by the Reliability Panel, at least one management option for an event must include the utilisation of some degree of ex-ante measures, either alone or in combination with a new or modified emergency frequency control scheme.

137 The final rule does not require or preclude the Reliability Panel to issue guidelines on these matters.

- the option(s) for managing the event, including AEMO's recommended option (or range of options) and the rationale for its recommendation
- for each recommended option, AEMO's estimate of the costs of employing ex-ante measures to manage the power system[138] and a description of the mechanisms that may be used (for example, the purchase of FCAS or use of generation dispatch constraints).

In addition, where a recommended option for managing the event includes a new or modified emergency frequency control scheme, AEMO's request must also include:

- the target capabilities for the scheme and the rationale for those target capabilities
- AEMO's estimate of unserved energy associated with operation of the scheme and
- AEMO's estimate of the costs associated with establishing, operating and maintaining the scheme.

In respect of a request to revoke the declaration of a protected event, AEMO's request to the Reliability Panel must include information explaining the nature of the event and the consequences for the power system if the event were to cease to be managed as a protected event.

The final rule supports efficient decision making by clearly specifying the key information to be submitted by AEMO to the Reliability Panel. This will provide a degree of discipline on AEMO and TNSPs in developing and refining key information required by the Reliability Panel in order for it to be able to undertake its assessment in a timely manner, and determine the most efficient outcome.

Further, by providing flexibility for the Reliability Panel to issue guidelines on protected events, including on the timing and content of any request from AEMO for the declaration (or revocation) of a protected event, the final rule provides the Reliability Panel with the ability to streamline these requests, particularly in the instance it finds that the requests being submitted by AEMO do not contain the appropriate level of detail, or are not being submitted within appropriate timeframes.[139]

138 That is, the additional costs to operate the power system in accordance with the power system security principles set out in clause 4.2.6 of the NER.

139 For example, if AEMO were to submit multiple requests for declarations of different events over multiple timeframes following the conclusion of a power system frequency risk review, and where this was having a detrimental impact on the Reliability Panel's ability to consider and assess the requests.

6.2.2 Determination of protected events

Following the submission of a request by AEMO for the declaration (or revocation) of a protected event, the Reliability Panel will commence a process to assess the recommended option (or range of options) put forward by AEMO to manage the relevant non-credible contingency event, having regard to the National Electricity Objective.

The Reliability Panel's consideration of a request for the declaration (or revocation) of a protected event must be undertaken in accordance with the rules consultation procedures.[140]

In carrying out its assessment, the Reliability Panel must have regard to the information provided by AEMO in its request, but may also request information from other participants and from relevant experts, as appropriate.

In determining the request, the Reliability Panel may assess:

- the costs of the recommended option(s), including the cost of ex-ante measures and the costs of any new or modified emergency frequency control scheme (and any load or generation shedding associated with the option), against
- the avoided cost of the consequences of the non-credible contingency event, should it occur.

Where the benefits of managing the event outweigh the costs of doing so, the Reliability Panel would declare the non-credible contingency event a protected event.

Where the Reliability Panel has determined to declare a non-credible contingency event a protected event, and where the most efficient management option includes a new or modified emergency frequency control scheme, the Reliability Panel must also determine a "protected event EFCS standard" for the scheme.

The protected event EFCS standard sets out a target capability (or set of capabilities) to guide the development of the scheme. The standard may include the following factors:[141]

- power system conditions within which the scheme is capable of responding
- the nature of the scheme's response (load shedding or generation shedding for the purposes of managing frequency)
- the speed of the response

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140 The rules consultation procedure is set out in rule 8.9 of the NER. Based on the minimum and maximum timeframes specified in the rule, the consultation process would take between 17 and 22 weeks from start to finish.

141 These factors are included within the definition of "protected event EFCS standard" which is set out in Chapter 10 of the NER.

- the amount of load shedding or generation shedding that may occur when the scheme responds
- capability to dynamically sense power system conditions.

The protected event EFCS standard is discussed further in section 6.2.3.

To facilitate the declaration (and revocation) of protected events by the Reliability Panel, the final rule places a new function on the Reliability Panel to determine on the advice of AEMO, which non-credible contingency events are to be protected events, and any conditions applicable to the determination.

In the protected event governance framework set out in the draft rule (see section 3.3.2), the Commission determined that AEMO was the appropriate body to decide whether an event should be classified as a protected event. However, in making this decision, the draft rule did not require AEMO to undertake an economic assessment. Instead, it was envisaged that the Reliability Panel would undertake an economic assessment when determining a post contingency operating state to apply to each protected event, once the event was determined by AEMO.

