Power System Operations Working Group –
Meeting 1b (follow up):

Ancillary Services and Frequency Operating Standards

October 15th 2018

Agenda

1. Follow on from meeting #1 – WEM FOS
   a) Items raised during the previous meeting
   b) Corrections identified
   c) Remaining items not covered previously
2. General discussion

WEM FOS

Frequency Operating Standards for the WEM (actions and corrections)

WEM FOS – items from last meeting

Clarification of principles (proposed amendments in red):

- The design of the revised WEM/FOS should:
- Be consistent with a move towards co-optimised security constrained ancillary services and economic dispatch.
- Adopt a simplified approach where possible with regards to the wording of the WEM FOS
- Maintain consistency with the current TR frequency settings, adapted to fit within the proposed FOS structure.
- Be clear in how it must apply to the power system and any islands in the SWIS.
- Ensure definitions are technology neutral to the extent possible.
- Include recommendations where appropriate to ensure a robust and effective review and governance cycle

WEM FOS – items from last meeting

An additional performance target for contingency events:

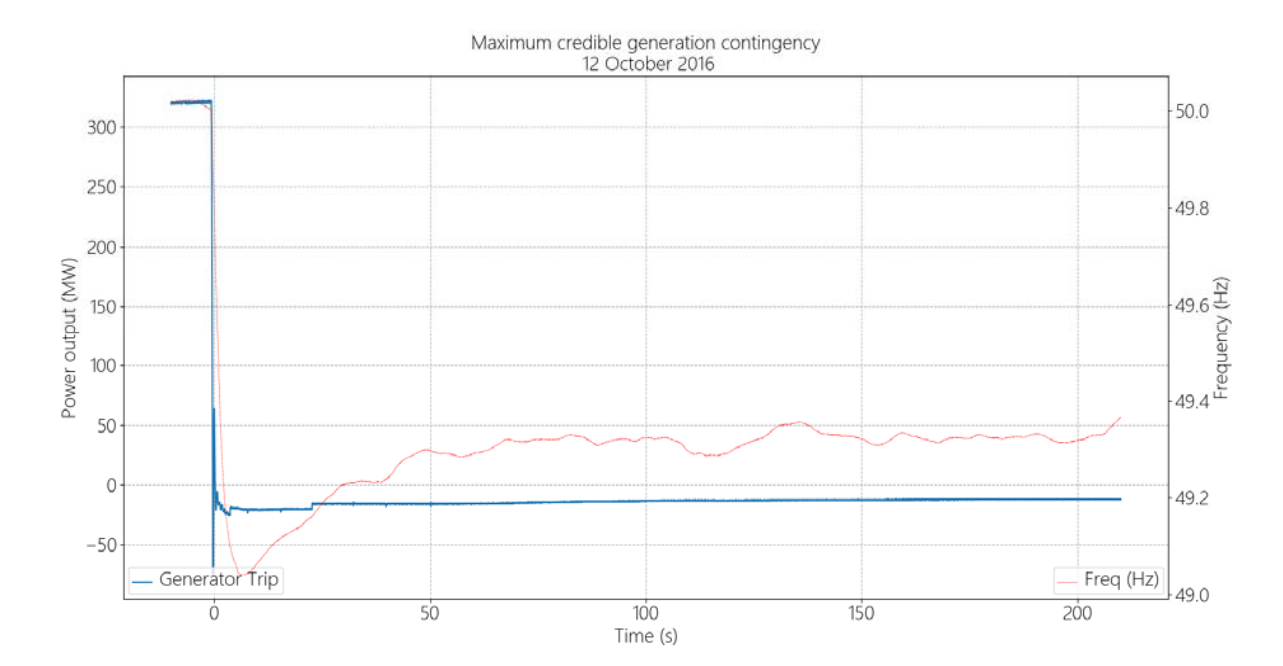
- A query was raised in meeting 1 around whether consideration should be given to adding a lower stabilisation target to the Credible Contingency Event category (non-island):

Condition	Containment	Stabilisation	Recovery
Accumulated Time Error	<10 seconds for 99% of the time over any 30 day period		
No Credible contingency event	[49.70 to 50.30 Hz] 49.8 to 50.2 Hz 99% of the time over any 30 day period	49.8 to 50.2 Hz within 5 min	
Credible contingency event	48.75 to 51 Hz	Below 50.5 Hz within 2 min **Above 4x.x Hz within y min**	49.8 to 50.2 Hz within 15 min
Separation event	48.75 to 51 Hz	Below 50.5 Hz within 2 min	49.8 to 50.2 Hz within 15 min
Multiple contingency event	47 to 52 Hz	Above 47.5 Hz within 10 seconds Below 51.5 Hz within 1 min Below 51Hz within 2 min 48.0 Hz to 50.5 Hz within 5 min	49.8 to 50.2 Hz within 15 min

WEM FOS – items from last meeting cont...

