

Australian Energy Market Commission

## CONSULTATION PAPER

# National Electricity Amendment (Declaration of Lack of Reserve conditions) Rule 2017

**Rule Proponent(s)**

AEMO

22 August 2017

**RULE  
CHANGE**

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## **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.

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# 1 Introduction

On 1 August 2017, Australian Energy Market Operator (AEMO) submitted a rule change request to the Australian Energy Market Commission (AEMC or Commission) in relation to the declaration of lack of reserves (LOR) conditions in the National Electricity Rules (NER). AEMO considers that the definitions of LOR levels that currently sit in the NER are no longer appropriate for identifying risks in the power system, and so it is seeking to replace these with a system triggered by a wider range of risks than those presently allowed for in the definitions.

This consultation paper has been prepared to facilitate public consultation on the rule change request and to seek stakeholder submissions.

## 1.1 Key dates for this rule change

In submitting its rule change request, AEMO noted that it desires to have this rule in place this summer to enable the LOR framework to immediately benefit from this tool.

The Commission recognises that AEMO's latest *Energy Supply Outlook* publication concluded that:<sup>1</sup>

*“AEMO expects all NEM regions will meet the reliability standard set in the NER over the next two years based, on the generation and storage expected to be available. There is, however, still a risk of electricity supply falling short of demand, especially in extreme conditions... South Australia is considered most at risk of breaching the reliability standard.”*

The Commission recognises the importance of making a final determination for this rule change request by summer. However, the nature of the proposed changes in this request is such that the Commission considers that industry should have sufficient opportunity for consultation. Accordingly, given the particular circumstances associated with the rule change, the Commission is proposing to assess this rule change request through the standard timeframe,<sup>2</sup> but treat this rule change request as a priority and significantly advance its consideration of the issues. The timeframes that stakeholders have to consider and respond to the matters will stay the same as those used under the standard rule making process.

Stakeholders are invited to make comments on this approach in submissions to this paper.

The key dates for stakeholders in this process are therefore:

- Commencement of this rule change process: 22 August 2017

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<sup>1</sup> AEMO, *Energy Supply Outlook*, June 2017, p. 3.

<sup>2</sup> AEMO did not seek to have this rule change processed under the expedited rule change process, which would have required the request to pass the urgent or non-controversial test under the National Electricity Law.

- Submissions to the consultation paper to be received by (4 weeks): 19 September 2017
- Publication of draft determination: 17 October 2017
- Submissions to the draft determination to be received by (6 weeks): 28 November 2017
- Publication of final determination: 19 December 2017

Obviously, if there is significant stakeholder concern or comments raised throughout this process, the Commission will revert to the standard timeframes.

Given the above timeframes, the Commission encourages stakeholders that wish to have meetings regarding this rule change to do so. Stakeholders wishing to meet with the AEMC should contact Sarah-Jane Derby on 02 8296 7823 or [sarah.derby@aemc.gov.au](mailto:sarah.derby@aemc.gov.au).

## **1.2 Structure of this paper**

The structure of this paper is as follows:

- chapter 2 sets out the background to the rule change request
- chapter 3 summarises the details of the rule change request, including the stated problem and proposed solution
- chapter 4 sets out the assessment framework for this rule change request
- chapter 5 identifies a number of questions and issues to facilitate the consultation on this rule change request
- chapter 6 outlines the process for making submissions.

## 2 Background

This chapter provides:

- an explanation of the current framework in the NER for the declaration of lack of reserve conditions
- a discussion of the operational aspects of the framework.

### 2.1 Current LOR declaration framework

Reserve levels are a concept defined in the NER<sup>3</sup> and refer to the amount of spare capacity available given amounts of generation, forecast demand and demand response, and scheduled network service provider (NSP) capability at any point in time.<sup>4</sup> A reserve level indicates the difference between available resources to meet demand for energy, and the level of energy demanded.

#### 2.1.1 LOR conditions

The lack of reserve (LOR) conditions, and declarations of these under clause 4.8.4, form part of the existing framework used to maintain reliability in the National Electricity Market (NEM). There are currently three different lack of reserve levels, each corresponding to the extent of the availability of reserve. These levels are:<sup>5</sup>

- Lack of reserve level 1 (LOR1), defined in clause 4.8.4(b) - "when AEMO considers that there is insufficient capacity reserves available in an operational forecasting timeframe to provide complete replacement of the contingency capacity reserve on the occurrence of the credible contingency event which has the potential for the most significant impact on the power system for the period nominated. This would generally be the instantaneous loss of the largest generating unit on the power system. Alternatively, it might be the loss of any interconnection under abnormal conditions."
- Lack of reserve level 2 (LOR2), defined in clause 4.8.4(c) - "when AEMO considers that the occurrence of the credible contingency event which has the potential for the most significant impact on the power system is likely to require involuntary load shedding. This would generally be the instantaneous loss of the largest generating unit on the power system. Alternatively, it might be the loss of any interconnection under abnormal conditions."
- Lack of reserve level 3 (LOR3), defined in clause 4.8.4(d) - "when AEMO considers that customer load (other than ancillary services or contracted

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<sup>3</sup> Capacity reserve is defined in chapter 10 of the NER.

<sup>4</sup> As well as network capability, particularly interconnectors, which allow different regions to share reserves.

<sup>5</sup> Clause 4.8.4 of the NER.

interruptible loads) would be, or is actually being, interrupted automatically or manually in order to maintain or restore the security of the power system."

Put simply, LOR1 is considered to apply if there is insufficient reserves to cover two successive credible contingencies, such as the loss of the two largest generating units. LOR2 is considered to apply if there is insufficient reserves to cover a credible contingency, such as the loss of the largest generating unit. LOR2 is considered to apply when there is insufficient supply to meet demand. An LOR3 condition would represent load shedding.

### 2.1.2 Credible contingency events

As can be seen above, under the current framework, the LOR1 and LOR2 definitions are based around the concept of credible contingency events, which are generally the loss of large, conventional generating units.

Clause 4.2.3(b) defines credible contingencies as a contingency event,<sup>6</sup> the occurrence of which AEMO considers to be reasonably possible in the surrounding circumstances including the technical envelope. They may be caused by events such as the loss of a single generator, a single load or a single line in the network.

The NER therefore provides guidance to AEMO as to which contingencies should be regarded as credible but leaves AEMO with some discretion. AEMO may reclassify contingency events from non-credible<sup>7</sup> to credible when it considers that the presence of abnormal conditions (e.g. severe weather conditions) means that the non-credible contingency is now more likely to occur.

