ANCILLARY SERVICES REPORT 2017/18

SYSTEM MANAGEMENT

June 2017

AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

IMPORTANT NOTICE

Disclaimer

This document or the information in it may be subsequently updated or amended. This document does not constitute legal or business advice, and should not be relied on as a substitute for obtaining detailed advice about the Wholesale Electricity Market or the Wholesale Electricity Market Rules, or any other applicable laws, procedures or policies. AEMO has made every effort to ensure the quality of the information in this document but cannot guarantee its accuracy or completeness.

Accordingly, to the maximum extent permitted by law, AEMO and its officers, employees and consultants involved in the preparation of this document:

- make no representation or warranty, express or implied, as to the currency, accuracy, reliability or completeness of the information in this document; and
- are not liable (whether by reason of negligence or otherwise) for any statements or representations in this document, or any omissions from it, or for any use or reliance on the information in it.

TABLE OF CONTENTS

FIGURES

TABLES

1. INTRODUCTION

1.1 System Management

Part 9 of the Electricity Industry Act 2004 provides for a wholesale electricity market and the establishment of market rules.

Regulation 13 of the Electricity Industry (Wholesale Electricity Market) Regulations 2004 (**Regulations**) states that the market rules may confer on an entity the function of operating the South West Interconnected System (**SWIS**) in a secure and reliable manner.

Clause 2.2.1 of the Wholesale Electricity Market Rules (**WEM Rules**) confers this function on AEMO. In this report, unless the context requires otherwise, references to AEMO include AEMO in its System Management capacity.

1.2 Ancillary Services Report – WEM Rule Obligations

The WEM Rules require AEMO to prepare an annual Ancillary Services report and submit it to the Economic Regulation Authority (**ERA**).

Clause 3.11.11 of the WEM Rules states:

> *By 1 June each year, System Management must submit to the Economic Regulation Authority a report containing information on:*
>
> *(a) the quantities of each of the Ancillary Services provided in the preceding year, including Ancillary Services provided under Ancillary Service Contracts, and the adequacy of these quantities;*
>
> *(b) the total cost of each of the categories of Ancillary Services provided, including Ancillary Services provided under Ancillary Service Contracts, in the preceding year*; *and*
>
> *(c) the Ancillary Service Requirements for the coming year and the Ancillary Services plan to meet those requirements*.

AEMO has prepared this report in accordance with the above requirements.

Clauses 3.11.6 and 3.11.12 of the WEM Rules state:

> *System Management must submit the Ancillary Service Requirements to the Economic Regulation Authority for approval. The Economic Regulation Authority must audit System Management's determination of the Ancillary Service Requirements and may require System Management to re-determine the Ancillary Service Requirements, in which case this clause 3.11.6 applies to any recalculated requirements.*
>
> *The Economic Regulation Authority must audit System Management's determination of the Ancillary Services plan submitted to the Economic Regulation Authority under clause 3.11.11. The Economic Regulation Authority may require System Management to amend the Ancillary Services plan and resubmit it to the Economic Regulation Authority, in which case this clause 3.11.12 applies to any amended plan.*

AEMO has submitted this report to the ERA for the purposes of the audits.

1.3 Terminology

A word or phrase defined in the WEM Rules has the same meaning when used in this report.

1.4 Reporting period[1]

This report provides information for the reporting periods set out below.

- Ancillary Service quantities and their adequacy: May 2016 – April 2017 (section 3 of this report).
- Ancillary Service cost: April 2016 – March 2017 (section 4 of this report).
- Ancillary Services Requirements and the plan to meet those requirements: July 2017 – June 2018 (section 5 of this report).

1.5 Publication

The current and previous Ancillary Service reports and letters of approval in relation to those reports may be found on the AEMO website at: http://www.aemo.com.au/Electricity/Wholesale-Electricity-Market-WEM/Data/System-Management-reports.

[1] Clause 3.11.11 of the WEM Rules requires information to be provided for "the preceding year". The information in sections 3 and 4 of this report reflects the most recent data that is available as at the date of this report. Consequently sections 3 and 4 of this report cover different reporting periods.

2. ANCILLARY SERVICE STANDARDS

This section summarises the Ancillary Service Standards (for each Ancillary Service category) and how AEMO applies the standards when determining the Ancillary Service Requirements.

Clause 3.11.1 of the WEM Rules requires AEMO to "determine all Ancillary Service Requirements in accordance with the SWIS Operating Standards and the Ancillary Service Standards".

The SWIS Operating Standards are defined in the WEM Rules but ultimately specified in the Technical Rules for the SWIS (**Technical Rules**). The WEM Rules define the SWIS Operating Standards as "[t]he standards for the operation of the SWIS including the frequency and time error standards and voltage standards set out in clause 3.1". Clause 3.1.1 of the WEM Rules, in turn, defines the frequency and time error standards for a Network in the SWIS by reference to "the Technical Rules that apply to that Network". The Technical Rules are made by Electricity Networks Corporation trading as Western Power (and approved by the ERA) under chapter 12 of the Electricity Networks Access Code 2004. The relevant SWIS Operating Standards are set out in table 2.1 'Frequency Operating Standards for the South West Interconnected network' of the Technical Rules. Table 2.1 is replicated in Appendix 1 for reference. These frequency operating standards are strongly influenced by the combined operation of a number of the Ancillary Service categories.

The Ancillary Service Standards are specified in the WEM Rules.

2.1 Load Following Ancillary Service (LFAS)

2.1.1 Ancillary Service Standard

Clause 3.10.1(a) of the WEM Rules states:

> *The standard for Load Following Service is a level which is sufficient to:*
>
> *(a) provide Minimum Frequency Keeping Capacity, where the minimum Frequency Keeping Capacity is the greater of :*
>
> *i. 30 MW; and*
>
> *ii. the capacity sufficient to cover 99.9% of the short term fluctuations in load and output of Non-Scheduled Generators and uninstructed output fluctuations from Scheduled Generators, measured as the variance of 1 minute average readings around a thirty minute rolling average.*

2.1.2 SWIS Operating Standard

The relevant SWIS Operating Standard for LFAS is a 'Normal Range' frequency band of "49.8 to 50.2 Hz for 99% of the time".