An additional performance target for contingency events:

Below is a frequency trace from a typical contingency event occurring around peak time, where a large generator has tripped



WEM FOS – items from last meeting cont...

An additional performance target for contingency events:

- We have reviewed some previous event data and considered the impact of this. Based on existing Spinning Reserve criteria, if all 70% of the available reserve is consumed (typical for events occurring over the peak), there is no ability to significantly recover frequency until manual re-balancing can occur (consistent with the current Ready Reserve standard also to recover Ancillary Services *after* 15 minutes)
- Timeframes for rebalancing depending on available plant, startup times and where we are within the current dispatch cycle which means it is not possible to reliably predict "when" frequency will be back above a particular point again in the current dispatch regime
- However it should also be noted that there have not been any particular issues observed or identified by participants that would indicate an urgent need to address this. On the basis, the recommendation for the PSOWG to consider is:

Recommendation

- Initially retain the original recommendation, which does include the adoption of a lower stabilisation target for the WEM FOS
- This will allow early adoption of the framework within the current dispatch regime without significantly impacting dispatch and ancillary service arrangements and costs
- Look to include this as part of the first WEM FOS review for possible introduction with a move to full SCED and 5-min dispatch

WEM FOS – items from last meeting

Islands - definition:

- Update to Recommendation 10 per comments from previous meeting:

Recommendation 10

Create a new definition of an 'island' as follows:

"*Island*: means a part of the *SWIS* that includes *generation systems* (or other energy sources), *networks* and *load*, for which all of its alternating current network connections with other parts of the *SWIS* have been disconnected, provided that the part:

is smaller than the rest of the *SWIS* that it has disconnected from, i.e. does not include more *generation* (or other energy sources) and *load* (determined by on-line quantities before dis-connection); and

contains active *generation* (or other energy sources) capable of supplying ~~the~~ *load* within the part of the SWIS that has been disconnected.

Provide separate prescription on the frequency operating standards that are to apply to an island containing only distribution networks, where the island was formed by a contingency event in relation to a distribution element. See Recommendation 13 below.

Provide a recommendation to the Public Utilities Office that consideration is given as to how Ancillary Service provisions may need to be modified to cater for *Islands*

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WEM FOS – corrections

Some items have also been discovered in the issues paper that need correction/clarification:

- In reviewing the material following the first PSOWG meeting, some items were identified that require correction or clarification to ensure they meet the stated intent. The following items are presented to the PSOWG as proposed amendments.

WEM FOS – corrections

- The definition of "recover" in relation to the Recovery range in the WEM FOS. The previous proposal could be read to result in reducing the allowed time to 14 minutes to return to the required range rather than the intended 15 minutes (per the current TR). Revised proposal:

recover means the time at which the *system frequency* returns to the

required range, provided it does not go outside that range at any time over the following 1 minute.

- The definition of "Separation Event" in relation to the formation of islands. Subsequent discussion identified an opportunity to simplify the wording to improve clarity:

means either a contingency event, ~~or~~ planned or unplanned switching that results in the formation of an island

WEM FOS – corrections

- The Definition of "Multiple Contingency Event". In reviewing this we realised that the previous timeframe of 5 minutes (same as the NEM definition) implies that the power system will be recovered sufficiently after 5 minutes and there will be sufficient levels of Ancillary Services available to cater for the next contingency event.
- While in the NEM this may be the case given dispatch arrangements and Ancillary Service availability, it will almost certainly not be fit for purpose for the WEM. Instead we propose to make this 15 minutes to align with the timeframe allowed to return to normal following a contingency event.

means either a contingency event other than a credible contingency event,

a sequence of credible contingency events within a period of 15 minutes, or a further separation event in an island.