The concept of a credible contingency is a key concept, underpinning both the reliability and the security frameworks in the NER. An example of the concept being used in the security framework is the obligation on AEMO to maintain the power system frequency within the operational frequency tolerance band when credible contingencies occur, and return the frequency to the normal operating frequency band within a specified time period. In its rule change request, AEMO states that definition of how credible contingencies work within the system security frameworks is not affected by this rule change in any way.<sup>8</sup>

The concept of credible contingencies is used differently within the context of reliability. The definitions of LOR1 and LOR2 incorporate the concept of credible contingency events, but provide further guidance about how the concept could be interpreted; that is, the loss of the *largest* generating unit. The "largest" description only

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<sup>6</sup> A contingency event is defined in NER clause 4.2.3(a) as being an event affecting the power system which AEMO expects would be likely to involve the failure or removal from operational service of one or more generating units and/or transmission elements.

<sup>7</sup> 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.

<sup>8</sup> AEMO, *Electricity rule change proposal - lack of reserve declarations*, 1 August 2017, p4.

applies to LOR definitions and does not appear elsewhere in the NER when credible contingencies are referenced. Credible contingency events are defined in clause 4.2.3 and, in particular, clause 4.2.3(b) refers to the loss of *one* generating unit, without mentioning largest.<sup>9</sup> The difference in the context of LOR definitions is presumably to improve the applicability of the concept of credible contingencies to the reliability framework.

The adequacy or fitness for purpose of the definition of credible contingency events in relation to either reliability or security is outside of the scope of this rule change request. It is instead being considered through the Commission's *Reliability Frameworks Review*,<sup>10</sup> which is a holistic review of the market and regulatory frameworks that underpin reliability in the NEM. The adequacy of the definition of credible contingency events has also been raised as an issue in the Reliability Panel's (the Panel) *Review of the Frequency Operating Standard (FOS)*.<sup>11</sup> AEMO has suggested that the use of credible contingency as it is used in the definition of generation event in the FOS does not satisfactorily describe all kinds of rapid, unexpected generation events.<sup>12</sup> One such unexpected generation event could be sudden changes in wind or solar generation due to single event like a wind change or large cloud respectively.

### 2.1.3 LOR declarations

The declaration of LOR conditions is one mechanism by which AEMO communicates the short-term risk of involuntary load shedding to industry, government and customers from real-time up to the end of the short-term horizon, i.e. the same time horizon as the short-term projected assessment of system adequacy (PASA). Short-term PASA covers the period six days into the future, starting from the end of the trading day covered by the pre-dispatch schedule.<sup>13</sup> The pre-dispatch schedule covers the period starting from the next trading interval to the final trading interval of the day for which all dispatch bids and offers have been received.<sup>14</sup>

In particular, the declaration of LORs is notified to the market when AEMO publishes a notice in accordance with clause 4.8.5 of the NER. The effect of issuing a market notice is to encourage any spare supply to be bid into the market.

If an LOR is not resolved by a market response, the current reliability framework allows AEMO to trigger intervention mechanisms, i.e. AEMO can issue a direction,<sup>15</sup>

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<sup>9</sup> Similarly, in S5.1.2.1, the guidance given to Network Service Providers is a "single generating unit."

<sup>10</sup> See <http://www.aemc.gov.au/Markets-Reviews-Advice/Reliability-Frameworks-Review>.

<sup>11</sup> See <http://www.aemc.gov.au/Markets-Reviews-Advice/Review-of-the-Frequency-Operating-Standard>.

<sup>12</sup> AEMO, submission to issues paper for review of the frequency operating standard, 1 August 2017, p. 6.

<sup>13</sup> Clause 3.7.3(b).

<sup>14</sup> Clause 3.8.20(a). For a more comprehensive description of the other methods that AEMO uses to inform the market please refer to section 6.3 of the *Reliability Frameworks Review* Issues Paper.

<sup>15</sup> Clause 4.8.9(a1)(1).

clause 4.8.9 instruction<sup>16</sup> or use the reliability and emergency reserve trader (RERT i.e. additional contracted reserve capacity)<sup>17</sup> to reduce the risk of load shedding. In that sense, LOR notices are generally the last opportunity for a market response to a forecast shortfall. In practice, AEMO may trigger an intervention following a declared LOR2 or LOR3. Intervention mechanisms and the triggers for interventions are discussed in more detail in Chapter 7 of the *Reliability Frameworks Review Issues Paper*.<sup>18</sup>

## 2.2 Operational aspects of the LOR framework

Currently, AEMO uses a deterministic model to determine LOR1 and LOR2 reserve levels as well as forecasts the total reserve levels. The methodology is summarised below, with more detail contained in appendix A. The deterministic method means that AEMO will forecast one specific amount for LOR1 reserves, one amount for LOR2 reserves and one amount for total reserve levels, for each trading interval, for each region. The amount forecast is in terms of capacity (MW).

### 2.2.1 Reserve level methodology

AEMO calculates LOR levels based on the credible contingency-based framework that is currently in the NER.<sup>19</sup> For a LOR1, this is the amount of capacity (MW) needed to withstand two credible contingency events without resorting to load shedding. Similarly, in the case of a LOR2, this is the amount of capacity (MW) needed to withstand one credible contingency event without the need for load shedding.

Using this method, AEMO calculates LOR levels for each region for each time period. AEMO then compares the calculated LOR levels against the forecast total reserve level in order to determine whether or not to declare an LOR condition.

Forecast total reserve levels are obtained from outputs of the short-term projected adequacy of supply (short-term PASA) and pre-dispatch projected adequacy of supply (pre-dispatch PASA) process.<sup>20</sup> Short-term PASA and pre-dispatch PASA solve for reserves for each region and for every half-hour within their respective time horizon. Their objective functions are to maximise reserves in each specific region for the half-hour it is solving.<sup>21</sup>

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<sup>16</sup> Clause 4.8.9(a1)(2)

<sup>17</sup> See clauses 3.20.7 and 3.20.8.

<sup>18</sup> See <http://www.aemc.gov.au/Markets-Reviews-Advice/Reliability-Frameworks-Review>.

<sup>19</sup> The methodology is discussed in more detail in appendix A.1

<sup>20</sup> The methodology is discussed in more detail in appendix A.2.

<sup>21</sup> Taking into account constraints so that only the total amount of energy transmissible to customers is considered. See AEMO, *Electricity rule change proposal - lack of reserve declarations*, 1 August 2017, p. 8.