The final rule differs from the draft rule in that the declaration of a protected event is made on the basis of an economic assessment of the benefits of managing the power system to maintain the relevant power system standards should the event occur, and the costs associated with managing the event.[142] As noted in the draft rule determination, the Reliability Panel already undertakes similar cost benefit assessments when developing various NEM standards. In particular, the Reliability Panel already makes similar judgements and assesses economic trade-offs when determining the system restart standard or the frequency operating standards, or when making recommendations for the level of the reliability standard and settings.[143] As such, the Reliability Panel is best placed to determine whether it is likely to be economically efficient to manage a non-credible contingency event in order to maintain the power system standards applicable to protected events, should the event occur.[144]

That said, the final rule recognises that AEMO has the relevant technical and operation expertise necessary to identify those non-credible contingency events which should be considered by the Reliability Panel as potential protected events. The Reliability Panel will utilise the information and technical expertise provided by AEMO in any request for declaration (or revocation) of a protected event when undertaking its assessment (although the Reliability Panel may also request information from other participants and from relevant experts, as appropriate).

142 The costs of managing the event relate to the use of ex-ante measures such as the procurement of FCAS and constraining generation dispatch, and potentially a new or modified special protection scheme, including the costs of load or generation shedding associated with that scheme.

143 See the Reliability Panel page of the AEMC website for more information on the role and responsibilities of the Reliability Panel.

144 The Commission does not consider it is appropriate for AEMO to undertake this economic assessment, as this would not be consistent with its functions as the market operator.

6.2.3 NSP planning

Once the Reliability Panel has determined a protected event EFCS standard, the final rule requires the relevant NSP to design, procure, commission, maintain, monitor, test, modify and report to AEMO in respect of the scheme, and to do so in a manner that ensures the scheme is available and in operation in accordance with the standard.[145] The final rule also requires NSPs to use reasonable endeavours to commission the new or upgraded scheme within the time contemplated by AEMO in its power system risk review, and the Reliability Panel in its determination of a protected event (where this is specified).

The inclusion of a protected event EFCS standard in the final rule provides a level of discipline on NSPs in terms of how they plan and implement a new or modified emergency frequency scheme designed specifically to manage a protected event. It is important that the scheme ultimately implemented by an NSP is consistent (both in terms of its performance capabilities and cost) with the scheme that was considered and assessed by the Reliability Panel in its determination of the protected event.[146]

Further, the capabilities of an emergency frequency control scheme linked to a protected event will generally determine the extent and costs of the ex-ante action taken by AEMO to maintain the relevant frequency operating standards following the occurrence of the event. Therefore, setting a protected event EFCS standard upon which NSPs must comply also provides some level of comfort that the additional costs incurred by AEMO in managing the power system to manage the event will not deviate significantly from the estimates of the costs considered by the Reliability Panel in its determination.

While the Commission considers there is benefit in having the Reliability Panel determine a standard for any emergency frequency control scheme linked to the management of a specific protected event, it does not consider it is appropriate for the Reliability Panel to define the parameters around other new network investments which may also provide a means of mitigating or managing (in combination with ex-ante actions of other measures) a protected event. Where the efficient management solution includes other network investment, these would be subject to existing NSP planning processes and would need to be progressed through these frameworks.

The final rule provides for the exclusion of investment required to be undertaken by an NSP for the purposes of meeting a protected event EFCS standard, from the RIT-T and the RIT-D.[147] This is because the potential options to address the management of the protected event, and the cost benefit analysis have been considered and assessed

145 Clause S5.1.10.1a(b) of the NER.

146 Where, in practice, the costs of managing a non-credible contingency event turn out to exceed the benefits of doings so, AEMO would be expected to identify this in the next power system frequency risk review, and to submit to the Panel a request for the revocation of the event as a protected event.

147 This wouldn't, however, preclude an NSP from applying the RIT-T or the RIT-D as part of the power system frequency risk review in order to discover alternative means of managing a protected event, other than a new or modified emergency frequency control scheme.

through the power system frequency review process and the Reliability Panel's declaration of the protected event and determination of the protected event EFCS standard. Therefore, as this analysis has already been undertaken, the investment required to be undertaken by the NSP in order to meet a protected event standard does not need to be delayed by another assessment through the RIT-T or RIT-D process.

The rules place an obligation on NSPs to design, procure, commission, maintain, monitor, test, modify and report to AEMO in respect of each EFCS applicable in respect of the NSPs network. The NSP must do so in accordance with the applicable protected event EFCS standard. As a result of this regulatory obligation imposed on NSPs under the rules, the network services provided in relation to that EFCS will be prescribed transmission services or standard control services for the purposes of the rules. Therefore:

- The NSP will be entitled to seek a revenue allowance that allows it to meet that regulatory obligation in a prudent and efficient manner. Any capital expenditure to be undertaken by the NSP in relation to a new or modified emergency frequency control scheme will be treated the same as other capital expenditure and rolled into the regulated asset base in accordance with the rules.

- Given that the regulatory obligation may be imposed during a regulatory control period, the NSP may be able (subject to the applicable materiality threshold) to seek a regulatory change event cost pass through from the AER.

The Commission also considers that these existing mechanisms are sufficient to allow NSPs to recover the costs of implementing emergency frequency controls schemes that are required to meet the protected event EFCS standard.

6.2.4 NSP implementation

Once the relevant NSP has designed a new or modified emergency frequency control scheme consistent with the standard, it must begin the process of implementing the scheme. This process includes the building of assets and/or changes to settings of existing assets, to implement under and over-frequency scheme components of the scheme.