2.1.3 LFAS Standard

To comply with the Ancillary Service Standard and the SWIS Operating Standard for LFAS, AEMO applies a combined standard, such that the SWIS system frequency is to be maintained between 49.8 Hz and 50.2 Hz for at least 99.9% of the time each month[2].

[2] For the purpose of Load Following, events that result in the frequency deviating from the Normal Operating State of 50 ± 0.32 Hz are excluded. Events outside of this range are typically due to the trip of a large unit and the initial response would be from units providing Spinning Reserve. .

This combined standard remains unchanged from the LFAS standard approved in previous years.

2.2 Spinning Reserve Service (SRS)

2.2.1 Ancillary Service Standard

Clause 3.10.2 of the WEM Rules states:

> *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 meed the Load Following requirement is counted as providing part of the Spinning Reserve requirement.*[3]
>
> *(c) the level may be relaxed by up to 12% by System Management 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.*

2.2.2 SWIS Operating Standard

The relevant SWIS Operating Standard for SRS is a “Single contingency event” and a “Target Recovery Time”. The single contingency event is a frequency band of “48.75 to 51 Hz”. The target recovery time is a return to the normal range frequency band (49.8 to 50.2 Hz) “within 15 minutes”.

2.2.3 SRS Standard

In relation to the SWIS Operating Standard for SRS, clause 2.2.1(d) of the Technical Rules states that the frequency operating standards must be satisfied “without the use of load shedding under all credible power system load and generation patterns and the most severe credible contingency event”. This statement implies that 100% of the ‘Single Contingency Event’ quantity must be enabled at all times. This approach would normally ensure that, following the loss of a 340 MW generator, the frequency would not drop below 48.75 Hz as 340 MW of spinning reserve would be dispatched.

The Ancillary Service Standard for SRS, by contrast, requires 70% of the magnitude of a generator–related contingency to be enabled (at lower cost than the comparable SWIS Operating Standard). The occurrence of this “most severe credible contingency event” in the SWIS is rare.

Operationally, applying the Ancillary Service Standard for SRS of a “Single Contingency Event” to only the largest generator would increase the risk to Power System Security, given that a Network event would have a larger impact than the largest generator event. AEMO therefore applies a combination of the Ancillary Service Standard and the SWIS Operating Standard for SRS as follows:

> The SRS requirement is a level equal to at least 70% of the quantity of the largest contingency.

[3] Only capacity providing LFAS that is also able to provide Spinning Reserve is considered.

This standard remains unchanged from the SRS standard approved in previous years.

2.3 Load Rejection Reserve Service (LRRS)

2.3.1 Ancillary Service Standard

Clause 3.10.4 of the WEM Rules states:

> *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 System Management where it considers that the probability of transmission faults is low.*

2.3.2 SWIS Operating Standard

The relevant SWIS Operating Standard for LRRS is a "Single contingency event" and a "Target Recovery Time". The single contingency event is a frequency band of "48.75 to 51 Hz". The target recovery time is a return "below 50.5 Hz within 2 minutes" and a return to the normal range frequency band (49.8 to 50.2 Hz) "within 15 minutes".

2.3.3 LRRS Standard

The SWIS Operating Standard and the Ancillary Service Standard for LRRS are consistent. AEMO therefore applies a combination of the standards as follows:

> The LRRS requirement is to ensure a level sufficient that after a single contingency event, system frequency does not exceed 51.0 Hz; it returns to less than 50.5 Hz within two minutes and is inside the 49.8 – 50.2 Hz range within 15 minutes.

This standard remains unchanged from the LRRS standard approved in previous years.

2.4 Dispatch Support Service (DSS)

Clause 3.9.9 of the WEM Rules states:

> *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 or SWIS Operating Standard for DSS. The relevant standards are determined on a case-by-case basis.

2.5 System Restart

2.5.1 Ancillary Service Standard

Clause 3.10.6 of the WEM Rules states:

> *The standard for System Restart Service is a level which is sufficient to meet System Management's operational plans as developed in accordance with clause 3.7.1.*

2.5.2 SWIS Operating Standard

There is no SWIS Operating Standard for System Restart. There is a System Management Standard (previously developed when System Management was part of Western Power) for System Restart.[4] See section 5.5 of this report for further details.

[4] Available at: http://www.aemo.com.au/-/media/Files/Electricity/WEM/Security_and_Reliroduecerability/Ancillary-Services/2016/SYSTEM-MANAGEMENT-STANDARD---SYSTEM-RESTART-SERVICES.pdf.

3. QUANTITIES OF ANCILLARY SERVICES PROVIDED IN PRECEDING YEAR (2016/17)

Clause 3.11.11(a) of the WEM Rules requires the Ancillary Services report to set out the quantities of each of the Ancillary Services provided in the preceding year, including Ancillary Services provided under Ancillary Service Contracts, and the adequacy of these quantities.

3.1 Load Following Ancillary Service

There is currently a market for LFAS with two main providers. Provision of LFAS by an independent Power Producer (**IPP**) is attributable to a specific Market Participant and is cleared either as LFAS raise, LFAS lower, or both. The provision of LFAS by the Balancing Portfolio is done through the units capable of doing so, on line at the time.

To clarify the concept of how much LFAS is provided, it is necessary to understand how it is provided. When LFAS is enabled on a generator to respond in the 49.8–50.2 Hz frequency range, the generator will respond up (raise) and down (lower). While the capacity to respond in one direction only may be required from the specific generator at that time, by enabling this capability the full response range is enabled. For example, if LFAS is enabled to provide necessary 'LFAS lower' response, an amount of 'LFAS raise' will also be made available or enabled even if not currently needed. In addition, when a generator is selected to provide LFAS, a block of capability is enabled. This is commonly between 30 MW and 40 MW and not the smaller increments required to exactly match the actual requirement.

