

# Decision on the Australian Energy Market Operator's 2021/22 ancillary services requirements

17 June 2021

**Economic Regulation Authority**

WESTERN AUSTRALIA

D233188

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# 1. Determination

The Economic Regulation Authority has conducted its audit of the 2021/22 ancillary services requirements and plan submitted by the Australian Energy Market Operator (AEMO).

Clause 3.11.6 of the Wholesale Electricity Market (WEM) Rules states that AEMO must submit the ancillary services requirements to the ERA for audit and approval.

The ERA has audited and approved AEMO's proposed requirements as listed in Table 1.

**Table 1: 2021/22 ancillary service requirements**

Ancillary service	Requirement
<b>Load following service upwards</b>	Up to 110 MW between 5:30am and 8:30 am <sup>1</sup> 65 MW between 8:30pm and 5:30am
<b>Load following service downwards</b>	Up to 110 MW between 5:30am and 8:30 am <sup>2</sup> 65 MW between 8:30pm and 5:30am
<b>Spinning reserve service</b>	At least the maximum of: <ol style="list-style-type: none"> <li>1. 70 per cent of the largest generating unit.</li> <li>2. 70 per cent of the largest contingency event that would result in generation loss.</li> </ol>
<b>Load rejection reserve service</b>	Up to a maximum of 90 MW.
<b>Dispatch support service</b>	No requirements for dispatch support services.
<b>System restart service</b>	Three facilities with system restart capability

<sup>1</sup> AEMO will implement the load following service upwards requirement in a staged approach, with 100 MW initially implemented between 5.30am and 8.30pm. AEMO will monitor the adequacy of this initial quantity and assess whether further adjustments are required up to the approved 110MW quantity.

<sup>2</sup> AEMO will implement the load following service downwards requirement in a staged approach, with 100 MW initially implemented between 5.30am and 8.30pm. AEMO will monitor the adequacy of this initial quantity and assess whether further adjustments are required up to the approved 110MW quantity.

## 2. Introduction

Ancillary services are essential services required by AEMO to operate the South West Interconnected System (SWIS) in a safe and reliable manner. These services maintain technical characteristics of the power system, including frequency and voltage.

The WEM Rules require AEMO to prepare an ancillary services report. The report must include the ancillary services costs and quantities provided in the previous year and AEMO's ancillary services requirements and plan for the coming year.

The ancillary services requirements must be determined in accordance with the SWIS operating standards and the ancillary service standards in the WEM Rules.<sup>3</sup> The requirements are the levels of services needed to meet the standards.

AEMO's ancillary services requirements and plan must be submitted to the ERA for audit and approval by 1 June each year. AEMO submitted its ancillary services report for 2021/22 to the ERA on 31 May 2021.

The WEM Rules require the ERA to:

- Audit and approve AEMO's determination of the ancillary services requirements. The ERA may require AEMO to re-determine the requirements.<sup>4</sup>
- Audit AEMO's determination of the ancillary services plan to meet the requirements. The ERA may require AEMO to re-determine the plan. The ERA is not required to approve AEMO's plan.<sup>5</sup>

AEMO must determine the requirements based on the facilities and configurations expected for the SWIS in the coming year, and may consider location, varying load levels, and varying daily conditions including the type of day, the time of day and variances across the year.<sup>6</sup>

AEMO must also determine the ancillary service plan for each class of ancillary service.<sup>7</sup>

The ERA has assessed AEMO's 2021/22 ancillary services requirements and plan against AEMO's obligations under the WEM Rules.

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<sup>3</sup> Wholesale Electricity Market Rules, 1 February 2021, rules 3.11.4 and 3.11.1 ([online](#)).

<sup>4</sup> Wholesale Electricity Market Rules, 1 February 2021, rule 3.11.6 ([online](#)).

<sup>5</sup> Wholesale Electricity Market Rules, 1 February 2021, rule 3.11.12 ([online](#)).

<sup>6</sup> Wholesale Electricity Market Rules, 1 February 2021, rules 3.11.2, 3.11.4 and 3.11.5 ([online](#)).

<sup>7</sup> Wholesale Electricity Market Rules, 1 February 2021, rules 3.1.11(c) ([online](#)).