Section 5.2.2 set out the implementation process relevant to the modification of existing emergency frequency control schemes, as identified through AEMO's power system frequency risk review. The process for the implementation of new of modified schemes identified through the Reliability Panel's determination of a protected event is the same process in section 5.2.2.

6.2.5 Monitoring and reporting

Consistent with the arrangements discussed in section 5.2.4, once an NSP has implemented a new or modified emergency frequency control scheme in accordance with the protected event EFCS standard set by the Reliability Panel, it is required to monitor and report on the scheme on a regular basis as part of its annual planning

report. This will improve transparency and accessibility of information pertaining to emergency frequency control schemes, and will assist NSPs and AEMO in conducting the power system frequency risk review at least every two years.

7 Other matters

This chapter sets out the Commission's views on a number of other matters relevant to the final rule. Specifically:

- Section 7.1 discusses the new arrangements for over-frequency generation shedding schemes.
- Section 7.2 provides an overview of the review of the frequency operating standards to be undertaken by the Reliability Panel following implementation of the rule.
- Section 7.3 sets out the transitional arrangements applicable to the final rule.

7.1 Over-frequency schemes components of the EFCS

In developing a framework for over-frequency schemes, the Commission has considered the following issues:

- Rationale for the development of over-frequency schemes.
- Order of generation shedding.
- Market impact on generators.
- Responsibility for implementation.

7.1.1 Rationale for the development of over-frequency schemes

The Commission considers that over-frequency events could have increasingly material impacts on power system frequency.

Regions with limited interconnection to the rest of the NEM may be particularly vulnerable to an over-frequency event. This is because of the potential consequences of an interconnector trip separating the region from the rest of the NEM. If this trip occurs while the interconnector is at full export capacity, this could result in a major supply and demand imbalance within the region. This could in turn cause frequency to rise very rapidly, potentially tripping generation in the region and causing a cascading outage and potentially a black system.

Whether this scenario occurs depends on actual patterns of demand and generation dispatch in a region, including the following:

- Ratio of domestic demand to potential export flow: The higher this ratio, the greater the risk that the trip of a fully loaded exporting interconnector will result

in a large supply / demand imbalance in the region, and resultant rate of frequency increase.[148]

- Ratio of domestic generation and demand: The higher this ratio, the greater the likelihood that the region will be exporting power to the rest of the NEM at any given time.[149] This is particularly the case if there are large volumes of low to zero variable cost generation in a region, as these generators will seek to be dispatched whenever their relevant fuel source is available.

- Inertia in the region: In regions with low levels of domestic inertia, tripping of a fully loaded exporting interconnector may result in high levels of RoCoF in the region. This could trigger tripping of generators in the region.

Over-frequency schemes are therefore likely to be more valuable in those regions with a greater chance of separation. The Commission notes that such mechanisms already exist to limit the consequences of over-frequency in Tasmania, while in South Australia ElectraNet and AEMO are currently working to establish an over-frequency scheme.[150]

In this context, the design of any over-frequency scheme will likely need to reflect the specifics of individual regions. This will include consideration of whether an over-frequency scheme is likely to be particularly necessary in any particular region.

7.1.2 How generators should be shed following an over-frequency event

Generators should be shed by an over-frequency scheme in order to firstly maintain system security, then reliability. This differs to under-frequency schemes, where the order of load shedding is determined by the JSSC in its load shedding schedules. JSSCs have no equivalent function in generation shedding. AEMO is therefore the appropriate body to make this decision, subject to guidance in the NER.

As noted in section 5.2.3, the final rule requires AEMO to establish an order of generation shedding and settings for shedding that AEMO determines is best calculated to achieve the power system security principles in clause 4.2.6 of the NER. AEMO may determine a sequence and settings that will shed generation in order to:

- restore the system to a *secure operating state*; and then to

- restore the system to a *reliable operating state*.

The Commission has considered the following issues in developing these principles:

148 As an example, the recent upgrade of the Heywood interconnector between South Australia and Victoria will increase potential export flows from South Australia from 460MW to 650MW. Assuming an average level of demand of around 1300 MW for South Australia, the ratio of potential maximum export to average total demand increased from 0.35 to 0.5.

149 Subject to limitations including price in both regions and other factors such as fuel availability.

150 AEMO, *Future Power System Security program - Progress Report*, August 2016, p. 32.

- **The main purpose of shedding generation is to return the system to a secure operating state:** Generation is shed to limit the consequences of an over-frequency event, including the subsequent risk of uncontrolled generator tripping and frequency collapse. However, the type of generation shed will affect the ongoing security of the power system. For this reason, AEMO should shed generation in such a way that maximises system strength and system inertia following the relevant contingency event.[151]

- **Second to this, AEMO should consider the ongoing reliability of the system:** Different types of generation will be able to restart in different timeframes and recommence exporting power to the grid, following being shed by an over-frequency EFCS. For example, most wind and solar generators and some gas/diesel peaking units are physically able to restart and recommence export relatively quickly after being shed. In contrast, some larger thermal units may take longer to restart due to physical limitations.[152] AEMO should consider these consequential issues when it decides on the order of generation shedding.