Figure 1 below is a graphical representation of changing 'LFAS raise' and 'LFAS lower' as the power output of the generator changes through a particular day.

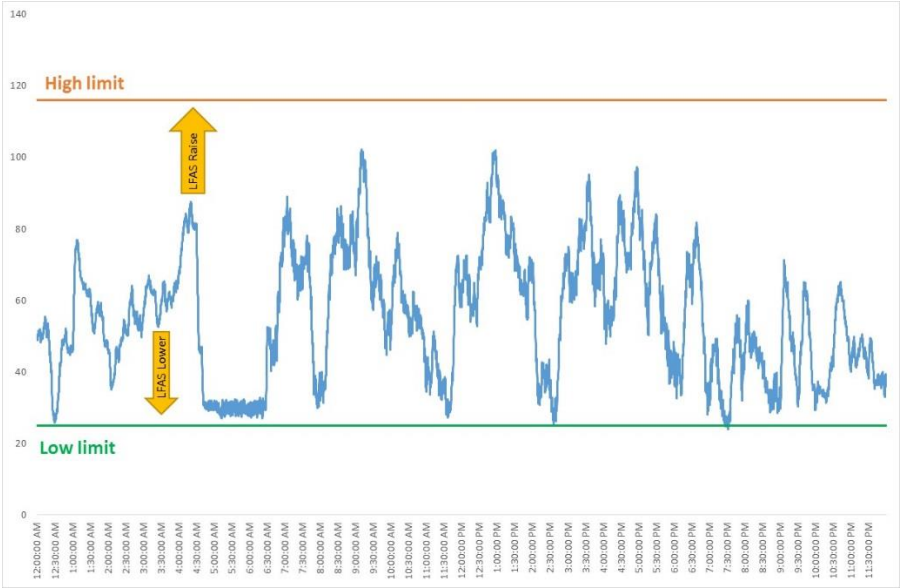

Figure 1: Graphical view of changing LFAS availability

The actual output of the machine at a particular point in time will determine the actual capability to move up or down, although the full range is enabled.

Due to the way the Balancing Portfolio is dispatched, it is not possible after the fact to distinguish the change of output due to LFAS movement or dispatch orders.

3.1.1 Quantity provided

When discussing the quantities provided, the information set out below is discussed.

1. The quantity enabled: As described above, this includes the total range of possible movement enabled. As movement can go in either direction, it is assumed that half of this is up and half down.
2. The actual quantity available: This indicates how much additional movement is available, acknowledging that some movement has already occurred thus 'using up' what has been provided.

As indicated in the previous Ancillary Services report,[5] the general requirement for LFAS for 2016/17 was ± 72 MW.

To determine the average LFAS provided over a period, it is assumed that half of the enabled range is available for 'LFAS raise' and half for 'LFAS lower'. Figure 1 below shows a load duration curve of the 'LFAS raise' enabled over the period of analysis. The same graph would apply for 'LFAS lower'. As can be seen from Figure 2 below, the requirement of 72 MW was met for 99% of the time.

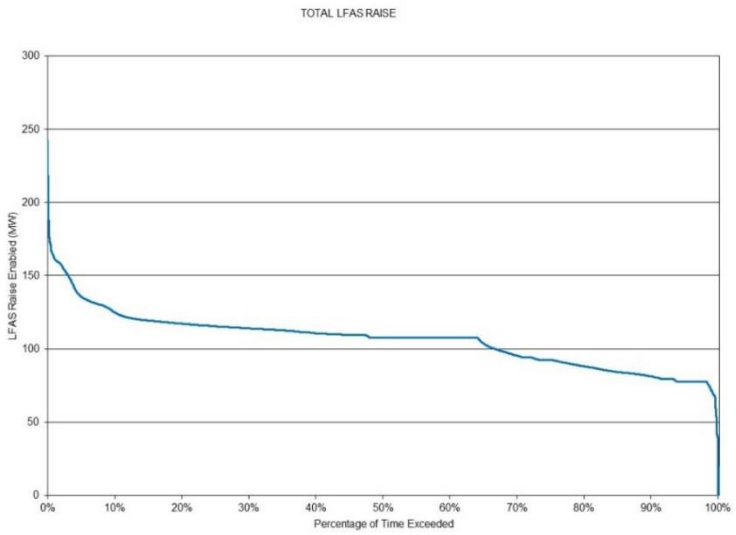

Figure 2: LFAS raise enabled from May 2016 – April 2017

The actual available 'LFAS raise' and 'LFAS lower' is shown in Figure 3 below. Again it should be noted that this is an indicative rather than complete representation of LFAS provided, as it indicates what was available after some was used.

[5] Available at: https://www.aemo.com.au/-/media/Files/Electricity/WEM/Data/System-Management-Reports/2016/2016-Ancillary-Services-Report.pdf. Section 4.2.3

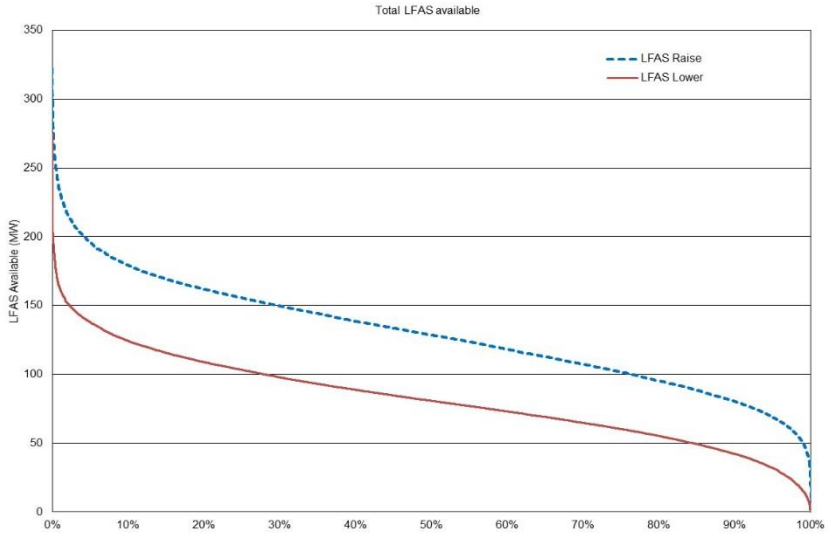

Figure 3: Actual LFAS available from May 2016 – April 2017

3.1.2 Adequacy of quantities enabled

LFAS adequacy can be assessed by confirming whether its target objective of keeping system frequency within the expected band of 49.8 Hz to 50.2 Hz for 99.9% of the time was met with the exception of events falling outside the Normal Operating State frequency range (50 ± 0.32 Hz). Table 1 shows the percentage of time the frequency was within this range for each month.