### 3. Load following service

Load following service is defined in the WEM Rules as:

- 3.9.1. Load Following Service is the service of frequently adjusting:
- (a) the output of one or more Scheduled Generators; or
  - (b) the output of one or more Non-Scheduled Generators,
- within a Trading Interval so as to match total system generation to total system load in real time in order to correct any SWIS frequency variations

The SWIS power system operates at a frequency of 50 hz and, in normal operating conditions, the frequency must remain within a band of 49.8 hz to 50.2 hz.<sup>8</sup> To ensure the frequency is maintained within the normal operating range, AEMO must balance generation supply with electricity demand in real time. AEMO uses load following services provided by accredited generators to continuously balance supply and demand.

Load following services are procured via a market. The market is settled on the load following service quantity determined by AEMO and approved by the ERA.

#### 3.1 AEMO's proposed load following service requirement

During 2020/2021 approximately 520 MW of non-scheduled generation connected to the SWIS. This included 390 MW of wind generation and 130 MW of solar generation, which can be intermittent and variable depending on weather conditions. Load following services are used to manage this volatility to ensure that electricity supply and demand are balanced. As a result of the connection of this large amount of non-scheduled generation, on 25 August 2020 AEMO asked the ERA to approve an increase in the load following service requirements.

On 15 September 2020, the ERA approved AEMO's updated load following service requirements for the remainder of 2020/21. The updated values were:

- up to +/- 105 MW between 5:30am and 7:30pm from 15 September 2020 (peak)
- up to +/- 80 MW between 7:30pm and 5:30am from 15 September 2020 (off-peak).

AEMO implemented the new requirements in a staged approach. Quantities of +/- 95 MW during peak periods and +/- 70 MW during off-peak periods were implemented from 25 September 2020, but with the ability move to the maximum peak requirement of up to +/- 105 MW and off-peak requirement of up to +/- 80 MW.

AEMO has proposed small changes to the load following service requirements for 2021/22. These changes include extending the peak window by one hour to 8:30pm, increasing the peak quantity by 5 MW to +/- 110 MW and reducing the off-peak quantity by 15 MW to +/- 65 MW. Similar to 2020, AEMO will implement its proposed new requirements in a staged approach. AEMO will initially implement quantities of +/- 100 MW during peak periods and +/- 65 MW during off-peak periods but will move to the maximum peak requirement of +/- 110 MW if the lower quantities are insufficient. Table 2 summarises these changes.

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<sup>8</sup> Frequency bands for a range of SWIS operating conditions are specified in chapter 2.2.1 of the Technical Rules ([online](#)) and Appendix 13 of the WEM Rules ([online](#)).

**Table 2: Summary of changes to load following service requirements**

Period	Approved load following service requirements	Initial load following service requirement
15 September 2020 to 30 June 2020	Up to +/- 105 MW between 5:30 am and 7:30 pm (peak) Up to +/- 80 MW between 7:30 pm and 5:30 am (off-peak)	+/- 95 MW between 5:30 am and 7:30 pm (peak) +/- 70 MW between 7:30 pm and 5:30 am (off-peak)
From 1 July 2021	Up to +/- 110 MW between 5:30 am and 8:30 pm (peak) +/- 65 MW between 8:30 pm and 5:30 am (off-peak)	+/- 100 MW between 5:30 am and 8:30 pm (peak) +/- 65 MW between 8:30 pm and 5:30 am (off-peak)

AEMO explained that the changes described in Table 2 are necessary:

- To better account for the volatility of the newly connected renewable generators. AEMO's 2021/22 requirement is based on its analysis of a larger dataset following completion of commissioning of the new renewable generators. This allowed AEMO to better consider the usage of load following services during full operation of these new generators.
- To account for the expected increase in distributed solar photovoltaics (PV) requiring a higher use of load following services during peak times.