7.1.3 Market impacts on generators

The Commission notes issues raised by some stakeholders regarding the impacts of an over-frequency scheme on the revenues of generators.[153]

While the Commission acknowledges that there will be an impact on generator revenues, the materiality of the impact is likely to be limited given that over-frequency events are very rare, and over-frequency schemes are unlikely to be triggered on a frequent basis. In addition, if the scheme is able to arrest a frequency collapse and prevent a black system event from occurring, all generators will maintain the ability to export power once the emergency conditions have passed. As such, the Commission does not consider the presence of an over-frequency scheme will have a material, if any, impact on investment signals.

Further, the Commission does not consider that generator shedding is a substitute for FCAS lower services. These services are used for the pre-contingent management of credible contingencies, as opposed to over-frequency schemes that will be used on an ex-post basis for limiting the consequences of protected or non-credible contingency events. The presence of an over-frequency scheme should not impact on the value or price of lower services.

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151 More information is available at: AEMO, *Future Power System Security program - Progress Report*, August 2016.

152 For example, large coal thermal units may need to restart auxiliaries such as fans and conveyer belts, and take some hours to restart boilers.

153 The CEC stated that introduction of an over-frequency EFCS could provide negative investment signals for renewable energy investment. The CEC stated that the over-frequency scheme as proposed would be arbitrary and would not provide compensation arrangements for semi-scheduled generators. It was also argued this would also reduce the value of frequency lower services. See CEC, Consultation paper submission, p. 2.

Given these factors, the Commission does not consider any form of compensation to generators is warranted for participation in an over-frequency scheme. Compliance with these schemes is necessary for the general maintenance of power system security.

7.1.4 Responsibility for implementation

While NSPs and generators will be able to jointly implement any over-frequency schemes, NSPs are ultimately responsible for ensuring such a scheme has been implemented in a manner which allows it to comply with its obligations with respect to the scheme (including commissioning, testing, monitoring and future modification).

NSPs have the required technical expertise and experience to implement these schemes and currently play a key role in both existing UFLS arrangements, as well as in the development of intra-regional, localised emergency control schemes for the management of stability issues. NSPs also already face a direct obligation under the rules to cooperate and assist AEMO in maintaining power system security.[154] Finally, NSPs are also provided with limitations on liability for their performance of system security functions.[155] For these reasons, the Commission considers NSPs are best placed to bear the final responsibility for implementing an over-frequency scheme.

However, in some cases, generators may wish to install new equipment or change settings on existing equipment themselves, to allow for scheme implementation.[156] This may provide generators with greater control over how their generation units are shed during an over-frequency event, potentially minimising impacts on this equipment.[157] This approach may be more efficient overall, if it utilises existing assets, rather than requiring NSPs to install new assets.

The final rule requires NSPs to identify opportunities for generators to install or adapt equipment to meet enable NSPs to comply with their obligations with respect to the scheme (including commissioning, testing, monitoring and future modification). Where an NSP has identified such an opportunity, it must negotiate in good faith with the generator regarding modifications to be made and other changes necessary to the generator's equipment so the NSP can meet its EFCS implementation obligations. Such negotiations will not affect the exercise of current rights under a connection agreement.

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154 NER clause 4.3.4(a).

155 Section 119(2) of the NEL applies to NSPs and excludes civil monetary liability for an act or omission in the performance or exercise, or purported performance or exercise, of a systems operation function or power (as prescribed in the regulations). The section does not apply to an act or omission done or made through negligence or bad faith. Civil monetary liability for negligence is capped. The amount of the cap is determined by the regulations.

156 For example, Generators may be able to change settings on existing protection equipment that sits on the Generator's side of the connection point.

157 For example, the Commission understands that Generators may be able to install equipment, or change settings on existing equipment, to shed specific units at specific frequencies. This would allow the generator to maintain some export to the power system during an over-frequency event, rather than having all export curtailed.

Importantly, where the generator has negotiated with the NSP and installs equipment, or changes settings on existing equipment, final responsibility for scheme performance, and any associated liability, remains with the NSP.

The Commission recognises that not all generators may wish to install equipment or change their plant settings to implement an over-frequency scheme. In these cases, NSPs will implement the over-frequency scheme.

7.2 Review of the frequency operating standards

Under chapter 8 of the NER, the Reliability Panel is required to review and, on the advice of AEMO, determine the power system security standards.[158] These standards may include various matters but at present, include standards for the range of allowable frequency of the power system under different conditions, including normal operation and following contingencies. These standards are set out in the frequency operating standards (FOS).

More specifically, the FOS set out the frequency requirements for AEMO's operation of the power system. This includes defined frequency bands and timeframes in which the system frequency must be restored to these bands following different events, such as the failure of a transmission line or separation of a region from the rest of the NEM. These requirements then inform how AEMO operates the power system, including through applying constraints to the dispatch of generation or procuring ancillary services.