## 2.2.2 LOR declarations

LORs are declared if the forecast reserve level in short-term PASA as discussed in appendix A.2 is lower than the calculated LOR level discussed in appendix A.1. If the LOR reserves forecast by short-term PASA (and pre-dispatch PASA subsequently) are lower than the reserves needed for a LOR1 or a LOR2, AEMO will publish market notices to advise the market of the potential shortfall. AEMO also issues notices for LOR3 conditions.<sup>22</sup> These market notices may be for the present (an actual or declared LOR notice) or may be for forecast shortfalls (a forecast LOR notice).

Figure 2.1 shows how an LOR was triggered on 12 February 2017 in Queensland as an example. The following reserve levels were estimated in the pre-dispatch PASA, for the period starting at 20:00 on 11 February 2017 to 18:00 on 12 February 2017:<sup>23</sup>

- the calculated LOR1 reserve level was 1100MW at its lowest during the 18:00 trading interval and the level was 1138MW at its highest for the trading intervals starting from 20:00 on the 11 February to 10:00 the following day
- the calculated LOR2 reserve level was between 680MW at its lowest and 695MW at its highest, for the same time periods as the LOR1 level
- the calculated LOR reserve level was between 1684MW at its highest at 20:00 and 639MW at its lowest at 18:00.

**Figure 2.1 LOR declaration triggers**

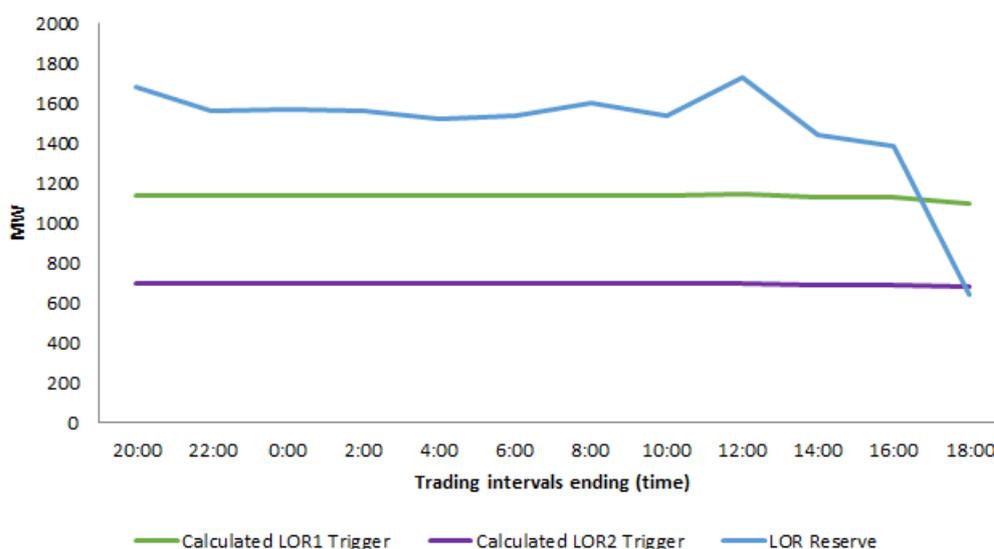


Figure 2.1 shows an example where a notice was published in relation to an actual LOR, rather than forecast LOR, although the declaration methodology is the same

<sup>22</sup> LOR3 is not linked to credible contingency events and typically follows an LOR2 declaration that is not resolved by the market. It is also based on short-term PASA forecasts.

<sup>23</sup> Data supplied by AEMO. AEMO, *Electricity rule change proposal - lack of reserve declarations*, 1 August 2017, p. 19.

regardless. An actual LOR1 was triggered at 16:16 and an actual LOR2 was triggered at 17:08. In both instances, AEMO sought market responses. The LOR2 was resolved at 19:38 and the LOR1 by 20:26.<sup>24</sup>

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<sup>24</sup> See AEMO's website for all market notices <https://www.aemo.com.au/Market-Notices>.

### 3 Details of the rule change request

This chapter provides a summary of the rule change request. AEMO has proposed to replace the current LOR declaration framework with a system triggered by a wider range of risks than those it considers are presently allowed for in the current NER definitions. This chapter sets out:

- the problem with the current framework as described by AEMO
- the details of AEMO's proposed solution to the problem
- the details of an additional amendment requested by AEMO.

The rule change request includes a proposed rule. Copies of the rule change request and proposed rule may be found on the AEMC website, [www.aemc.gov.au](http://www.aemc.gov.au).

#### 3.1 The problem

In its rule change request, AEMO provides its rationale for the rule change and raises a number of issues with the current framework. According to AEMO, the problem is two-fold:

- First, AEMO considers that the concept of credible contingencies no longer represents an accurate risk of load shedding as forecast errors that are completely unrelated to contingencies now occur frequently, for example, short-term demand and supply forecast errors in extreme conditions. In some instances, they can even be larger than the largest credible contingency.
- Second, AEMO notes it is working on a more sophisticated approach to predicting the risk of load shedding to address the rise in the abovementioned forecast errors, and the current contingency-based LOR framework is not compatible with this approach.

##### 3.1.1 Inadequacy of the credible contingency-based framework

According to AEMO, rapid deteriorations in short-term power system conditions resulting from non-contingency based variations now occur frequently. These non-contingency based variations occur as a result of:<sup>25</sup>

- short-term grid demand forecast error, particularly during extreme hot weather, which is in turn affected by small errors in weather forecasts
- short-term large-scale wind and large-scale solar generation forecast error
- widespread partial availability reductions in thermal generation during stressful ambient conditions

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<sup>25</sup> AEMO, *Electricity rule change proposal - lack of reserve declarations*, 1 August 2017, p.2.

- variations in network constraints.

AEMO notes that non-contingency based deviations were the main cause of reserve deterioration on 8 February 2017 in South Australia.<sup>26</sup> As a result of a rapid decline in reserves that was unanticipated, the short-term PASA process did not trigger any forecast LOR2s. A LOR2 was first declared at 17:13, followed by load shedding 50 minutes later. AEMO stated that the LOR2 declaration occurred too late to implement intervention options that could have avoided the need for load shedding and there was not enough time for a market response either due to inadequate warning of the true risk of load shedding.

AEMO also notes that there have been other instances of significant deterioration in reserves, most notably on 12 February 2017 in Queensland due to unforeseen limitations unrelated to contingencies.<sup>27</sup> In that instance, there were rapid changes in both demand and supply forecasts. However, load shedding did not occur.