### 3.2 ERA's assessment of proposed load following service requirements

The method used by AEMO to calculate the 2021/22 requirements had two steps. AEMO first considered data from March 2018 to February 2021 to consider the trend in the requirement for load following services. AEMO reported that the frequency keeping mechanism used during peak times increased by approximately 10 MW and 25 MW over the past two years respectively and that this trend was likely to continue with the increasing pace of distributed PV connections.<sup>9</sup>

AEMO then considered the most recent data to February 2021 when determining the requirement. The data used by AEMO was a time series record of the estimated load following service usage for each five-minute period. In developing the requirement, AEMO considered the output deviations for facilities dispatched for load following services and the balancing portfolio from their base point targets.<sup>10</sup>

AEMO analysed the distribution of these values and determined the values that were equal to the estimated quantity of load following service upwards that was used 99 per cent of the time and the estimated quantity of load following downwards used 99 per cent of the time.<sup>11</sup> AEMO

<sup>9</sup> AEMO defined frequency keeping mechanisms as the measurement of the deviations of load following facilities from their base point levels and/or the deviation of balancing portfolio facilities from their base point levels.

<sup>10</sup> In the balancing market, independent power producers and the balancing portfolio are given a balancing base point representing their dispatch instruction target for a trading interval.

<sup>11</sup> The SWIS operating standards require the frequency to be within the normal range of 49.8 to 50.2 Hz for 99 per cent of the time.

then averaged these two values to derive its load following service requirements.<sup>12</sup> AEMO derived a requirement of 110 MW for daytime peak periods and 65 MW for overnight off-peak periods, consistent with the level of usage of services during this period.

To undertake its audit of AEMO's 2021/22 load following service requirements, the ERA applied AEMO's methodology to a smaller data sample for the six-month period to February 2021. The ERA chose the six-month timeframe because it captured the full operation of the newly connected renewable generators following the completion of their commissioning. This period also included the most recent levels of distributed solar PV. The ERA's audit produced outcomes consistent with AEMO's load following service daytime requirements of +/- 110 MW and overnight requirements of +/- 65 MW.

The ERA also considered AEMO's proposal to extend the length of the daytime load following service requirement by one hour. Using data provided by AEMO, the ERA analysed AEMO's estimated load following service requirement for the sample period 6:30 pm to 9:30 pm during September 2020 to February 2021. The outcome of this analysis demonstrated that estimated load following service requirements for the 7:30 pm to 8:30 pm window was typical of the peak period compared to the off-peak period. The ERA's analysis supports AEMO's proposal to extend the peak window.

AEMO stated that it would monitor the adequacy of the revised load following service requirements to consider whether further adjustments will be necessary during 2021/22. The ERA requests that AEMO provide an update to the ERA on the adequacy of the revised load following service requirements early in 2022.

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<sup>12</sup> In deriving the requirements, AEMO also considered experiences of its personnel in operating the power system and maintaining frequency



## 4. Spinning reserve service

The spinning reserve ancillary service provides a rapid increase in generation following a sudden or unexpected shortfall in supply resulting from the loss of a large generator or transmission equipment.

The SWIS operating standards require the frequency to remain within the 48.75 Hz to 51 Hz band for a single contingency event, such as an outage of one transmission line.

Spinning reserve is defined in the WEM Rules as:

- 3.9.2. Spinning Reserve Service is the service of holding capacity associated with a synchronised Scheduled Generator or Interruptible Load in reserve so that the relevant Facility is able to respond appropriately in any of the following situations:
- (a) to retard frequency drops following the failure of one or more generating works or transmission equipment; and
  - (b) in the case of Spinning Reserve Service provided by Scheduled Generators to supply electricity if the alternative is to trigger involuntary load curtailment

The ancillary service standard for spinning reserve service is defined in WEM Rule 3.10.2. This rule states:

- 3.10.2. The standard for Spinning Reserve Service is a level which satisfies the following principles:
- (a) the level must be sufficient to cover the greater of:
    - i. 70% of the total output, including Parasitic Load, of the generation unit synchronised to the SWIS with the highest total output at that time; and
    - ii. the maximum load ramp expected over a period of 15 minutes;
  - (b) the level must include capacity utilised to meet the Load Following Service standard under clause 3.10.1, so that the capacity provided to meet the Load Following requirement is counted as providing part of the Spinning Reserve requirement;
  - (c) the level may be relaxed by up to 12% by AEMO where it expects that the shortfall will be for a period of less than 30 minutes; and
  - (d) the level may be relaxed following activation of Spinning Reserve and may be relaxed by up to 100% if all reserves are exhausted and to maintain reserves would require involuntary load shedding. In such situations the levels must be fully restored as soon as practicable.