The final rule determination raises the following issues that are relevant to such a review:

- The appropriateness of the requirements in the FOS that relate to multiple contingency events. Currently, the FOS include a requirement for AEMO to maintain the FOS for any multiple contingency event. AEMO has argued that this is impractical, as it is not possible to maintain the FOS for all possible multiple contingencies.
- The incorporation of the new event classification for "protected events" into the FOS. The final rule introduces a new category of contingency event, the "protected event". AEMO is now required to maintain the frequency of the power system within certain bands for these events. These requirements will be defined in the FOS.

Accordingly, the AEMC has requested that the Reliability Panel undertake a review of the frequency operating standards that apply in the NEM.[159] This review is related to and is intended to complement the ongoing work program that the AEMC is

158 Clause 8.8.1(a)(2) of the NER.

159 This request was made on 30 March 2017. The terms of reference for the Review of the Frequency Operating Standards are available on the AEMC website.

undertaking to enable the maintenance of power system security in the NEM, including the emergency frequency control scheme rule change.

The final rule includes an interim FOS to apply for any protected event(s) that may be declared prior to a review of the FOS being completed (the interim FOS is discussed in the next section). Following the completion of the review of the FOS by the Reliability Panel, due by December 2017, a revised FOS for protected events may replace this interim standard.

7.3 Transitional arrangements

7.3.1 Interim frequency operating standards

As noted above, the final rule includes an interim FOS to apply for any protected event(s) that may be declared prior to a review of the FOS being completed by the Reliability Panel. Specifically, the interim standards will apply from the commencement date of the final rule, until such time as the Reliability Panel determines the NEM frequency operating standards for protected events in the power system security standards under clause 8.8.1(a)(2).

The interim frequency operating standard to apply to protected events will be set out in Chapter 11 of the NER.[160]The Commission considers that, for a protected event, the power system should be maintained within the extreme frequency excursion tolerance limits that apply to a multiple contingency events under the current frequency operating standards for the NEM mainland and Tasmania. As these values are different for the NEM mainland and Tasmania, the resultant interim frequency standards for a protected event are as follows.

Tasmania

For a protected event, system frequency should not exceed the applicable extreme frequency excursion tolerance limits, and should not exceed the applicable load change band for more than two minutes while there is no contingency event, or the applicable normal operating frequency band for more than 10 minutes while there is no contingency event:

Condition	Containment	Stabilisation	Recovery
Protected Event	47.0 to 55.0 Hz	48.0 to 52.0 Hz within 2 minutes	49.0 to 51.0 Hz within 10 minutes

This standard would apply for both an interconnected and an islanded system.

NEM Mainland

For a protected event, system frequency should not exceed the applicable extreme frequency excursion tolerance limits and should not exceed the applicable load change band for more than two minutes while there is no contingency event or the applicable normal operating frequency band for more than 10 minutes while there is no contingency event:

NEM Mainland Frequency Operating Standards – interconnected system

Condition	Containment	Stabilisation	Recovery
Protected Event	47.0 to 52.0 Hz	49.5 to 50.5Hz within 2 minutes	49.85 to 50.15 Hz within 10 minutes

This standard would only apply for an interconnected system. A different standard will apply to an islanded system and during periods of supply scarcity in respect of stabilisation and recovery:[161]

NEM Mainland Frequency Operating Standards – for an islanded system and during periods of supply scarcity

Condition	Containment	Stabilisation	Recovery
Protected Event	47.0 to 52.0 Hz	49.0 to 51.0 Hz within 2 minutes	49.5 to 50.5 Hz within 10 minutes

7.3.2 Transition of the existing load shedding procedures

On the commencement of the final rule, AEMO will be required to review and update its existing load shedding procedures to ensure these are consistent with the final rule – that is, applicable to matters relevant to manual load shedding as opposed to automatic load shedding. The final rule therefore includes a transitional rule requiring AEMO to review and amend its existing load shedding procedures. Transitional provisions will also bring any existing load shedding procedures into the new framework.

160 Clause 11.97.2(b) of the NER.

161 The mainland frequency operating standards during supply scarcity apply if: a situation of supply scarcity is current; in cases where an island incorporates more than one region then the critical frequency to be adopted be the maximum value of the critical frequencies for these regions; the power system has undergone a contingency event, the frequency has reached the Recovery frequency band and AEMO considers the power system is sufficiently secure to begin load restoration; the estimated amount of load available for under-frequency load shedding within the power system or the island is more than the amount required to ensure that any subsequent frequency excursions would not go below the proposed Containment and Stabilisation bands as a result of a subsequent generation event, load event, network event or a separation event during load restoration; and the amount of generation reserve available for frequency regulation is consistent with AEMO's current practice.

Another outcome of AEMO's review of existing load shedding procedures will be the removal of any existing automatic load shedding settings (for automatic emergency load shedding) from this procedure. Transitional provisions in the final rule will also bring these settings and schedules into the new framework.

Any existing emergency load shedding schemes or generation shedding schemes will be deemed to be EFCS for the purposes of the new rules.