AEMO states that all NEM regions frequently experience the identified forecast errors, and that, at times, their collective size may be larger than the largest traditional generation credible contingency event. At the same time, the largest credible contingency has also changed in size over the years. In South Australia, for example, it has declined in size following the closure of Northern Power station, while the underlying risk of forecast error has risen.<sup>28</sup>

### 3.1.2 Incompatibility of current framework

As a result of the growth in forecast errors, AEMO has been looking at ways to improve its power system operation. It wants to move to a more sophisticated risk warning system based on the underlying probability of involuntary load shedding due to all causes, including forecast errors, rather than one based on generator contingencies. AEMO has started analysis towards the development of a risk forecasting tool that will take a probabilistic approach to triggering LORs.

AEMO would like to have a flexible system that enables the probability measures to evolve with the changing market. However, it considers that the existing rules for LOR1 and LOR2 are inextricably linked and limited to identifiable contingencies and are therefore are incompatible with such an approach. It states that the current definitions of LORs are inflexible and restrict AEMO's ability to use more sophisticated probabilistic risk assessment techniques to trigger LORs. AEMO states that power system risk assessment, particularly one that uses probabilistic techniques such as the

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26 See [http://www.aemo.com.au/-/media/Files/Electricity/NEM/Market\\_Notices\\_and\\_Events/Power\\_System\\_Incident\\_Reports/2017/System-Event-Report-South-Australia-8-February-2017.pdf](http://www.aemo.com.au/-/media/Files/Electricity/NEM/Market_Notices_and_Events/Power_System_Incident_Reports/2017/System-Event-Report-South-Australia-8-February-2017.pdf).

27 AEMO, *Electricity rule change proposal - lack of reserve declarations*, 1 August 2017, pp.18-19.

28 Ibid. p. 3.

one it is working on is very difficult to express within the legal framework of the NER.<sup>29</sup>

Beyond the difficulties posed by the current framework in terms of incorporating a probabilistic approach, AEMO also identified a number of issues with the LOR framework, including that:<sup>30</sup>

- participants find it difficult to understand the true risk (i.e. the risk of load shedding) implied by an LOR declaration
- there is a lack of transparency in exactly what contingencies AEMO will contemplate and what tools it will use to assess the risk.

### **3.2 The proposed solution**

AEMO's proposed solution would:

- remove the current contingency-based LOR definitions from the NER and replace them with a high-level description of lack of reserves
- move the details of the LOR framework to a guideline (the "reserve level declaration guidelines") to be developed by AEMO, supported by a high-level framework for the guidelines in the NER
- use a probability assessment to declare LORs, although initially, this would still be based on the current contingency-based framework.

Under AEMO's proposed solution, the high-level framework set out in the NER for the guidelines would set out what it should include when preparing the reserve level declaration guidelines as discussed in section 3.2.2, what the probability assessment it plans to use for declaring LORs must take into account, as discussed in section 3.2.3 and consultation details for amending the guidelines, as discussed in section 3.2.4.

#### **3.2.1 Description of lack of reserves**

AEMO proposes to delete clauses 4.8.4 (b), (c) and (d), which currently provide contingency-based definitions of LOR1 and LOR2 and a prescriptive definition of LOR3 respectively and replace them with one high-level definition for lack of reserve, as follows:

“when AEMO determines, in accordance with the reserve level declaration guidelines, that the probability of involuntary load shedding is, or is forecast to be, more than remote.”

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<sup>29</sup> Ibid. p. 6.

<sup>30</sup> Ibid. p. 6.

### 3.2.2 Reserve level declaration guidelines

AEMO proposes that the NER should specify that the guidelines must:

- describe how AEMO continually assesses the probability of capacity reserves being insufficient to avoid involuntary load shedding given reasonably foreseeable conditions and events
- describe how that assessment applies in relation to different periods of time
- specify two or more probability levels, at which AEMO will declare a corresponding lack of reserve condition in relation to a specified period of time, indicating an increasing probability of involuntary load shedding
- be reviewed at least once every four years.

AEMO states that the guidelines would allow it to develop a risk assessment technique fit-for-purpose for the evolving changes occurring in the NEM, and continue to refine that technique as necessary to respond to ongoing changes.

AEMO provided an example of a potential structure for the guidelines for illustration purposes in its rule change request.<sup>31</sup>

Consultation on these guidelines is discussed further in section 3.2.4 below.

### 3.2.3 The probability assessment methodology

AEMO proposes that the NER should require AEMO to take into account the following when using the probability assessment for declaring LORs:

- actual and forecast power system and environmental conditions or similar conditions
- the likelihood of the occurrence and impact on the power system of events that are foreseeable in nature but unpredictable in timing
- prudent allowances for forecasting error.

AEMO is presently analysing historical forecast errors in both the inputs and the outputs to PASA, including the errors raised in section 3.1.1. AEMO notes that it is currently trialling a Bayesian Belief Network<sup>32</sup> that will find correlations between historical forecast errors and relevant conditions, such as the forecast lead-time, ambient temperature, expected wind and solar forecast. In particular, the analysis will lead to a distribution of possible variations (i.e. errors) from a reserve forecast. AEMO states that it intends to incorporate the results of the trial with conventional

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<sup>31</sup> Ibid. pp. 8-9.

<sup>32</sup> Ibid. p. 8.

contingencies to calculate a more accurate distribution of the risk of involuntary load shedding.

AEMO recognises that the industry is familiar with the current three-tiered approach and therefore intends to similarly categorise its initial LOR assessment levels.<sup>33</sup> Therefore, at least initially, AEMO intends to similarly categorise LORs under the new framework i.e. having three categories that are broadly similar to the current contingency-based levels.

### **3.2.4 Consultation details for amending the guidelines**

In its rule change request, AEMO states that it intends for the guidelines to be consulted on, explained to the market and published.

AEMO anticipates that the initial guidelines will be developed by AEMO in parallel with the AEMC's consultation through this rule change. In particular, and assuming the AEMC makes a rule as contemplated by AEMO, AEMO plans to provide the Commission with draft guidelines to be published on the AEMC's website alongside the draft determination for this rule change to allow for consultation on the initial guidelines. AEMO then anticipates having the first edition of the guidelines in place by the start of the upcoming summer, subject to the Commission's determination and timing for this rule change request.