### 4.1 AEMO's proposed spinning reserve requirements

AEMO's proposed spinning reserve requirement for 2021/22 is shown in Table 3. AEMO has proposed to keep this requirement the same as in 2020/21. However, the application of this requirement in 2021/22 may result in higher quantities of spinning reserve being enabled in certain circumstances, than in prior years. This is discussed in section 4.2.

**Table 3: Spinning reserve service 2021/22 requirement**

Ancillary service	Requirement
Spinning reserve service	At least the maximum of: <ol style="list-style-type: none"> <li>1. 70 per cent of the largest generating unit.</li> <li>2. 70 per cent of the largest contingency event that would result in generation loss.</li> </ol>

## 4.2 ERA's assessment of proposed spinning reserve requirements

The standards for spinning reserve mean that the spinning reserve requirement is not a static MW level. Rather, it is a dynamic requirement that AEMO sets in the planning horizon and adjusts closer to real time according to system conditions. The requirement is not used for settlement purposes. Instead, the WEM Rules require compensation for the provision of spinning reserve services to be determined through the margin values process or by contract.<sup>13</sup>

As a result, the ERA's assessment of AEMO's spinning reserve requirement is limited to considering:

- Whether AEMO's proposed requirement is consistent with the ancillary service standards.
- Whether there is any historical evidence that the real-time spinning reserve levels derived from AEMO's wording of the requirement were not adequate.

AEMO's obligation under the WEM Rules for spinning reserve is that it must set the spinning reserve requirement in accordance with the SWIS operating standards, and the ancillary service standard referred to in section 4. The WEM Rules currently require the application of standards under different frameworks (for example, the SWIS operating standards are found in the Technical Rules, which apply to the network and the ancillary services standards are in the WEM Rules).<sup>14</sup> This creates the opportunity for ambiguity when deriving the wording of a requirement to meet both standards. AEMO's requirement (section 4.1) specifically refers to its obligations under both these standards and is therefore consistent with the standards.

AEMO's requirement under the SWIS operating standards and ancillary service standards means that it must identify the largest contingency event. In the past, the requirement has meant that a maximum of 238 MW has been enabled for spinning reserve as this has corresponded with 70 per cent of the largest contingency being a 340 MW single generating unit. During 2020/21, AEMO advised that the operation of this unit was no longer the largest contingency. The largest contingency is now a combination of simultaneous generation and load trips north of the Northern Terminal following the loss of the 330 kilovolt line from the Neerabup Terminal through to the Three Springs Terminal, coupled with associated

<sup>13</sup> The ancillary service costs: spinning reserve, load rejection reserve and system restart costs (margin values and Cost\_LR) for 2021/22 is available [online](#).

<sup>14</sup> This will no longer be the case in future as changes to the WEM Rules for the market reforms have moved the SWIS frequency operating standards to the WEM Rules.

disconnection of rooftop distributed PV (referred to as the MARNET contingency). This contingency now sets a maximum spinning reserve requirement of 310 MW.<sup>15</sup>

The ERA also assessed AEMO's performance with meeting the SWIS operating standards to maintain frequency above 48.75 Hz to consider whether AEMO's requirement, which is unchanged, has been adequate. AEMO's report showed that its performance managing frequency in 2020/21 exceeded the SWIS operating standards. Frequency was maintained in the normal operating range for over 99.9 per cent of the time and there were no frequency excursions below 48.75 Hz in 2018/19, which was the applicable level for spinning reserve. There were also no under-frequency load shedding events. Based on this performance, there is no evidence to suggest that AEMO's spinning reserve requirement has not been adequate.

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<sup>15</sup> The MARNET contingency is only expected to bind in specific circumstances where a combination of generation and load occurs following the loss of the 330 kV line from the Neerabup Terminal to the Three Springs Terminal coupled with the disconnection of solar PV. Where these circumstances do not occur, this contingency does not set the spinning reserve requirement.