7.3.3 Other matters

The final rule includes flexibility to enable AEMO to undertake a truncated power system frequency risk review where there is a pressing need to consider emerging risks associated with certain non-credible contingency events, and assess possible options for management of those risks. For example, there may be merit in AEMO undertaking a power system frequency risk review for South Australia ahead of other jurisdictions in the NEM.

While the final rule requires AEMO to complete a first review within at least 12 months of commencement of the rule (that is, by 6 April 2018), it provides AEMO with the flexibility to complete one (or more) reviews before this date. In addition, the final rule does not require AEMO to undertake a power system frequency risk review covering all the NEM jurisdictions, and therefore provides AEMO with the flexibility to carry out regional specific reviews, if necessary and as appropriate.

In the instance that AEMO identifies a non-credible contingency event which it considers may be economically efficient to manage to limit the consequences of the event, the final rule requires AEMO to progress this through a request for the declaration of a protected event to the Reliability Panel. The Commission does not consider it appropriate to provide a streamlined process for the declaration of a protected event on the basis that the economic trade-off being undertaken by the Reliability Panel is a crucial feature of the framework and must be carried out carefully and in consultation with stakeholders.

Abbreviations

AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
COAG	Council of Australian Governments
Commission	See AEMC
DER	distributed energy resources
DNSPs	distribution network service providers
EFCS	emergency frequency control schemes
FCAS	frequency control ancillary services
FOS	frequency operating standards
JSSC	jurisdictional system security coordinator
MCE	Ministerial Council on Energy
NEL	National Electricity Law
NEM	National Electricity Market
NEO	National Electricity Objective
NER	National Electricity Rules
NSPs	Network Service Providers
NT	Northern Territory
OFGS	over-frequency generator shedding
PE	protected event
PSFR review	Power System Frequency Risk Review
PV	photo-voltaic
RIT-D	Regulatory Investment Test for Distribution

RIT-T	Regulatory Investment Test for Transmission
RoCoF	rate of change of frequency
South Australian Government	See the proponent
the proponent	South Australian Minister for Mineral Resources and Energy
TNSPs	transmission network service providers
UFLS	under-frequency load shedding

A Summary of other issues raised in submissions

This appendix sets out the issues raised in the second round of consultation on this rule change request and the AEMC's response to each issue. Where relevant, stakeholder comments have been addressed throughout the final rule determination. The table below summarises issues raised by stakeholders that were not explicitly addressed in the consultation paper and draft determination, with the Commission's response to these comments.[162]

Stakeholder	Issue	AEMC response
AEC (submission to draft determination, p. 1)	The Reliability Panel should be conferred the right to request AEMO to review any EFCS if requested to do so.	The final rule includes a periodic review of risks associated with non-credible contingency events. This review includes an assessment of the appropriateness of existing EFCS. AEMO is required to consult on the draft report which sets out the outcomes of the review through publication of a draft report. The Reliability Panel has the opportunity to comment on the draft report, if appropriate. This matter is discussed in chapter 4 of this determination.
ElectraNet (submission to draft determination, p. 5)	The final rule should clarify the arrangements for recovery of costs associated with implementing, maintaining and operating an emergency frequency control scheme.	The cost recovery arrangements for NSPs under the final rule are described in section 6.2.3.
Engie (submission to draft determination, pp. 2-3)	Engie understands that a ministerial direction is currently in place in South Australia that restricts AEMO from purchasing contingency raise FCAS as preparation for a credible contingency event. Engie points out that under the proposed protected event framework, if AEMO is required to purchase contingency FCAS to achieve the post contingent operating state for a protected event in South Australia, then the standard for a credible contingency	The FOS for South Australia following a separation event is 47-52 Hz, based on previous notification by the JSSC for South Australia. The final rule includes an interim frequency operating standard to apply to protected events which is consistent with that which has been applied by the South Australian direction. The FOS for a credible contingency event will therefore be no less stringent than that to be

162 AEMC, Draft Rule Determination, 22 December 2016

Stakeholder	Issue	AEMC response
	event may be less stringent than that for a protected event.	applied to a protected event.
ENA (submission to draft determination, p.2)	When developing an EFCS proposal, AEMO should consider alternatives for mitigating the consequences, including network augmentation, use of system constraints and FCAS, or use of proposed inertia and FFR markets.	Under the final rule, the EFCS proposal will be an output from the power system frequency risk review, which will be a collaborative process between AEMO and NSPs. This review will be required to consider network augmentation and non-network solutions along with the declaration of protected events and new or modified EFCS. This matter is discussed further in chapter 4.
ENA (submission to draft determination, p. 2)	The EFCS design specification should be developed at the initial stage of the process to better inform NSP cost estimates that are in turn an input to the Reliability Panel assessment.	AEMO and NSPs will collaborate in undertaking the power system frequency risk review which will include consideration of potential EFCS capabilities along with the associated specifications and costs. This matter is discussed further in chapter 4.
ENA (submission to draft determination, p. 3)	The final determination should allow for AEMO to implement a temporary arrangement where the likelihood and consequence of a protected event is significant.	Under the final rule, the Reliability Panel will assess and declare a protected event along with the associated timing for the activation of this declaration. Where it becomes apparent that the benefits of managing the event no longer outweigh the costs of doing so, the final rule provides for AEMO to submit to the Reliability Panel a request for revocation of a protected event. This matter is discussed further in chapter 6.
ENA (submission to draft determination, p. 4)	The ENA submits that monitoring and reporting of EFCS implementation compliance can be adequately captured through existing, well established and effective compliance regimes managed by the AER.	The reporting obligations under the final rule are discussed in section 5.2.4 of this determination.
Energy Queensland (submission to draft determination, p. 1)	As distributed energy resource (DER) penetration increases, imperative that a future distribution system operator (DSO) and AEMO work in collaboration to manage EFCS capability alongside aggregated DER. The final rule	The periodic risk review in the final rule creates an iterative process that can react to future power system developments. The roles and responsibilities of relevant parties in relation to new or existing EFCS are discussed in