Table 1: Monthly frequency performance for May 2016 – April 2017[6]

Month	Time within 49.8 – 50.2 Hz	Average Frequency (Hz)
May 2016	100.00%	50.00
Jun 2016	100.00%	50.00
Jul 2016	100.00%	50.00
Aug 2016	100.00%	50.00
Sep 2016	99.99%	50.00
Oct 2016	100.00%	50.00
Nov 2016	100.00%	50.00
Dec 2016	100.00%	50.00
Jan 2017	99.99%	50.00
Feb 2017	100.00%	50.00
Mar 2017	99.98%	50.00
Apr 2017	100.00%	50.00

The frequency requirement was achieved for each month with the frequency distribution being at least 99.98%, producing a better-than--standard performance[7]. Within the current constraints, it is not

[6] This frequency data is based on one minute averages with periods outside the Normal Operating State (50 ± 0.32 Hz) excluded. Data for the entire frequency range is shown in section 3.6 of this report, including the distribution of instantaneous frequency measurements.

[7] This performance is similar to that achieved in the National Electricity Market (refer http://aemc.gov.au/getattachment/c8a0a093-4bf2-432b-8e7b-6157c58a3785/Final-report.aspx (Figure 5.1). By keeping frequency close to 50Hz other non-LFAS providing generators are not required

possible to accurately provide only the approved requirement, but this value is used as a targeted minimum. It is important to note that the frequency performance is not only a function of LFAS quantity, but also a function of responsiveness of LFAS providing generators and how quickly they move to correct the frequency and bring it back to the target range. All LFAS providing generators have to meet a minimum performance standard, however are remunerated based on quantity provided. Faster and more flexible machines which are often assigned to LFAS perform better and the probability of the frequency being outside the target range at the time the measurement is made will be much smaller; hence a better frequency performance.

Payments are made for up to a maximum of the previously approved requirement of ± 72 MW.

3.2 Spinning Reserve Service

When bringing a generator onto the system, large amounts of Spinning Reserve are made available. AEMO must ensure that there is sufficient generation or interruptible load capacity on-line to meet the 70% requirement from plant that is required to respond. Due to balancing dispatch quantities over time and the make up of the plant providing Spinning Reserve, there will generally be more spinning reserve provided than that required. However only the requirement will be paid for. Following a frequency decline, other on-line generators not required to provide Spinning Reserve that are not at maximum output will also provide initial response to the event via their governor response as required by the Technical Rules.

3.2.1 Quantity of Spinning Reserve Service provided

The average SRS enabled from 1 May 2016 to 30 April 2017 was as follows:

- 296 MW (inclusive of 'LFAS raise'[8]) during the Peak[9] Trading Intervals; and
- 283 MW (inclusive of 'LFAS raise') during the Off-Peak Trading Intervals.

to respond as often thus reducing wear and tear, provides greater certainty of performance for system disturbances (eg if below 49.8Hz and generator trips then more likely to have load shedding) and synchronous equipment is designed to operate at 50Hz.

[8] Only LFAS capable of providing Spinning Reserve was included in this calculation.

[9] The WEM Rules define a Peak Trading Interval as a Trading Interval occurring between 8 AM and 10 PM, and an Off-Peak Trading Interval as a Trading Interval occurring between 10 PM and 8 AM.

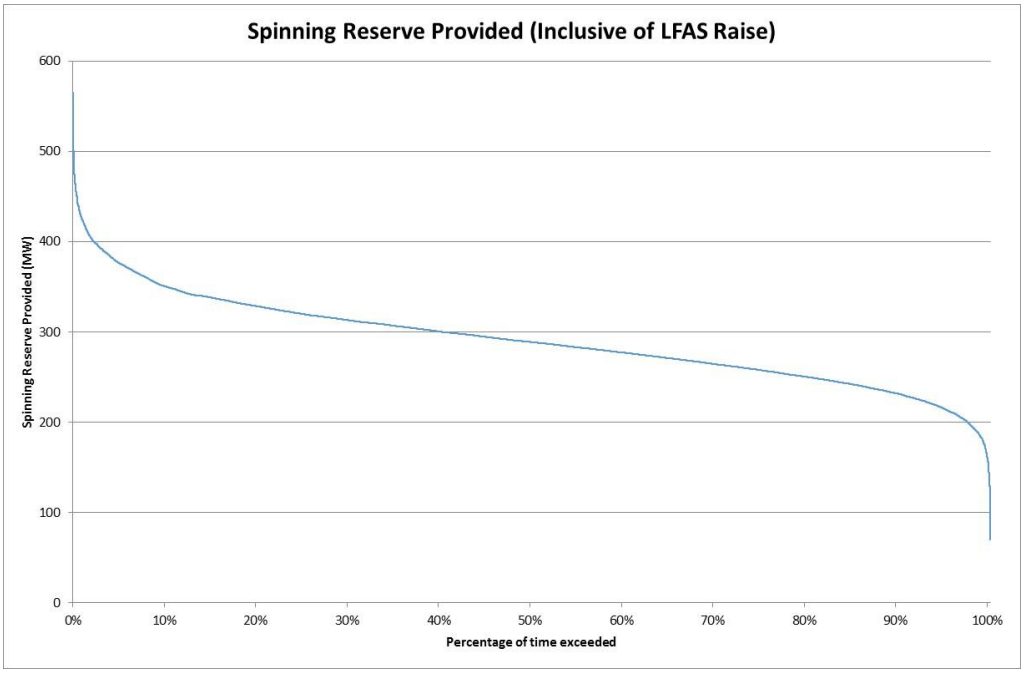

Figure 4: Spinning Reserve Service enabled from May 2016 – April 2017

3.2.2 Adequacy of quantities enabled

The 2016 Ancillary Services report specified SRS requirements at section 4.3.3 of the report as:

The greater of:

- *The largest generation event is the loss of Collie Power Station as the largest unit on the SWIS with a maximum generated output of 340MW. This normally sets the spinning reserve demand and so, the maximum spinning reserve level that is normally required is anticipated to be 0.7 multiplied by 340MW which is approximately 240MW; or*

- *The largest network event is the loss of a transmission line when a power station is only being supplied by a single line. The largest instance of this is when Bluewaters Terminal is supplied by either the MU-BLW 91 or BLW-SHO 91 line. A forced outage of this line would result in the loss of about 430MW if both Bluewaters generators were dispatched at their full output whilst one of these transmission lines was undergoing a planned outage. This would set the spinning reserve demand for such a network event to be 0.7 multiplied by 430MW which is 301MW. Normally however co-ordinated network and generator planned outages make this a rare event."*

While the actual amount of Spinning Reserve required varies depending on the prevailing single largest contingency at the time, the average amount provided was above the maximum expected requirement of 240 MW. This requirement was met for 86% of the time.

AEMO considers that adequate Spinning Reserve was made available.

3.3 Load Rejection Reserve Service

When a generator providing LRRS is on line, it will have the capability to reduce its output when the frequency increases. The capacity to provide load rejection considers the current output and the minimum stable load the generator can reach, where applicable considering the number of mills in service. The requirement to actively manage the LRRS provided in real time is typically only at low system load levels when generators are already at their minimum output with limited ability to reduce

further without taking additional actions. Outside of these times, load rejection is naturally available through a generator's ability to reduce their output.

3.3.1 Quantity of Load Rejection Reserve Service

The average LRRS provided during the period from 1 May 2016 to 30 April 2017 was 304 MW during Peak Trading Intervals and 189 MW during Off-Peak Trading Intervals. This met the requirement of 120 MW.

The distribution of LRRS provided during this period is shown in Figure 5 below.

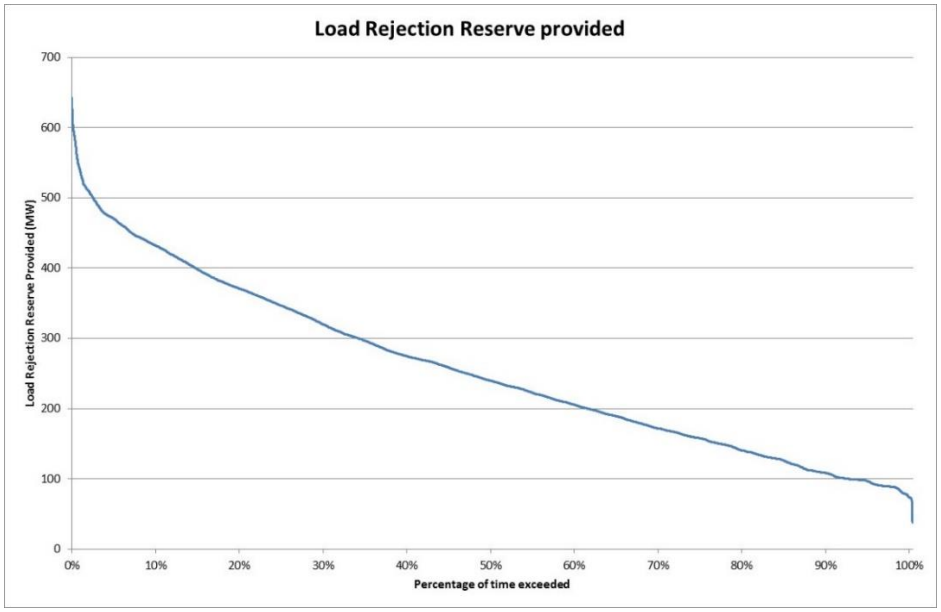

Figure 5: LRRS provided from May 2016 to April 2017

3.3.2 Adequacy of quantities provided

The requirement from the 2016 Ancillary Service report was to provide 120 MW of LRRS. This was met 86% of the time. As indicated in section 2.3.1, AEMO may relax the requirement by up to 25%.

The LRRS requirement aims to meet the standard; after a single contingency event, frequency is to be maintained below 51 Hz. No over-frequency events above 51 Hz were recorded in this time period despite loss of load in excess of 120 MW.

3.4 Dispatch Support Service

Synergy is contracted to provide DSS under an existing Ancillary Services Contract. The DSS quantities provided from 1 May 2016 to 30 April 2017 and comparative information for 1 May 2015 to 30 April 2016 are set out in Table 2.

Table 2: Usage of DSS contracts from May 2016 – April 2017

Dispatch Support Facility	1/5/2016 – 30/4/2017	1/5/2015 – 30/4/2016
Mungarra Gas Turbines	4,279 MWh	17,122 MWh
Kalgoorlie Gas Turbines	0	1,437 MWh

There was a substantial reduction in Mungarra DSS usage due to the commissioning of the Three Springs – Neerabup 330 kV line in August 2015. There was no need to run the Kalgoorlie Gas Turbines for forced or planned outages in the Eastern Goldfields during the year.

3.5 System Restart

AEMO has existing Ancillary Service Contracts for System Restart as set out in Table 3.

Table 3: Status of System Restart Ancillary Service Contracts

Market Participant	Facility	Contract Expiry	Sub-network Area
Synergy	Kwinana GT1	30 June 2018	South Metro
Synergy	Pinjar GT3 and Pinjar GT5	30 June 2021	North Metro
Perth Energy	Kwinana GT1 (Kwinana Donaldson	30 June 2021	South Metro

No System Restart Services were used in 2016/17.