## 5. Load rejection reserve service

Load rejection reserve provides a quick reduction in the output of generators in instances where a large load is suddenly and unexpectedly lost, for example because of a transmission line outage.

Load rejection reserve is defined in clause 3.9.6 of the WEM Rules. The rule states:

- 3.9.6. Load Rejection Reserve Service is the service of holding capacity associated with a Scheduled Generator in reserve so that the Scheduled Generator can reduce output rapidly in response to a sudden decrease in SWIS load.

The SWIS operating standards require the frequency to remain below 51 Hz for a single contingency event, such as the outage of one transmission line.

The quantity of load rejection reserve is set by AEMO to meet the standards outlined in clause 3.10.4 of the WEM Rules. The rule states:

- 3.10.4. The standard for Load Rejection Reserve Service is a level which satisfies the following principles:
- (a) the level sufficient to keep over-frequency below 51 Hz for all credible load rejection events;
  - (b) may be relaxed by up to 25% by AEMO where it considers that the probability of transmission faults is low.

### 5.1 AEMO's proposed load rejection reserve requirements

The load rejection reserve requirement approved for 2020/21 was up to a maximum of 90 MW. There has been no change in this requirement between the approved requirement during 2020/21 and AEMO's proposed requirement for 2021/22.

AEMO undertook a trial of dynamic load rejection reserve from April 2019 and implemented the dynamic method of assessing the requirement permanently in 2020/21. In determining the method dynamically, AEMO calculates the maximum requirement based on the largest credible contingency in real time, which may be less than the approved load rejection requirement.

**Table 4: Load rejection reserve service 2021/22 requirement**

Ancillary service	Requirement
Load rejection reserve service	Up to a maximum of 90 MW

### 5.2 ERA's assessment of proposed load rejection reserve requirements

Similar to spinning reserve, the ERA assessed AEMO's load rejection reserve requirement by considering:

- Whether AEMO's proposed requirement is consistent with the SWIS operating standards and the ancillary service standards.

- Whether there is any evidence that the load rejection reserve requirement was not adequate to meet the standard.

AEMO's proposal of a value of up to 90 MW is consistent with the standards. The largest credible contingency for a load rejection reserve event is approximately 90 MW, based on a reduction of 120 MW from the sudden loss of the Eastern Goldfields region or the Boddington Gold mine, less 30 MW of load relief that would occur in response to the frequency change.<sup>16</sup>

The standards applicable to load rejection reserve require AEMO to set the service at a level sufficient to keep the frequency below 51 Hz. The ERA considered the frequency performance information provided by AEMO to assess whether AEMO's load rejection reserve requirement was adequate to meet the frequency standard. AEMO reported that there were no frequency excursions greater than 51 Hz during the 2020/21 reporting period. Based on this performance, and that there has been no change to the largest load rejection contingency, there is no evidence that AEMO's load rejection reserve requirement is not adequate.

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<sup>16</sup> Load relief is the reduction in consumption from frequency dependent loads (for example, induction motors). These loads decelerate in response to a fall in system frequency. Since power consumption of these loads relies on their rotational speed, less power is drawn during a frequency drop.

## 6. Contracted services

The WEM Rules state AEMO may enter ancillary service contracts with a rule participant for load rejection reserve, system restart or dispatch support services.

- 3.11.8A. AEMO may enter into an Ancillary Service Contract with a Rule Participant for the provision of a Load Rejection Reserve Service, System Restart Service or Dispatch Support Service.

Load rejection reserve services were discussed in section 5 of this report. The remaining services – system restart and dispatch support services – are discussed below.

### 6.1 System restart

System restart services are provided by generators capable of restarting and providing power to the grid in total blackout conditions. This will enable other generators without this capability to also start.

The system restart service is defined in clause 3.9.8 of the WEM Rules. The rule states:

- 3.9.8. System Restart Service is the ability of a Registered Facility which is a generation system to start without requiring energy to be supplied from a Network to assist in the re-energisation of the SWIS in the event of system shutdown.