Stakeholder	Issue	AEMC response
	must clearly delineate responsibilities of all parties in relation to these future developments.	chapter 5.
Energy Queensland (submission to draft determination, p. 2)	In the event that a future EFCS system utilises the capability of digital meters and DER, the EFCS framework will need to consider whether, under the emergency circumstances proposed, access to such load is a mandatory function or one that must be purchased.	Noted.
South Australian Government (submission to draft determination, p. 4)	The draft rule does not address the issue of the role of market customers in providing load that is able to be automatically interrupted. Clause 4.3.5 should be clarified and amended if necessary to reflect the adopted practice for emergency UFLS.	The Commission has considered this issue. Based on existing definitions in the NER, Market Customers include local retailers under clause 2.3.4. Clause 4.3.5 would therefore appear to be consistent with current practice whereby 60 percent of expected demand is made available as interruptible load in accordance with S5.1.10.
RES (submission to consultation paper, p. 2)	Wind power, solar PV and battery energy storage can all provide responses to over frequency events more quickly than conventional generators and should be considered as part of ways to improve the effectiveness of an OFGS.	The draft rule would have provided AEMO with the ability to consider all available technologies when developing an EFCS proposal and when developing the detailed EFCS functional design. This could have included emergency frequency control provided by wind power, solar PV and battery storage.
ENA (submission to the consultation paper, p. 2)	The ENA stated that the Emergency frequency control scheme rule changes should include consideration of: • whether the schemes should also focus on a hybrid load perspective that includes solar PV and batteries, rather than conventional generation; • that current arrangements could be enhanced to cater for two-way interconnector flows with the potential for significant flow changes over relatively short intervals;	The draft rule would have provided AEMO with the ability to consider all available technologies when developing an EFCS proposal and when developing the detailed EFCS functional design. This may have included the solutions described by ENA.

Stakeholder	Issue	AEMC response
	• prioritising a coordinated control approach for DER; and • whether technology neutral rules adequately address the requirements of DER or storage options	
ENA (submission to the consultation paper, p. 4)	Oversight of UFLS schemes should not be the sole responsibility of one party. One example would be the Victorian Electricity Emergency Committee – Technical Working Group.	Under the draft rule, the Reliability Panel would have been responsible for developing the EFCS standard. The Reliability Panel consists of members from industry and consumer groups. It would have provided effective oversight for the development of these schemes. Jurisdictions would continue to be responsible for determining the order of load shedding.
ENA (submission to the consultation paper, p, 6)	S5.1.8 could be amended to provide TNSPs with explicit responsibility for managing change in frequency, including fast frequency response, for a defined set of non-credible contingency events. The economic efficiency by which TNSPs achieve such obligations for system strength outcomes would require regulatory oversight.	S5.1.8 deals with stability issues rather than frequency issues. The Commission considered that AEMO would be better placed than TNSPs to develop an EFCS that is coordinated and consistent across the NEM.
South Australian Government (submission to the consultation paper, p. 6)	There is no predictable indication that there is an increasing risk of failure of a dual redundant connection between regions under normal operating conditions. Therefore the applicability of re-classification (under 4.2.3A NER) should be expanded to include the context of non-credible events causing a major disturbance that would result in cascading failure if not accounted for in the design of the emergency frequency control scheme.	AEMO is currently able to reclassify events from credible to non-credible, where it considers that the event has become reasonably possible in the surrounding circumstances due to the presence of abnormal conditions. The draft rule would have introduced a new category of contingency event - the protected event - which would have allowed AEMO to identify specific events as protected events and requested that the Reliability Panel develop a post-contingent operating state for those events. This would have allowed AEMO to use both ex-ante and ex-post solutions to limit the consequences of those events.

Stakeholder	Issue	AEMC response
South Australian Government (submission to the consultation paper, p. 7)	AEMO and the JSSC, in consultation, should have the ability to direct NSPs to invest in new technologies, in cases where the NSPs have not done so. This will allow AEMO to rely on both the load nominated for shedding and the suitability of mechanisms to shed the load when designing an emergency load shedding scheme.	The Commission considered that new technologies should be able to deliver emergency frequency control where this technology represents the most efficient solution. The draft rule would have allocated responsibility for scheme approval, design and implementation between the Reliability Panel, AEMO and NSP accordingly.