WEM FOS – corrections

- Performance requirements for a "Multiple Contingency Event". While the performance standards indicate timeframes for stabilisation and recovery, the NEM FOS also indicates that reasonable endeavours should be used to achieve these during these extreme circumstances. This was discussed briefly in the previous PSOWG meeting and it is proposed that this be appropriate to apply in the WEM FOS

Condition	Containment	Stabilisation	Recovery
Accumulated Time Error	<10 seconds for 99% of the time over any 30 day period		
No Credible contingency event	[49.70 to 50.30 Hz] 49.8 to 50.2 Hz 99% of the time over any 30 day period	49.8 to 50.2 Hz within 5 min	
Credible contingency event	48.75 to 51 Hz	Below 50.5 Hz within 2 min	49.8 to 50.2 Hz within 15 min
Separation event	48.75 to 51 Hz	Below 50.5 Hz within 2 min	49.8 to 50.2 Hz within 15 min
Multiple contingency event	47 to 52 Hz (reasonable endeavours)	Above 47.5 Hz within 10 seconds Below 51.5 Hz within 1 min Below 51Hz within 2 min 48.0 Hz to 50.5 Hz within 5 min (reasonable endeavours)	49.8 to 50.2 Hz within 15 min (reasonable endeavours)

Frequency Operating Standards for the WEM (continuation)

WEM FOS – recommendations

Protected events:

- A 'protected event' is defined as:

> "A protected event means a *non-credible contingency event* that the *Reliability Panel* has declared to be a *protected event* under clause 8.8.4, where that declaration has come into effect and has not been revoked. Protected events are a category of *non-credible contingency event*"

- These are intended to be very specific, non-credible contingency event that has been categorised as high enough impact by the AEMC Reliability Panel to warrant special treatment.

Within the SWIS, looking at both the non-island and islanded WEM FOS recommendations covering multiple contingencies, and taking into consideration the additional work to be done around the classification framework for *credible contingencies*, it is perhaps difficult to see where there would be a need for a protected event definition currently

Recommendation 14

At this time, do not proceed with the definition of *protected event* and associated frequency settings. However, recommend that once the appropriate governance framework is established, that this be one of the first items to review and include if deemed necessary in the future.

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WEM FOS – recommendations

Scarcity of supply - NEM:

- The NEM FOS defines 'supply scarcity' as:

  "…the condition where load has been disconnected either manually or automatically, other than in accordance with dispatch instructions or service provision, and not yet restored to supply".

- The NEM FOS uses this definition to apply a separate set of frequency settings under this condition
- During these types of events the table effectively reduces the frequency standards to widest possible range to cater for further contingency events.

Table A.1.3 NEM Mainland Frequency Operating Standards – during supply scarcity

Condition	Containment	Stabilisation	Recovery
No contingency event or load event	49.5 to 50.5 Hz		
Generation event, load event or network event	48 to 52 Hz (Queensland and South Australia) 48.5 to 52 Hz (New South Wales and Victoria)	49 to 51 Hz within 2 minutes	49.5 to 50.5 Hz within 10 minutes
Protected event	47 to 52 Hz	49.0 to 51.0 Hz within 2 minutes	49.5 to 50.5 Hz within 10 minutes
Multiple contingency event or separation event	47 to 52 Hz (reasonable endeavours)	49.0 to 51.0 Hz within 2 minutes (reasonable endeavours)	49.5 to 50.5 Hz within 10 minutes (reasonable endeavours)

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WEM FOS – recommendations

Scarcity of supply – WEM Rules:

A similar principle currently applies in the WEM in relation to the way that Ancillary Service requirements are defined:

WEM Rule 3.10.2 currently allows for the Spinning Reserve Service to be relaxed by up to 12% where there is a shortfall in SRAS that is anticipated to last less than 30 minutes. If this relaxation were not allowed, System Management could be faced with a situation requiring it to issue load shed directions to enable capacity from energy to be re-allocated for frequency Ancillary Services (which is not an effective outcome).

WEM Rule 3.10.2 also allows for the Spinning Reserve Service to be relaxed by up to 100% where all reserves are exhausted. If the relaxation were not allowed, System Management could be faced with a situation in which a multiple contingency event has exhausted all available frequency Ancillary Services, requiring it to issue load shed directions to recover Ancillary Services before the system has re-stabilised. Again, this is not an effective outcome.

Similarly, the WEM Rules currently cater for reduced LFAS quantities during supply scarcity conditions. WEM Rule 3.10.5 allows for the level of LFAS, SRAS and LRAS to be reduced following relevant contingencies, or when System Management considers the standard cannot be met without shedding load

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WEM FOS – recommendations

Scarcity of supply:

- Rather than describing a new set of frequency standards, it could be possible to allow for "scarce" conditions within the WEM Rule drafting, e.g.
  - Link the quantities of Ancillary Services to meeting the Frequency Operating Standards
  - Allow for this to be relaxed under "scarce" conditions (adding appropriate definitions), and including a reasonable endeavours approach (similar to current WEM rules)

The recommendation for the PSOWG to consider is:

Recommendation 16

Do not adopt a 'scarcity of supply' table for the FOS.

Ensure the WEM rules are drafted appropriately to allow for scarcity conditions and to ensure there is not an undue trade-off in these conditions between energy and frequency Ancillary Services.