In terms of updating the guidelines after the initial guidelines have been made, the proposed rule suggests a process that differs from the standard rules consultation procedures. The proposed rule identifies the key stakeholders AEMO would be specifically required to consult with, i.e. those who may be most directly affected by a reserve level declaration according to AEMO. This consultation procedure is not as broad ranging as the rules consultation procedure. However the proposed consultation approach would not preclude AEMO from consulting with any other stakeholder.

Under AEMO's proposal, the NER would specify that AEMO:

- must provide the proposed guidelines to generators, transmission network service providers (TNSPs), jurisdictional system security coordinators (JSSCs) together with an explanatory statement and an invitation to make submissions on the proposed guidelines
- must allow at least 15 business days for submissions in response to the invitation
- may hold conferences and information sessions, or undertake such other consultation on the proposed guidelines as AEMO considers appropriate
- must, in determining to make or amend the guidelines, consider any submissions made, and publish the reasons for its determination, a summary of each issue

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<sup>33</sup> AEMO discusses this in a number of areas in the rule change request, including on pp. 7-8 and it is also indicated in its illustrative guidelines on pp. 8-9. See AEMO, *Electricity rule change proposal - lack of reserve declarations*, 1 August 2017.

raised in those submissions that AEMO considers to be material, and AEMO's response to each such issue.

### **3.3 Additional proposed amendment**

AEMO is also proposing one additional amendment.

Clause 4.8.5 of the NER obliges AEMO to publish LOR declarations as soon as possible. This is primarily conveyed to the market by way of market notices, as discussed in section 2.2.2. AEMO also publishes a procedure on this matter.<sup>34</sup> Clauses 3.13.4(f)(6)(i) and 3.13.4(f)(6)(ii) of the NER also oblige AEMO to publish LOR declarations automatically, but within pre-dispatch information.

AEMO considers the chapter 3 clauses are excessively prescriptive and redundant in the presence of clause 4.8.5.<sup>35</sup> AEMO states that while compliance with this obligation is straightforward within the current framework, it may become more difficult over time with more sophisticated LOR declaration levels and may unnecessarily hinder the rollout of improved LORs.

It proposes to delete clauses 3.13.4(f)(6)(i) and 3.13.4(f)(6)(ii) as a solution.

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<sup>34</sup> See AEMO's short-term reserve procedure  
[http://www.aemo.com.au/-/media/Files/Electricity/NEM/Security\\_and\\_Reliability/Power\\_System\\_Ops/Procedures/SO\\_OP\\_3703---Short-Term-Reserve-Management.pdf](http://www.aemo.com.au/-/media/Files/Electricity/NEM/Security_and_Reliability/Power_System_Ops/Procedures/SO_OP_3703---Short-Term-Reserve-Management.pdf).

<sup>35</sup> AEMO, *Electricity rule change proposal - lack of reserve declarations*, 1 August 2017, pp. 11-12.

## 4 Assessment framework

The Commission's assessment of this rule change request must consider whether the proposed rule meets the National Electricity Objective (NEO) as set out under section 7 of the NEL.

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 NEO.<sup>36</sup> This is the decision making framework that the Commission must apply.

The NEO is:<sup>37</sup>

“To promote efficient investment in, and efficient operation and use of, electricity services for the longer 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.”

Based on a preliminary assessment of this rule change request, the Commission considers that the relevant aspects of the NEO are the efficient investment in, and efficient operation and use of electricity services with respect to the reliability of supply of electricity and reliability of the national electricity system because:

- AEMO uses declarations of LORs to inform the market that reserve levels are low and to communicate the risk of load shedding. Market participants use this information to manage risk and to make efficient investment and operational decisions. Managing the risk of load shedding and having an adequate supply of electricity through efficient investment and operational decisions directly contribute to the reliability of supply.
- LORs represent the short-term risk of load shedding, typically about a week in the future. As a result, they primarily drive short-term operational decisions. However, they can also have an impact on the broader reliability framework and the investment decisions made by market participants as well through confidence in the overall reliability frameworks.

The assessment framework will consider whether or not this rule change improves the efficiency of the declarations of LORs, investment and operation of the electricity system, and so reliability. In particular, it will consider the following principles:

- **Providing certainty and managing risk:** For declarations of LORs to work efficiently in eliciting a market response, participants must understand what is

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<sup>36</sup> Section 88 of the NEL.

<sup>37</sup> Section 7 of the NEL.

the true risk implied by declaration. In assessing this rule change, the Commission will consider the extent to which the proposed rule will improve the confidence of the market with regards to the risk of load shedding and whether this would lead to more efficient management of load shedding risk.

- **Quality of information:** High-quality information is important as it underpins the accuracy of the forecasts used to declare LORs and by extension, the meaningfulness of the notices. More accurate forecasts minimises erroneously-declared LORs and allows AEMO to better target interventions. The Commission will consider the extent to which the proposed rule will improve the meaningfulness of the notices and the efficiency of the operation of the LOR declaration framework.
- **Transparency of information:** AEMO considers that the current LOR framework lacks transparency as stakeholders are not aware of what contingencies AEMO will use to declare LORs. Transparency of information is a key feature of markets and promotes efficient investment decisions. The Commission will consider the extent to which the proposed rule will improve transparency of what constitutes an LOR and the methodology behind an LOR declaration for stakeholders.
- **Balance between improving flexibility and imposing costs:** AEMO considers that its proposal would improve flexibility of the LOR framework. Flexibility can promote efficient outcomes as it would allow AEMO to be more responsive to unexpected variations in operating conditions. However, giving AEMO more discretion and flexibility about how to declare LORs needs to be balanced against the potential costs.

The Commission will need to consider the impact the rule change would have on the likelihood of LORs being declared and in particular, the consequences for the notices and their reflection of the risk of load shedding in the case of an increase in the number of declarations. The Commission will need to consider the implications for the use of intervention mechanisms. For example, a declaration of a LOR2 is a trigger for AEMO to use the RERT.<sup>38</sup> In assessing the rule change request, the Commission will have regard to the trade-off between the potential benefits in terms of improved reliability and the potential costs of higher interventions. Such a trade-off is a core feature of the reliability frameworks in the NEM.

The Commission will not assess the proposed rule against additional elements required by the Northern Territory legislation as the proposed rule relates to parts of the NER that currently do not apply in the NT.<sup>39</sup>

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<sup>38</sup> See the Reliability Panel's RERT guidelines [http://www.aemc.gov.au/getattachment/98a21db3-9e02-4e7e-9626-8973f0f45e5c/Reliability-and-Emergency-Reserve-Trader-\(RERT\)-Gu.aspx](http://www.aemc.gov.au/getattachment/98a21db3-9e02-4e7e-9626-8973f0f45e5c/Reliability-and-Emergency-Reserve-Trader-(RERT)-Gu.aspx).