B Legal requirements under the NEL

This appendix sets out the relevant legal requirements under the NEL for the AEMC to make this final rule determination.

B.1 Final rule determination

In accordance with ss. 102 and 103 of the NEL the Commission has made this final rule determination and related final rule in relation to the rule proposed by the South Australian Minister for Mineral Resources and Energy.

The Commission's reasons for making this final rule determination are set out in section 2.4, and in detail in chapters 4-7 of the final determination.

A copy of the more preferable final rule is attached to and published with this final rule determination. Its key features are described in section 2.3, and in detail in chapters 4-7 of the final determination.

B.2 Power to make the rule

The Commission is satisfied that the more preferable final rule falls within the subject matter about which the Commission may make rules. The more preferable final rule falls within s. 34 of the NEL as it relates to:

- the operation of the national electricity system for the purposes of the safety, security and reliability of that system, and
- the activities of persons (including registered participants) participating in the national electricity market or involved in the operation of the national electricity system.

Further, the more preferable final rule falls within the matters set out in schedule 1 to the NEL as it relates to:

- the operation of generating systems, transmission systems, distribution systems or other facilities
- the augmentation of transmission systems and distribution systems, and
- the application of a rule applicable to network service providers, to regulated transmission system operators, or to AEMO in its capacity as a provider of transmission services.

B.3 Commission's considerations

In assessing the rule change request, the Commission considered:

- its powers under the NEL to make the rule
- the rule change request
- submissions received during first and second rounds of consultation
- the Commission's analysis as to the ways in which the proposed rule will or is likely to, contribute to the NEO, and
- the ongoing package of work being undertaken by the Commission in conjunction with AEMO related to system security.

There is no relevant MCE statement of policy principles for this rule change request.[163]

The Commission may only make a rule that has effect with respect to an adoptive jurisdiction if satisfied that the proposed rule is compatible with the proper performance of AEMO's declared network functions.[164] The more preferable final rule is compatible with AEMO's declared network functions as it leaves those functions unchanged.

B.4 Application in the Northern Territory

The National Electricity (Northern Territory) (National Uniform Legislation) Act 2015 allows for an expanded definition of the national electricity system in the context of the application of the NEO to rules made in respect of the Northern Territory, as well as providing the Commission with the ability to make a differential rule that varies in its terms between the national electricity system and the Northern Territory's local electricity system.

The Commission has considered whether a differential rule is required for the Northern Territory electricity service providers and concluded that it is not required in this instance. This is because the provisions of the final rule either do not currently apply in the Northern Territory or (in relation to the Chapter 10 definitions) have no practical effect because they relate to other provisions that do not apply

B.5 Civil penalties

The more preferable final rule introduces new clauses 4.3.4(b1) and 4.3.4(b2) of the NER. The Commission will be recommending to the COAG Energy Council that these clauses be classified as civil penalty provisions under Schedule 1 of the National Electricity (South Australia) Regulations.

163 Under s. 33 of the NEL the AEMC must have regard to any relevant MCE statement of policy principles in making a rule. The MCE is referenced in the AEMC's governing legislation and is a legally enduring body comprising the Federal, State and Territory Ministers responsible for Energy. On 1 July 2011 the MCE was amalgamated with the Ministerial Council on Mineral and Petroleum Resources. The amalgamated council is now called the COAG Energy Council.

164 Section 91(8) of the NEL.

The Commission considers that clause 4.3.2(b1) and (b2) should be classified as civil penalty provisions because a breach of these provisions could have a material impact on power system security, and reliability, and classification of these provisions as civil penalties will encourage compliance with them by NSPs.

The Commission does not consider any other provisions of the final rule should be classified as civil penalty provisions.

The Commission cannot create new civil penalty provisions. However, it may recommend to the COAG Energy Council that new or existing provisions of the NER be classified as civil penalty provisions.

B.6 Power to make a more preferable rule

Under section 91A of the NEL the Commission may make a rule that is different (including materially different) from a market initiated proposed rule if the Commission is satisfied that, having regard to the issues or issues that were raised by the market initiated proposed rule, the more preferable rule will or is likely to better contribute to the achievement of the NEO.

As discussed in Chapter 2, the Commission has determined to make a final rule which is a more preferable rule. The reasons for the Commission's decision are set out in Chapters 4-7.

B.7 Designated system operations functions and powers of TNSPs

The Commission will be recommending to the COAG Energy Council that new clauses 4.3.4(b1) and 4.3.4(b2) of the NER be designated as NSP system operations functions or powers under the National Electricity (South Australia) Regulations.

This is to allow NSPs to be covered by the immunity in s 119(2) of the NEL from civil monetary liability for the performance of their functions in relation to implementing, monitoring, testing etc an EFCS, and applying settings to an EFCS that are consistent with an EFCS Settings Schedule (unless the NSP's act or omission is done in bad faith or through negligence).