3.6 Combined effect of LFAS, SRS and LRRS

The combined effects of LFAS, SRS and the LRRS are to assist in meeting the frequency variation operating standard contained in clause 2.2.1 of the Technical Rules. The specific criteria which need to be met are:

Frequency Variations

(a) The nominal operating frequency of the power system is 50 Hz.

(b) The accumulated synchronous time error must be less than 10 seconds for 99% of the time.

(c) The frequency standards for the power system are summarised in Table 2.1.

The criteria relevant to Ancillary Services provision are set out in Table 4 below.

Table 4: Extract of Table 2.1 of Technical Rules

Condition	Frequency range	Requirement
Normal operating range of SWIS	49.8 Hz to 50.2 Hz	99% of the time
Single contingency event	48.75 Hz to 51 Hz	Return to normal range within 15 minutes and for over frequency events below 50.5 Hz within 2 minutes.

Tables 5 and 6 below confirm that all these requirements were met. Figure 5 illustrates the distribution of “instantaneous” frequency measurements for the year. Indications at 49.5 Hz include all values below 49.5 Hz. The frequency was within the 49.80 – 50.20 Hz band 99.99% of the time.

Table 5: Time error performance May 2016 – April 2017

Month	% of time less than 10 seconds
May 2016	99.48
Jun 2016	99.99
Jul 2016	100.00
Aug 2016	99.49
Sep 2016	100.00
Oct 2016	99.97
Nov 2016	100.00
Dec 2016	100.00
Jan 2017	100.00
Feb 2017	100.00
Mar 2017	100.00
Apr 2017	100.00

Table 6: Frequency performance over full range - May 2016 to April 2017

Month	Time within 49.8 – 50.2 Hz	Average Frequency (Hz)
May 2016	100.00%	50.00
Jun 2016	100.00%	50.00
Jul 2016	100.00%	50.00
Aug 2016	100.00%	50.00
Sep 2016	99.98%	50.00
Oct 2016	99.98%	50.00
Nov 2016	100.00%	50.00
Dec 2016	99.99%	50.00
Jan 2017	99.99%	50.00
Feb 2017	100.00%	50.00
Mar 2017	99.98%	50.00
Apr 2017	100.00%	50.00

Figure 6 illustrates the distribution of “instantaneous” frequency measurements for the year. Indications at 49.5 Hz include all values below 49.5 Hz. The frequency was within the 49.8–50.2 Hz band 99.99% of the time.

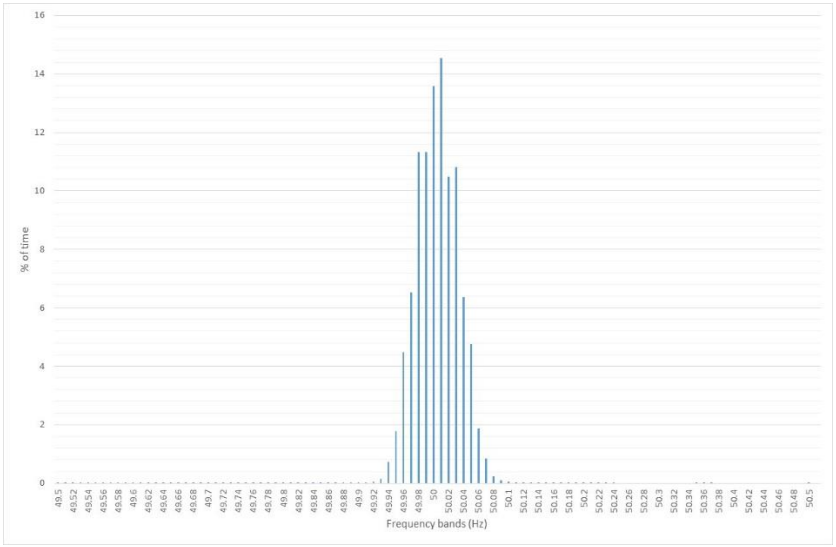

Figure 6: Instantaneous Frequency distribution measurements

4. COST OF ANCILLARY SERVICES IN THE PRECEDING YEAR (2016/17)

Clause 3.11.11 (b) of the WEM Rules requires this report to include the total cost of each Ancillary Service category provided in the preceding year.

The cost of each Ancillary Service as calculated and collected by AEMO for 1 April 2016 to 31 March 2017 is set out in Table 7 with comparative figures from 1 April 2015 to 31 March 2016.

Table 7: Historical cost of Ancillary Services

ANCILLARY SERVICE	WEM Rule	1/4/2016 – 31/3/2017	1/4/2015 – 31/3/2016
LOAD FOLLOWING			
Capacity Total	9.9.2(q)	8,714,121	8,733,763
Availability			
• Availability raise	9.9.2(a)	18,227,331	12,052,038
• Availability lower	9.9.2(b)	36,201,041	18,973,393
• Availability Total	9.9.2 (d)	54,428,373	31,025,431
LOAD FOLLOWING TOTAL		63,142,494	39,759,195
SPINNING RESERVE[10]	9.9.2 (f)	16,915,504	14,514,071[11]
CONTRACT LOAD REJECTION	9.9.4 (a)[12]	-	-
CONTRACT SYSTEM RESTART[13]	9.9.4 (a)	877,971	485,245
CONTRACT DISPATCH SUPPORT	9.9.4 (a)	423,313	2,097,812
RESIDUAL COST_LRD COST[14]	9.9.1	716,324	44,989
TOTAL		82,075,608	56,901,314

LFAS costs in 2016/17 have significantly increased from 2015/16 costs,. As LFAS is provided through a market mechanism, the price paid depends on the prices offered by Market Participants, which have increased substantially. This may be related to increase in gas prices or other factors unknown to AEMO. There has been no change to volumes paid in relation to this service.