<sup>39</sup> From 1 July 2016, the NER, as amended from time to time, apply in the Northern Territory, subject to derogations set out in Regulations made under the NT legislation adopting the National Electricity Law (NEL), that is, the National Electricity (Northern Territory) (National Uniform Legislation) (Modifications) Regulations. Under those Regulations, only certain parts of the NER

**Question 1      Assessment framework**

**(a) Is the assessment framework appropriate for considering the changes proposed in the rule change request?**

**(b) Are there any other relevant considerations that should be included in the assessment framework?**

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have been adopted in the NT. As the proposed rule relates to parts of the NER that currently do not apply in the Northern Territory (i.e. chapters 3 and 4) or will have no practical effect (i.e. chapter 10 definitions), the Commission will not assess the proposed rule against additional elements required by the Northern Territory legislation, that is, the National Electricity (Northern Territory) (National Uniform Legislation) Act 2015.

## 5 Issues for Consultation

Taking into consideration the assessment framework, a number of issues have been identified for initial consultation. Stakeholders are encouraged to comment on these issues as well as any other aspect of the rule change request or this paper, including the proposed assessment framework.

### 5.1 The current LOR framework

The contingency-based framework has remained more or less unchanged since the start of the NEM and has only been subject to relatively minor rule changes.<sup>40</sup> The Commission is seeking information on how stakeholders use the current LOR framework and in particular, how they would be affected by the proposed changes to this framework.

As discussed in chapter 3, AEMO is proposing to remove the individual LOR levels from the NER and replace them with one high-level definition for lack of reserves. It is proposing, in the first instance, to keep the LOR levels broadly the same as they are now.<sup>41</sup> However, the intention is for AEMO to transition to a different framework whereby its obligation under the NER would be to declare at least two LORs.<sup>42</sup>

The Commission understands that market participants are familiar with and use the current LOR framework operationally.<sup>43</sup> For example, declarations of LORs are used to seek a market response where there is a forecast lack of reserves. The Commission is seeking feedback on this matter to better understand how stakeholders use the current LOR framework.

It is also worth noting that AEMO is also proposing a change to remove from the NER its obligation to publish declarations of LORs within pre-dispatch information. The Commission understands that AEMO does not consider that this information is used by participants in this form, and so participants would be unaffected by this change.

Further, the current LOR framework has a number of flow-on implications. For example, the declaration of a LOR2 condition is one trigger for the RERT, with this set out in the *RERT guidelines* prepared and maintained by the Reliability Panel, with the triggering of the RERT having cost implications. The Commission will therefore need to consider, and is interested in stakeholder views on, broader or unforeseen consequences of removing these hard-wired definitions from the NER.

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<sup>40</sup> See AEMC, *Reclassification of contingency events*, final rule determination, 2 October 2008 and AEMC, *Governance arrangements and implementation of the reliability standard and settings*, final rule determination, 26 March 2015.

<sup>41</sup> AEMO discusses this in a number of areas in the rule change request, including on pp. 7-8 and it is also indicated in its illustrative guidelines on pp. 8-9. See AEMO, *Electricity rule change proposal - lack of reserve declarations*, 1 August 2017.

<sup>42</sup> See clause 4.8.4A(b)(3) of AEMO's proposed rule drafting.

## **Question 2      LOR framework**

**(a) How do participants use the current LOR declaration framework? Do participants rely on or use any particular LOR level (e.g. LOR2)? Would moving away from this framework have any impact on participants?**

**(b) Do stakeholders use the information published on LORs in pre-dispatch information?**

**(c) Are there any unforeseen consequences or impacts that may result from the proposed change to the LOR framework?**

## **5.2      The proposed LOR framework**

This section identifies aspects of AEMO's proposed LOR framework on which the Commission is seeking feedback.

### **5.2.1      Balance between the NER and guidelines**

AEMO's proposed LOR framework would effectively remove the definitions of what LOR levels are from the NER and move them to a guideline, to be maintained and amended by AEMO in accordance with a process prescribed in the NER.

This guideline could be used to facilitate the move from a deterministic framework to a probabilistic framework, being one that is based on a model which is constantly learning and changing to improve accuracy.

AEMO considers that the flexibility of having the detail in the guidelines would make it more responsive to the drivers of change occurring in the NEM, such as the impact of an increasing penetration of intermittent, renewable energy. AEMO considers that the benefits would be in the efficiencies gained in not erroneously-declared LORs and would give participants a more accurate picture of the true risk of load shedding.

AEMO notes that:<sup>44</sup>

- if the risks of load shedding are under-estimated (LORs not declared in time or at all), then market responses may be inadequate and load shedding is more likely to occur
- if risks are over-estimated, then they may lead to unnecessary interventions the costs of which would be recovered from the market.

However, the current framework, with LOR levels clearly defined in the NER provides some level of certainty for stakeholders. Removing these definitions from the NER

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<sup>43</sup> AEMO has noted in its rule change request that industry education will be crucial in moving away from a contingency-based LOR framework due to participants' familiarity with the process.

<sup>44</sup> AEMO, *Electricity rule change proposal - lack of reserve declarations*, 1 August 2017, p. 6.

could increase uncertainty about how LORs would be declared and at what levels they would be triggered. For example, if the probabilistic margin trigger level was set too low, this could lead to too many LORs being declared and unnecessary interventions, the costs of which would be recovered from the market. According to AEMO's proposal, the probabilistic margin trigger would be at the discretion of AEMO through the guidelines, albeit subject to consultation.

In its rule change request, AEMO notes that under the new framework, there could be more frequent declarations initially and that AEMO would mitigate this by selecting an appropriate confidence interval for the errors, that trades off these costs against the benefits of reduced load shedding.<sup>45</sup> This trade off will be a key in assessing the rule change request.

### **Question 3      Balance between the NER and guidelines**

**(a) What are stakeholders' views on the proposed framework (i.e. moving the detail of LOR levels from the NER to AEMO-maintained guidelines)? What aspects should be in the NER? What aspects should be in the guidelines?**

**(b) Do stakeholders see any risks arising from the proposed approach?**

#### **5.2.2      LOR declaration margins**

Section 3.2.3 summarises the methodology of the probabilistic assessment being proposed by AEMO to be used in declaring LORs.