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WEM FOS

Frequency Operating Standards for the WEM (islands)

WEM FOS – recommendations

Intent:

To provide some clarity, the intent of the following recommendations is to ensure:

- The WEM FOS does not place unrealistic and onerous restrictions on the operation of a sub-island within the SWIS (e.g. North Country Region or Eastern Goldfields Region), but still provide some level of standard that should apply
- To provide a way of sub-categorising islands within the SWIS into an additional category for which the WEM FOS does not apply at all, e.g. for the purposes of microgrid operation or self-sustained island operation

This will help in ensuring that:

- There is clarity on what the WEM FOS applies to; and
- There is clarity within other parts of the market that reference the WEM FOS as to what else may not apply (e.g. Ancillary Service provision within a microgrid)

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WEM FOS – recommendations

Islands – performance:

- The TR FOS has very limited specification around the frequency performance requirements within an island, only a single entry
- However even though for the SWIS the separation frequency requirements are recommended to be the same as other types of events, there is merit in maintaining a separate definition such that this could be modified in the future to be a different range if need be

The recommendation for the resulting frequency band to apply in both the island that is formed following the event and in the rest of the SWIS is:

Recommendation 13

No accumulated time error to apply within an island.

Reasonable endeavours to apply

Remove the 99% / 5-minute obligation for the normal frequency range within an island

Relax timeframe to return to normal frequency operating range within the island following initial formation (as soon as practicable)

Maintain contingency event frequency band within the island but relax timeframes to return to normal frequency operating range following credible and multiple contingency events (as soon as practicable).

Within a sub-island of the SWIS, a multiple contingency event would be fairly extreme and difficult to cater for practically in terms of ancillary service provisions. Propose that the multiple contingency event frequency band within the island remains the same, but with relaxed timeframes to return to normal frequency operating range (as soon as practicable).

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WEM FOS – recommendations

Islands – performance:

It is intended that reasonable endeavours are used to meet these *frequency operating standards* for an island

Condition	Containment	Stabilisation	Recovery
No Credible contingency event	49.5 to 50.5 Hz ~~99% of the time over any 30 day period~~		
Credible contingency event	48.75 to 51 Hz	~~Below 50.5 Hz within 5 min~~	49.5 to 50.5 Hz as soon as practicable
Separation event that formed the island	48.75 to 51 Hz	~~Below 50.5 Hz within 5 min~~	49.5 to 50.5 Hz as soon as practicable
Multiple contingency event or separation event	47 to 52 Hz	~~Above 47.5 Hz within 10 seconds~~ ~~Below 51.5 Hz within 2 min~~ ~~Below 51Hz within 5 min~~ ~~48.0 Hz to 50.5 Hz within 10 min~~	49.5 to 50.5 Hz as soon as practicable

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WEM FOS – recommendations

Islands – autonomous islands:

- There are several locations within the SWIS that have historical arrangements in place whereby they are able to operate autonomously within their own islands under certain network conditions.
- Examples of this are the TransAlta network in the goldfields and large refinery operations in the South West and around Kwinana.
- In these cases, AEMO has no direct control of frequency in the island, and ongoing supply may be based on contractual arrangements (where other market customers are involved).

The recommendation is to recognise that these types of islands are not intended to be covered by the frequency operating standards:

Recommendation 15

Make it clear that the revised WEM/SWIS FOS does not apply to *Autonomous Islands*

Discuss and provide options for the consideration of the Public Utilities Office in regard to reporting and governance arrangements on *Autonomous Islands*, including:

- How an *Autonomous Island* is identified
- How an *Autonomous Island* is authorised (if required)
- The possible use of s.25 of the Electricity Act 1945 as the reference form of words for the frequency obligations that apply in an *Autonomous Island*.
- Reporting arrangements for *Autonomous Islands* (if required)

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WEM FOS – recommendations

Islands – autonomous islands, other thoughts:

- In terms of frequency standards that might apply in these islands, the Electricity Act does have a simple form of frequency requirement that could apply to "network operators" covered by the Act:

> *25. Duties as to supply of electricity*
>
> *(1) A network operator shall*
>
> *.....*
>
> *declare the system pressure and/or frequency at which the network operator proposes to supply electricity to the premises of a consumer at the position thereon where the electricity will pass beyond the service apparatus of the network operator, and maintain constantly the said pressure within the limit of ±6% and the said frequency within the limit of ±2½%.*