A noticeable reduction was achieved in DSS costs due to the reductions as indicated in section 3.4

[10] Spinning Reserve costs include services provided by Synergy and services provided under other Ancillary Service Contracts.
[11] There is a reduction of $96 290.04 in this value compared to the 2016 report due to a settlement adjustment.
[12] AEMO did not enter into any Load Rejection contracts.
[13] The Contract System Restart costs include the contract costs for Synergy and other providers.
[14] The Residual Cost_LRD Cost refers to payments to Synergy as the default provider of Ancillary Services, for services not contracted. From 2016/17 this includes payment for Load rejection reserves.

5. ANCILLARY SERVICES REQUIREMENTS AND PLAN FOR 2017/18

Clause 3.11.11(c) of the WEM Rules requires this report to include the Ancillary Services Requirements for the coming year and the Ancillary Services plan to meet those requirements.

This section details for each type of Ancillary Service:

- the requirements for the 2017/18 year for that type of Ancillary Service, where "Requirement" is interpreted to mean the quantities needed to achieve the standards discussed in section 2 of this report; and
- the Ancillary Service plan for each Ancillary Service type, being the method of procurement through contract, established market or other mechanism provided for in the WEM Rules. Related future plans concerning the service are also detailed.

Historically, determination of appropriate quantities of Ancillary Services, particularly for LFAS, SRS and LRRS, has been somewhat empirical with the execution of existing requirements resulting in better-than-standard performance. To ensure these minimum requirements are met consistently, the actual provision of the Ancillary Services is normally higher. In addition, the actual provision of these Ancillary Services has been for greater quantities than those required due to the way in which these services are made available. However, payments are only made according to the approved requirements resulting in no additional costs being incurred by Market Participants.

5.1 Load Following Ancillary Service

5.1.1 LFAS Requirement for 2017/18

The last approved Ancillary Services report specified a general LFAS requirement of ± 72 MW. This was historically determined as equivalent to the operating range of two HEGTs or Frame 9 generators. This level was set based on observations that this level was enough to maintain the combined frequency standard of 99.9%.

AEMO's experience and observations that ± 72 MW is adequate, has not changed since the last approved Ancillary Services report. Despite the further integration of rooftop PV within the SWIS, frequency control has been maintained with this 72 MW of LFAS. AEMO doesn't anticipate any significant changes, such as significant increase in intermittent large or small scale solar or fluctuating loads, on the system occurring in the next year. Thus the general LFAS requirement for 2017/18 is proposed to remain at ± 72 MW.

Outside of the general requirement, increased need for LFAS occurs when commissioning generators need to perform ramp up/down tests. The general level may also be relaxed in accordance with clause 3.10.5 of the WEM Rules, which states:

> *The level of Load Following Service, Spinning Reserve Service and Load Rejection Reserve Service may be reduced:*
>
> *(a) following relevant contingencies; or*
>
> *(b) where System Management cannot meet the standard without shedding load, provided that System Management considers that reducing the level is not inconsistent with maintaining Power System Security.*

5.1.2 LFAS Plan

The WEM Rules established an LFAS Market that currently consists of two competing providers. LFAS is sourced through the LFAS Market in accordance with the LFAS rules. The provision of these

services through the market to date has been sufficient to meet the LFAS requirement. These services will continue in 2017/18.

5.2 Spinning Reserve Service

5.2.1 Spinning Reserve Requirement for 2017/18

AEMO understands that there is no new large generator or network configuration proposed that will change the "Single Contingency Event" from the previously approved report. The approach of catering for 70% of the largest single contingency event (as described in section 2.2 of this report) will be continued. Thus the Spinning Reserve requirement for 2017/18 will be the greater of:

- the largest generation event, that is, the loss of Collie Power Station as the largest unit on the SWIS with a maximum generated output of 340 MW. This normally sets the Spinning Reserve standard so the maximum Spinning Reserve level normally required is 70% of the loss of Collie Power Station or approximately 240 MW; or
- the largest Network event, that is, the loss of a Transmission line when a power station is only being supplied by a single line. The largest instance of this is when both Bluewaters Facilities are online at maximum output and Bluewaters terminals are being supplied by either the Muja Bluewaters 330 kV or Bluewaters Shotts 330 kV line only. The Spinning Reserve requirement for such a Network event would be 70% of 430 MW or 301 MW. The probability of this event occurring is rare because planned Network and generator Outages are coordinated.

The actual Spinning Reserve requirement will vary in real time depending on the dispatch and commissioning plans of the various Market Participants and Network Outages.

The general level may also be relaxed in accordance with clauses 3.10.2(c) and (d) of the WEM Rules, which states:

> *The standard for Spinning Reserve Service is a level which satisfies the following principles:*
>
> *…*
>
> *(c) the level may be relaxed by up to 12% by System Management 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 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.*

5.2.2 SRS Plan

The WEM Rules provide that Synergy (through its Balancing Portfolio) is the default provider of SRS.[15] Its portfolio of Scheduled Generators is adequate to provide the SRS requirement.

The WEM Rules further allow AEMO to contract with alternate providers where this provides a less expensive alternative to Synergy.[16] In this regard, Simcoa has had an existing contract for 42 MW of SRS in place since market commencement. In the 2014/15 financial year, a competitive process procured SRS at a discount to the administered price. Two short-term contracts of 13 MW each were awarded to Bluewaters and Simcoa. These were subsequently extended to 30 June 2017. Further extensions are being contemplated. Also being contemplated by AEMO is the possibility of increasing the quantity that non–Synergy providers could efficiently provide, as well as a new tender process to allow other non-Synergy suppliers to bid to provide SRS Ancillary Services.

[15] See clause 3.11.7A of the WEM Rules.
[16] See clause 3.11.8(b) of the WEM Rules.

The introduction of new generation, particularly through the 'Generation Interim Access Framework', may change the relative magnitude of the single largest contingency event on the Network. As an example, theoretically, more than 430 MW of generation could be lost as a result of a single contingency. If the Generation Interim Access Framework is implemented, a review will be required to determine if the current approach is still appropriate. If any changes are required, AEMO will seek ERA approval through the rule change process under clauses 2.5 to 2.8 of the WEM Rules.