AEMO notes in its rule change request that the loss of the largest generating unit (i.e. a credible contingency event) is no different from other sources of potential forecasting error. In other words, it is a probabilistic way of expressing the potential loss of the largest generating unit. In the future, AEMO may treat credible contingencies as another variable in its probabilistic model and have one probabilistic determination of when to declare an LOR.

However, given the familiarity of AEMO staff and industry with the contingency-based, three-tiered LOR framework, AEMO intends that the LOR declaration margins should initially remain at least as large as the current approach. AEMO proposes that this could be achieved in two ways:<sup>46</sup>

- setting the margin at the *larger of* the largest considered contingency (or contingencies) *or* a probabilistic margin
- setting the margin at the largest considered contingency (or contingencies) *plus* an allowance for non-contingency based variations.

AEMO states that it is presently investigating which is the more appropriate approach.

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<sup>45</sup> AEMO, *Electricity rule change proposal - lack of reserve declarations*, 1 August 2017, p. 14.

<sup>46</sup> AEMO, *Electricity rule change proposal - lack of reserve declarations*, 1 August 2017, p. 8.

#### **Question 4      LOR declaration levels**

**Do stakeholders have any views on AEMO's two options or any other views on the proposed probabilistic assessment methodology?**

### **5.2.3      Consultation on the guidelines**

Given the timeframe for this rule change request as discussed in section 1.1, the first guidelines will be developed in parallel with this rule change request. AEMO will provide a draft version of the guidelines to the Commission which will be published with the Draft Determination of this rule change request. Stakeholders will then have six weeks to consider and provide feedback on both the draft determination and the draft guidelines. Assuming the Commission decides to make a rule, it would be important that both are considered together, since it is only with both of these documents that a full picture of the proposal could be obtained.

AEMO will consider all submissions that relate to its draft guidelines when finalising the guidelines.

In its rule change request, AEMO proposes a consultation framework for the reserve level declaration guidelines, stating that it intends for the guidelines to be consulted on, explained to the market and published. The proposed rule drafting identifies the key stakeholders AEMO would specifically be required to consult with as generators, TNSPs and JSSCs (although this would not preclude AEMO from consulting with other stakeholders) and proposes one round of consultation lasting 15 business days. In addition, the proposed clause would allow, but not require, AEMO to carry out additional consultation should it choose to.

AEMO does not propose to use the rules consultation procedures.<sup>47</sup> The rules consultation procedures are a more comprehensive process than the one proposed by AEMO in the rule change request. The rules consultation procedures typically involve a two-stage consultation process which lasts between four to six months.

AEMO provides a number of reasons why it does not consider that the rules consultation procedures are appropriate for the proposed LOR framework, including that the proposed guidelines are replacing a determination process that is currently opaque and not subject to any consultation and that a rules consultation procedures requirement is inconsistent with the level of consultation used for several other procedures or guidelines of equal or greater significance and complexity under the NER.<sup>48</sup> In the case of the former, AEMO is referring to the fact that the processes for determining what credible contingencies are, and how they are applied to LOR declarations are unclear and that there are currently no requirements in the NER for AEMO to undertake consultation to determine these processes. In the latter, AEMO

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<sup>47</sup> Clause 8.9 of the NER sets out the process for the rules consultation procedures.

<sup>48</sup> See AEMO, *Electricity rule change proposal - lack of reserve declarations*, 1 August 2017, p.10 for more details about AEMO's reasons.

provides several examples, including the criteria under which to reclassify non-credible contingencies to credible contingencies.

AEMO also considers that the rules consultation procedures would be unnecessarily burdensome for both AEMO and stakeholders. In proposing this rule change, AEMO is seeking to add flexibility to the LOR declaration process and it is proposing for this flexibility to extend its ability to continually improve the technical model underpinning the probabilistic assessment. This flexibility is said to be undermined by the rules consultation procedures.

The Commission notes that while AEMO has identified the stakeholders that would be most likely affected by this rule change, there may be other key stakeholders that AEMO has missed. For example, consumer groups may have an interest in LOR declarations in so far as there are costs associated with managing reserves and sensitivities around load shedding. Similarly, larger energy users may have an interest in this matter as they may be affected by directions and clause 4.8.9 instructions.

**Question 5      Level of consultation**

**(a) Is the proposed level and scope of consultation for developing and amending the proposed guidelines adequate, both for the initial development and on an ongoing basis for any amendments to the proposed guidelines?**

**(b) AEMO is proposing targeted consultation with generators, TNSPs and JSSCs. Are there any other stakeholders that should be included in AEMO's proposed targeted consultation?**

## **6 Lodging a submission**

The Commission has published a notice under s.95 of the NEL for this rule change proposal inviting written submission. Submissions are to be lodged online or by mail by **19 September 2017** in accordance with the following requirements.

Where practicable, submissions should be prepared in accordance with the Commission's Guidelines for making written submissions on rule change requests.<sup>49</sup> The Commission publishes all submissions on its website subject to a claim of confidentiality.

All enquiries on this project should be addressed to Sarah-Jane Derby on (02) 8296 7823 or [sarah.derby@aemc.gov.au](mailto:sarah.derby@aemc.gov.au).

### **6.1 Lodging a submission electronically**

Electronic submissions must be lodged online via the Commission's website, [www.aemc.gov.au](http://www.aemc.gov.au), using the "lodge a submission" function and selecting the project reference code ERC0226. The submission must be on letterhead (if submitted on behalf of an organisation), signed and dated.

### **6.2 Lodging a submission by mail**

The submission must be on letterhead (if submitted on behalf of an organisation), signed and dated. The submission should be sent by mail to:

Australian Energy Market Commission  
PO Box A2449  
Sydney South NSW 1235

The envelope must be clearly marked with the project reference code ERC0226.

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<sup>49</sup> This guideline is available on the Commission's website [www.aemc.gov.au](http://www.aemc.gov.au).

## Abbreviations

AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
ASEFS	Australian Solar Energy Forecasting Systems
AWEFS	Australian Wind Energy Forecasting Systems
Commission	See AEMC
JSSCs	Jurisdictional system security coordinators
LOR	Lack of reserves
NEL	National Electricity Law
NEM	National Electricity Market
NEO	National Electricity Objective
NER	National Electricity Rules
NSP	Network Service Provider
PASA	Projected assessment of system adequacy
POE	Probability of exceedance
RERT	Reliability and emergency reserve trader
TNSPs	Transmission network service providers

## A Reserve methodology

### A.1 LOR levels methodology

AEMO calculates LOR levels based on the contingency-based framework that is currently in the NER. For a LOR1, this is the amount of capacity (MW) needed to withstand two credible contingency events without resorting to load shedding. Similarly, in the case of a LOR2, this is the amount of capacity (MW) needed to withstand one credible contingency event without the need for load shedding. These levels vary constantly based on region, time of day, temperature, network constraints, planned outages and so on.