- Other considerations:
  - Identifying where these autonomous islands are authorised to exist (and which network operator is responsible for operating them)
    - perhaps a register on the ERA website?
  - What reporting arrangements should exist
    - perhaps an annual report outlining any "significant" deviations? E.g. where the frequency went outside of the 2.5% limit for an extended period of time, or the number of times the limit was exceeded in a year/month/etc.
    - possibly limit reporting requirements for only where there are market customers being supplied, i.e. not for companies supplying their own load (e.g. refinery sites)

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WEM FOS – other thoughts

RoCoF

- Per discussion in the Ancillary Service slides, there may be merit in introducing a "Frequency Rate of Change Limit" to the WEM FOS to allow for, and guide, Ancillary Service provisions into the future.
- A RoCoF limit would ensure that the frequency fall-off would not exceed the point at which Underfrequency Load Shed relays operate, or exceed the rate at which generators are designed to remain synchronised to the system.
- An advantage of having a specific RoCoF setting in the standard is that it can be specifically catered for in Ancillary Service design.
- The need for this will be guided by some of the GHD analysis and will be discussed at future PSOWG sessions.

Any other thoughts?

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PSO scope items

Key items of scope for the PSOWG:

- Ancillary Services
  - Analysis and review
  - Framework options
- Power System Security and Reliability
  - Frequency Operating Standards
  - Operating States
  - Credible Contingency Events
  - Power System Reliability
  - Coordination between NSPs and AEMO
- Constraints
  - Frameworks, definitions and processes
  - Library (location, form, etc)
- Planning and Forecasting
  - PASA arrangements (timeframes, forecasts, information)
  - Load and non-scheduled generation forecasting arrangements
- Outage Management
  - Outage framework
  - Outage processes
  - Commissioning
- Dispatch
  - Structure of dispatch (form of instructions, etc)
  - Signal requirements
  - Fast start inflexibility

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Thank you

Thank you very much for your attendance and thoughtful contribution

- We will endeavour to send a copy of these slides, along with notes from todays workshop out to attendees and interested parties within the next 5 business days
- Please feel free to send any other questions or thoughts to the PSOWG email inbox:

WARPSO@aemo.com.au

WEM FOS

Summaries

WEM FOS – SUMMARY

Part A – Summary of Standards:

The resultant Wholesale Electricity Market *frequency operating standards* based on the recommendations above (also set out in Part B below), are summarised in the following tables for convenience. To the extent of any inconsistency between these tables and Part B below, Part B prevails.

The following table applies to the South West Interconnected System, including within an *island* and during periods of supply scarcity during load restoration.

Wholesale Electricity Market Frequency Operating Standards – interconnected system

Condition	Containment	Stabilisation	Recovery
Accumulated Time Error	<10 seconds for 99% of the time over any 30 day period		
No Credible contingency event	[49.70 to 50.30 Hz] 49.8 to 50.2 Hz 99% of the time over any 30 day period	49.8 to 50.2 Hz within 5 min	
Credible contingency event	48.75 to 51 Hz	Below 50.5 Hz within 2 min	49.8 to 50.2 Hz within 15 min
Separation event	48.75 to 51 Hz	Below 50.5 Hz within 2 min	49.8 to 50.2 Hz within 15 min
Multiple contingency event	47 to 52 Hz (reasonable endeavours)	Above 47.5 Hz within 10 seconds Below 51.5 Hz within 1 min Below 51Hz within 2 min 48.0 Hz to 50.5 Hz within 5 min (reasonable endeavours)	49.8 to 50.2 Hz within 15 min (reasonable endeavours)

WEM FOS – SUMMARY

Part A – Summary of Standards:

Wholesale Electricity Market Frequency Operating Standards – island

It is intended that reasonable endeavours are used to meet these *frequency operating standards* for an island

Condition	Containment	Stabilisation	Recovery
No Credible contingency event	49.5 to 50.5 Hz ~~99% of the time over any 30 day period~~		
Credible contingency event	48.75 to 51 Hz	~~Below 50.5 Hz within 5 min~~	49.5 to 50.5 Hz as soon as practicable
Separation event that formed the island	48.75 to 51 Hz	~~Below 50.5 Hz within 5 min~~	49.5 to 50.5 Hz as soon as practicable
Multiple contingency event or separation event	47 to 52 Hz	~~Above 47.5 Hz within 10 seconds~~ ~~Below 51.5 Hz within 2 min~~ ~~Below 51Hz within 5 min~~ ~~48.0 Hz to 50.5 Hz within 10 min~~	49.5 to 50.5 Hz as soon as practicable