The ancillary service standard for system restart is defined in clause 3.10.6 and AEMO's operational plans to restart the SWIS are outlined in clause 3.7.1. These rules state:

- 3.10.6. The standard for System Restart Service is a level which is sufficient to meet AEMO's operational plans as developed in accordance with clause 3.7.1.
- 3.7.1. AEMO must make operational plans and preparations to restart the SWIS in the event of system shutdown.

AEMO has specified that it requires three system restart facilities. These facilities should not be in the same location, to mitigate the risk of total service failure due to a common reason.

System restart service facilities are located in the North Metropolitan, South Metropolitan and South Country regions of the network. The South Country contract remains valid until 2028, however the North Metropolitan and South Metropolitan contracts end on 30 June 2021.

At the time of this determination AEMO has contracted three services in three different geographical locations, consistent with its operational plans. AEMO advised that the procurement process for the North Metropolitan and South Metropolitan contracts that are due to expire will be finalised prior to 30 June 2021. The ERA will monitor the completion of the procurement process.

**Table 5: System restart service 2021/22 requirement**

Ancillary service	Requirement
System restart service	Three facilities with system restart capability

## 6.2 Dispatch support services

Clause 3.9.9 of the WEM Rules defines dispatch support services. This rule states:

- 3.9.9. Dispatch Support Service is any other ancillary service that is needed to maintain Power System Security and Power System Reliability that are not covered by the other Ancillary Service categories. Dispatch Support Service is to include the service of controlling voltage levels in the SWIS, where that service is not already provided under any Arrangement for Access or Network Control Service Contract.

There is no ancillary service standard for dispatch support services, rather the need for the service is determined by AEMO.

AEMO has not identified a current requirement for dispatch support services.

Should the need for these services arise, AEMO may seek to procure these services. Prior to entering into an ancillary services contract for dispatch support services, AEMO must obtain the ERA's approval under clause 3.11.8B.

## 7. Ancillary service costs 2020/21

AEMO reported the total ancillary services costs for the period 1 April 2020 to 31 March 2021. Total ancillary services costs during this period were \$3.7 million lower than the corresponding 2019/20 period.

This reduction was due to a \$6.2 million reduction in load following service costs. However, an increase in spinning reserve costs by \$2.4 million partially offset this reduction.

Lower load following service costs were predominantly due to a decrease in the load following service upwards cost of \$4.5 million. Load following service downwards costs reduced by \$1.6 million and load following capacity costs fell by \$128,000.

Total load following service costs decreased, despite an increase in the quantities, due to reductions in the clearing price of both load following service markets.

The ERA's analysis of AEMO's 2021/22 requirements indicates there could be a small increase in load following service costs for 2021/22.

Spinning reserve ancillary service costs rose from \$11.7 million in 2019/2020 to \$14.1 million in 2020/21. This increase was primarily due to an increase in the approved margin values used to determine the cost of the service. The margin values are used in the calculation that determines the compensation paid to Synergy for spinning reserve service. Margin values increased from 17.32 per cent peak and 12.92 per cent off-peak in 2019/20 to 39.65 per cent peak and 23.24 per cent off-peak in 2020/21.<sup>17</sup>

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<sup>17</sup> Further information on the increase to Spinning Reserve Service costs is outlined in the ERA's Ancillary Service costs: Spinning Reserve, load rejection reserve and system restart costs (Margin values and Cost\_LR) for 2021/22 determination.



## 8. Conclusion

The ERA approves AEMO's 2021/22 ancillary service requirements as set out in Table 1. To make its determination, the ERA considered:

- AEMO's performance maintaining power system security and reliability.
- AEMO's improvements for assessing and setting its ancillary services requirements. These improvements include the revision of the peak and off-peak timing for the load following service requirements, the implementation of a dynamic load rejection reserve requirement and a new contingency for determining spinning reserve service requirements.
- The requirement under the WEM Rules for AEMO to monitor whether changes are required to the service levels during 2021/21. Should there be any changes, AEMO will need to reassess its requirements and seek the ERA's approval under clause 3.11.6 of the WEM Rules.

AEMO stated that it would monitor the adequacy of the revised load following service requirements to consider whether further adjustments were necessary during 2021/22. The ERA requests AEMO provide an update to the ERA on the adequacy of the revised load following service requirements in early 2022.