As mentioned, the NER provides guidance to AEMO as to which contingency events should be regarded as credible in the context of LOR levels,<sup>50</sup> but leaves AEMO with some discretion as to exactly which events should be classified as such.<sup>51</sup> In its rule change request, AEMO detailed what credible contingency events AEMO generally considers. In the case of LORs, the NER defines that this would generally be the (loss of the) largest generating unit, with AEMO considering these at all times in its LOR assessments. The loss of interconnection under abnormal conditions is also explicitly mentioned in the NER, and AEMO considers the loss of interconnection:<sup>52</sup>

- where one circuit of a double-circuit interconnection is out of service; and
- where the loss of double circuits that form an interconnection are re-classified as being a credible contingency.

AEMO also considers the loss of the Basslink cable at all times as a credible contingency for LOR declarations.<sup>53</sup> AEMO does not generally consider the loss of other transmission line elements as contingencies for the purposes of LOR declaration.

Using this method, AEMO calculates LOR levels for each region for each time period. AEMO then compares the calculated LOR levels against the forecast total reserve level in order to determine whether or not to declare an LOR condition, which are discussed below.

### A.2 Total reserve levels methodology

Forecast total reserve levels are obtained from outputs of the short-term projected adequacy of supply (short-term PASA) and pre-dispatch projected adequacy of supply (pre-dispatch PASA) process.

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50 As discussed in section 2.1.2, this guidance is different for LORs.

51 See clause 4.8.4 of the NER.

52 AEMO, *Electricity rule change proposal - lack of reserve declarations*, 1 August 2017, p. 5.

53 Ibid. p.5.

At a high level, AEMO calculates a region's reserves as follows:<sup>54</sup>

- amount of scheduled generation that has offered in its availability; plus
- forecast semi-scheduled generation and large non-scheduled generation; plus
- surplus reserve available from adjacent regions; less
- operational demand (which refers to electricity used by residential, commercial and large industrial consumers, as well as including non-scheduled generation).<sup>55</sup>

Short-term PASA is published every two hours, and provides detailed disclosure of short-term power system supply/demand balance (i.e. reserves) prospects for six days following the next trading day. The information is provided for each half-hour within the report period. Pre-dispatch PASA provides 30-minute pre-dispatch (forecast) data by region to the end of the next market day, and is updated half hourly.<sup>56</sup>

Short-term PASA and pre-dispatch PASA solve for reserves for each region and for every half-hour within their respective time horizon. Their objective functions are to maximise reserves in each specific region for the half-hour it is solving.<sup>57</sup> Total reserves (operationally known as LOR reserves) are calculated using short-term PASA demand and supply outputs.

Short-term PASA uses the following assumptions for demand and supply:<sup>58</sup>

- demand forecasts use a 50% probability of exceedance (POE) half-hour demand based on expected weather patterns<sup>59</sup>
- intermittent generation forecasts based on Australian Wind Energy Forecasting Systems (AWEFS) and Australian Solar Energy Forecasting Systems (ASEFS)<sup>60</sup>

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<sup>54</sup> AEMO, *Electricity rule change proposal - lack of reserve declarations*, 1 August 2017, pp. 7-8.

<sup>55</sup> It does not include electricity used by scheduled loads or demand met by rooftop solar PV - in other words, operational demand decreases as rooftop PV generation rises.

<sup>56</sup> The Commission is considering a rule change proposed to implement five-minute settlement (from thirty-minute settlement), which may affect pre-dispatch information. See <http://www.aemc.gov.au/Rule-Changes/Five-Minute-Settlement>.

<sup>57</sup> Taking into account constraints so that only the total amount of energy transmissible to customers is considered. See AEMO, *Electricity rule change proposal - lack of reserve declarations*, 1 August 2017, p. 8.

<sup>58</sup> AEMO, *Reliability Standard Implementation Guidelines*, October 2016, accessed from [https://www.aemo.com.au/-/media/Files/Stakeholder\\_Consultation/Consultations/Electricity\\_Consultations/2016/EAAP/Reliability-Standard-Implementation-Guidelines.pdf](https://www.aemo.com.au/-/media/Files/Stakeholder_Consultation/Consultations/Electricity_Consultations/2016/EAAP/Reliability-Standard-Implementation-Guidelines.pdf).

<sup>59</sup> Demand is expressed as the probability the forecast would be met or exceeded.

<sup>60</sup> See <https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/Solar-and-wind-energy-forecasting>.

- scheduled generation capacity and outages based on available capacity within the PASA availability.<sup>61</sup>

The AWEFS and ASEFS are used to forecast the potential wind and solar output. ASEFS is designed to produce solar generation forecasts for large solar power stations and small-scale distributed photovoltaic (PV) systems, covering forecasting time frames from five minutes to two years. AWEFS forecasts wind generation over similar timeframes.

The AWEFS was established in response to the growth in intermittent wind generation in the NEM, and the increasing impact this growth was having on NEM forecasting processes.<sup>62</sup> Because of the intermittent and weather-dependent nature of wind and solar generation, they are more difficult to forecast than thermal generation.<sup>63</sup> Extreme weather events compound this issue, making both demand and supply forecasts, even for thermal generators, challenging.

AEMO and others, such as the Finkel Panel's *Independent Review into the Security of the National Electricity Market* report have identified short-term demand and supply forecasting errors as a risk.<sup>64</sup> To address this, AEMO is currently developing a tool to continuously calculate and project the risk of errors in its short-term reserve forecasting, caused by changes in forecast demand or supply, which is a driver for this rule change request. This is discussed in more detail in section 3.2.3.

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<sup>61</sup> Scheduled generators provide this information to AEMO for the PASA process.

<sup>62</sup> See <https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/Solar-and-wind-energy-forecasting>.

<sup>63</sup> The Commission is aware that the AWEFS has recently been raised as an issue in relation to how this has been used as an input into the causer pays methodology for recovery of frequency control ancillary services (FCAS). The Commission considers that this issue is out of scope for this review, although obviously, still relevant.

<sup>64</sup> See the first page of AEMO's rule change request here <http://www.aemc.gov.au/getattachment/f34981af-a794-4836-a576-c090966d5804/Rule-change-request.aspx>.