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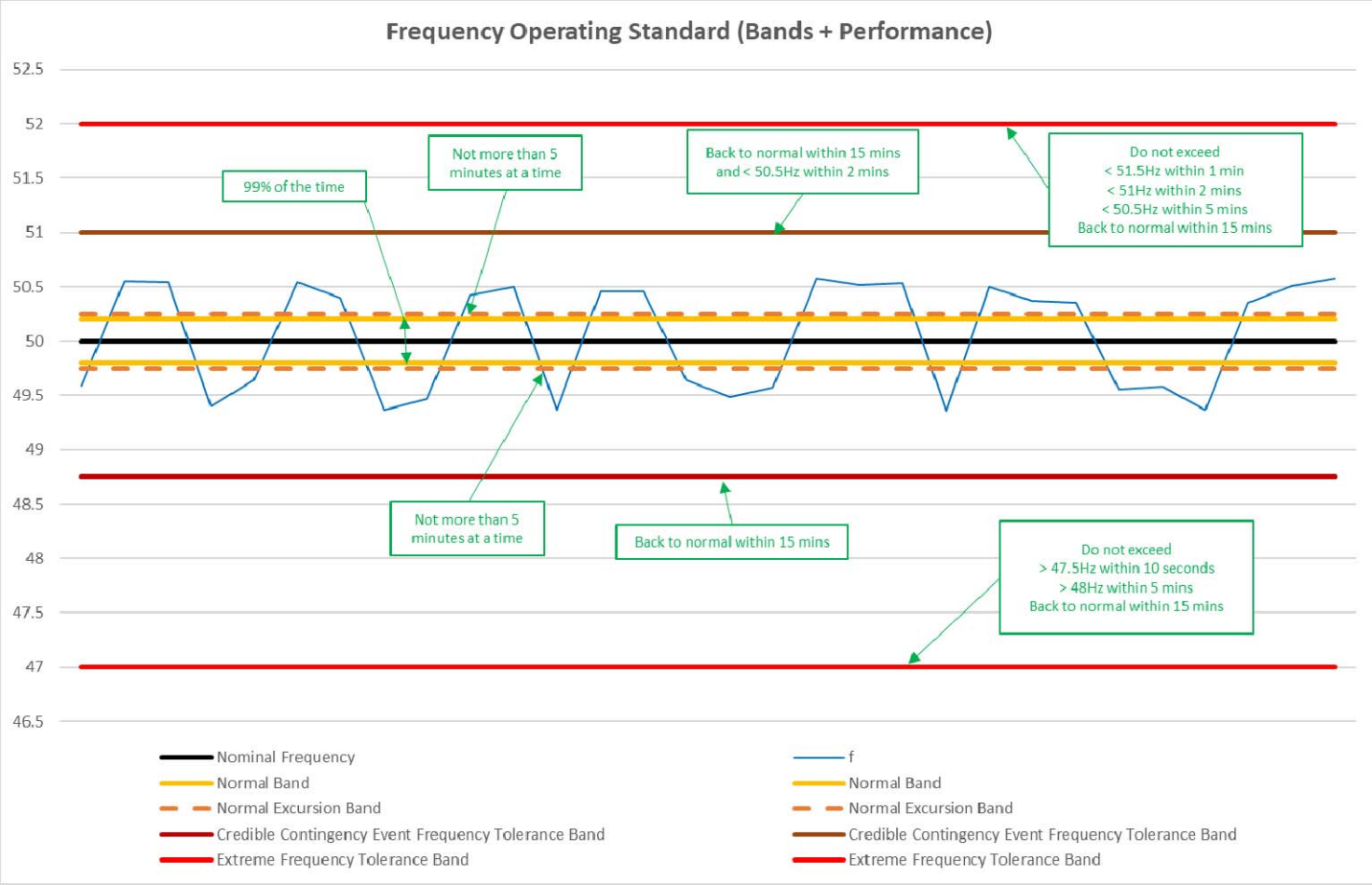
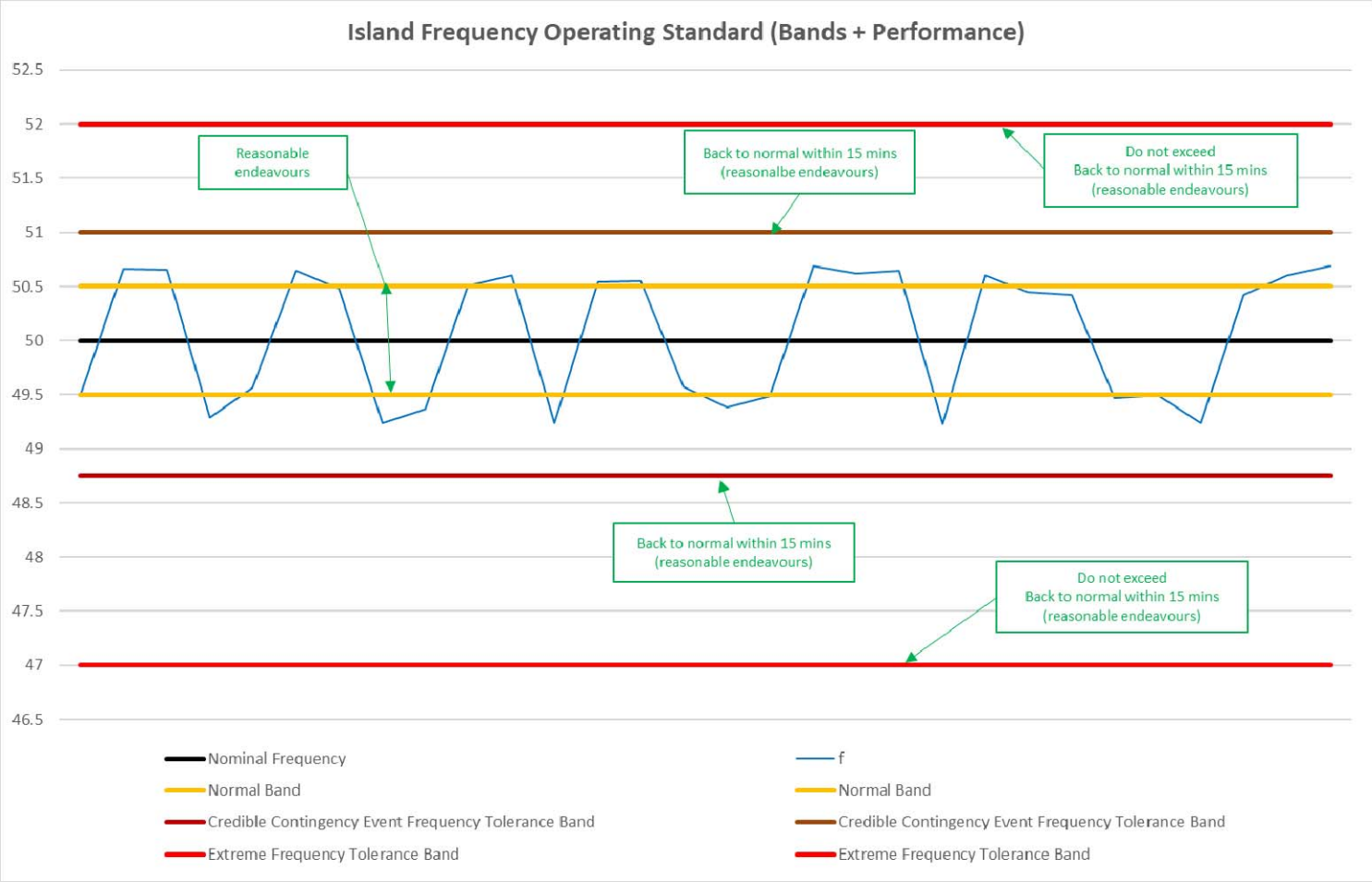
WEM FOS – SUMMARY