5.3 Load Rejection Reserve Service

5.3.1 LRRS Requirement for 2017/18

The requirement for LRRS is determined by the amount of load lost during a Network fault. The loss of Load may be due to the severe voltage dip, which in turn causes customer Loads to automatically disconnect. It may also be caused by disconnection of a radial part of the Network, reducing the Load on the remaining interconnected system.

From observations of Load reductions that have occurred, as well as a forecast of the largest Network contingency that could result in loss of Load, a level of 120 MW of LRRS is derived. This value was approved in the 2016 Ancillary Services Report[17] and AEMO believes that nothing has changed on the system that would require a need to change this figure. . As indicated in section 3.3 of this report, there is normally more than 120 MW of LRRS available. However this is the target minimum requirement to prevent an over-frequency occurring considering a likely loss of load contingency.

5.3.2 LRRS Plan

The Synergy Balancing Portfolio is the default provider of LRRS and is in itself adequate to provide this Ancillary Services Requirement.

5.4 Dispatch Support Service

5.4.1 DSS Requirement for 2017/18

DSS is generally developed on a case-by-case basis. There is an existing DSS contract with Synergy for Out of Merit dispatch in the Kalgoorlie and Geraldton (Mungarra Gas Turbines) areas, particularly during transmission Outages. The DSS contract compensates Synergy for this Out of Merit dispatch in lieu of any current alternative mechanism.

5.4.2 DSS Plan

The support required under the Synergy DSS contract is not easily predictable as it depends mainly on the transmission Outage requirements and potential Load increases in the area. AEMO does not expect a substantial increase in the use of this service from the current levels unless there are long-duration Network Outages.

The Synergy DSS contract for both West Kalgoorlie and Mungarra is due to expire on 1 July 2018. Synergy has decided to retire this plant capacity and analysis is underway to determine if these services are still required and if so by what means.

[17] http://www.aemo.com.au/-/media/Files/Electricity/WEM/Data/System-Management-Reports/2016/2016-Ancillary-Services-Report.pdf Section 4.4.3

5.5 System Restart

5.5.1 System Restart Requirement for 2017/18

AEMO requires that there should be at least three generating stations that can start up under black system conditions and energise the rest of the system. Three services are required to ensure that a service is available to cover one Planned Outage and one Forced Outage amongst the service providers to meet the desired reliability target.

In addition, the black start generators should not be in the same location, to mitigate the risk of common failure in the same geographic or electrical area (sub-networks). The System Restart[18] requirement is based on having restart capability in each of the three electrical sub-networks, being North Metropolitan, South Metropolitan and South Country.

Without this diversity, the risk of a generator being unable to start for extended periods is increased due to it being dependant on supply from a remote black start location where the restart path is subject to Network failures. This is particularly the case for generators with long start-up times in the South Country should they need to be started from metropolitan black start providers. If the South Country generators are not quickly restored, they will enter a warm or cold state resulting in an inability to be restarted for several hours. This will cause considerable delay to total system restoration.

This scenario has arisen previously when adverse weather conditions caused a failure of the 330kV Network between Perth and Collie in the morning that was not able to be restored until the weather lifted around midday. This is considered a Credible Contingency Event.

It should be noted that certain generators with self-start facilities, such as those at Kalgoorlie, cannot restart the rest of the system due to Network constraints, and are therefore not considered for system restart.

Of further note is that there is currently no black start capability in the South Country, as previous attempts to procure a service in that area have been unsuccessful.

5.5.2 System Restart Plan

The status of the three contracts for SRS is as indicated in Table 3 (section 3.5). As has been done previously, these three facilities are planned to be tested during this year. Contract negotiations are currently underway for a new facility in the South Country expected to be available in the first half of 2019.

[18]Available at: http://www.aemo.com.au/-/media/Files/Electricity/WEM/Security_and_Reliability/Ancillary-Services/2016/SYSTEM-MANAGEMENT-STANDARD---SYSTEM-RESTART-SERVICES.pdf.

5.6 Summary of General Requirements and Plans

Table 8: Summary of Ancillary services requirements and plan for 2017/18

Ancillary Service	Requirement	Summary of provision for 2017/18
Load Following AS	± 72 MW	LFAS Market.
Spinning Reserve AS	70% of largest generator or network contingency resulting in loss of generation	Existing 42 MW contract expires in September 2023. Extend contracts with existing providers for 26 MW. Synergy is the default provider of remaining amount.
Load Rejection Reserve AS	120 MW	Synergy will provide this service.
Dispatch Support Service	Case by case basis	Existing contracts continue until June 2018.
System Restart Service	Three required in diverse network areas	Currently three contracts in place. One expires June 2018. Contract negotiations underway for additional service in South Country.

APPENDIX 1

Technical Rules Table 2.1 Frequency Operating Standards for the South West Interconnected Network

TECHNICAL RULES FOR THE SOUTH WEST INTERCONNECTED NETWORK

SECTION 2 – TRANSMISSION AND DISTRIBUTION SYSTEM PERFORMANCE AND PLANNING CRITERIA

Table 2.1 *Frequency operating standards* for the *South West Interconnected Network*.

Condition	***Frequency* Band**	**Target Recovery Time**
Normal Range:		
South West	49.8 to 50.2 Hz for 99% of the time	
Island[1]	49.5 to 50.5 Hz	
Single contingency event	48.75 to 51 Hz	Normal Range: within 15 minutes. For over-*frequency* events: below 50.5 Hz within 2 minutes
Multiple *contingency event*	47.0 to 52.0 Hz	Normal Range within 15 minutes For under-*frequency* events: (a) above 47.5 Hz within 10 seconds (b) above 48.0 Hz within 5 minutes (c) above 48.5 Hz within 15 minutes. (d) For over-*frequency* events: (e) below 51.5 Hz within 1 minute (f) below 51.0 Hz within 2 minutes (g) below 50.5 Hz within 5 minutes

Note:

An island is formed when the *interconnection* between parts of the *interconnected transmission system* is broken, for example if the *interconnection* between the Goldfields region and remainder of the power system is broken.