Proposed WEM FOS Performance Standards (SWIS):



WEM FOS – SUMMARY

Proposed WEM FOS Performance Standards (island):



WEM FOS – Complete

Part B – The Frequency Operating Standards:

For the purposes of the Wholesale Electricity Market (WEM) Rules, except during a system restart the *frequency operating standards*, for the operation of the SWIS ~~(excluding *autonomous islands*)~~ are:

~~a) except in an *island* or during a *system restart*~~, the *accumulated time error* should not exceed 10 seconds for 99% of the time over any 30-day period;

b) except as a result of a *credible contingency event*, *separation event*, or *multiple contingency event*, *system frequency* should:
   a. not exceed the applicable *normal operating frequency excursion band*; and
   b. not exceed the applicable *normal operating frequency band* for more than five minutes on any occasion; and
   c. not exceed the applicable *normal operating frequency band* for more than 1% of the time over any 30-day period;

c) as a result of a *credible contingency event*, *system frequency* should:
   a. not exceed the *credible contingency event frequency tolerance band*; and
   b. stabilise lower than 50.5 Hz within 2 minutes~~, or within 5 minutes in an *island*~~; and
   c. recover to within the *normal operating frequency band* within 15 minutes~~, or as soon as practicable in an *island*~~;

d) as a result of any *separation event*, *system frequency* should:
   a. not exceed the *island separation band*; and
   b. stabilise lower than 50.5Hz within two minutes~~, or within 5 minutes in an *island*~~; and
   c. recover to within the applicable *normal operating frequency band* within fifteen minutes~~, or as soon as practicable in an *island*~~;

e) as a result of any *multiple contingency event*, reasonable endeavours should be used to ~~*system frequency* should~~:
   a. ~~not exceed~~ maintain *system frequency* with the *extreme frequency excursion tolerance limits*; and
   b. stabilise *system frequency* above 47.5 Hz within 10 seconds; and
   c. stabilise *system frequency* lower than 51.5 Hz within 1 minute~~, or with best endeavours within 2 minutes in an *island*~~; and
   d. stabilise *system frequency* lower than 51 Hz within 2 minutes~~, or with best endeavours within 5 minutes in an *island*~~; and
   e. stabilise *system frequency* within 48Hz to 50.5 Hz within 5 minutes~~, or with best endeavours within 10 minutes in an *island*~~; and
   f. recover *system frequency* to within the *normal operating frequency band* within 15 minutes~~, or as soon as practicable in an *island*~~.

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WEM FOS – Complete

Part B – The Frequency Operating Standards:

For the purposes of the Wholesale Electricity Market (WEM) Rules, except during a system restart the *frequency operating standards*, for the operation of an *island* (excluding *autonomous islands*) are:

~~except in an *island* or during a *system restart*, the *accumulated time error* should not exceed 10 seconds for 99% of the time over any 30-day period;~~

a) except as a result of a *credible contingency event*, *separation event*, or *multiple contingency event*, reasonable endeavours should be used to:
   a. maintain *system frequency* within the applicable *normal operating band*;

b) as a result of a *credible contingency event*, reasonable endeavours should be used to:
   a. maintain *system frequency* within the *credible contingency event frequency tolerance band*; and
   b. recover to within the *normal operating frequency band* as soon as practicable;

c) as a result of any *separation event*, reasonable endeavours should be used to:
   a. maintain *system frequency* within the *island separation band*; and
   b. recover to within the applicable *normal operating frequency band* as soon as practicable;

d) as a result of any *multiple contingency event*, reasonable endeavours should be used to ~~*system frequency* should~~:
   a. ~~not exceed~~ maintain *system frequency* with the *extreme frequency excursion tolerance limits*; and
   b. recover *system frequency* to within the *normal operating frequency band* as soon as practicable.

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WEM FOS – Complete

Part B – The Frequency Operating Standards:

For the purposes of the above:

- the timing of a *credible contingency event*, *separation event* or *multiple contingency event* commences at the time AEMO records the *system frequency* in its SCADA system going outside of the *normal operating frequency excursion band* and is completed at time at which the frequency has recovered (see below)
- stabilise means when the *system frequency* has remained above or below the required level for at least 20 seconds
- recover means the time at which the *system frequency* returns to the required range, provided it does not go outside that range at any time over the following 1 minute.

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WEM FOS – Complete

Part C – Application of Rules Terms:

For the purpose of these *frequency operating standards* the following frequency band settings apply:

Frequency Operating Band	SWIS (Hz)	Island (Hz)
normal operating frequency band	49.8 to 50.2	49.5 to 50.5
normal operating frequency excursion band	[49.7 to 50.3]	[49.5 to 50.5]
credible contingency event frequency tolerance band	48.75 to 51	48.75 to 51
extreme frequency excursion tolerance limit	47.0 to 52.0	47.0 to 52.0

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WEM FOS – Complete

Part D – Definitions:

Words and phrases shown in *italics* in this document have a defined meaning associated with them. The intention is to re-use existing WEM Rule definitions where possible, however some of these terms will need to be added, and some terms are used within the WEM Rules for other similar purposes but are not defined terms within the WEM Rules. The following table lists each of the items that require definition:

Term	Meaning
accumulated time error	means, in respect of a measurement of system frequency that AEMO uses for controlling system frequency, the integral over time of the difference between 20 milliseconds and the inverse of that system frequency as recorded by AEMO via its SCADA system.
AEMO	has the meaning given to it currently in the WEM Rules: AEMO or Australian Energy Market Operator: Means the Australian Energy Market Operator Limited (ACN 072 010 327)
contingency event	has the meaning given to it in the WEM Rules (Note that this is yet to be defined in the WEM Rules but will be as part of future PSSR work)
credible contingency event	has the meaning given to it in the WEM Rules (Note that this is yet to be defined in the WEM Rules but will be as part of future PSSR work)
credible contingency event frequency tolerance band	has the meaning given to it in the WEM Rules (will have the values assigned as per the table in Part C)
distribution system	has the meaning given to it in the WEM Rules (Note that this is currently used in the WEM Rules but is not yet defined)
extreme frequency excursion tolerance limit	has the meaning given to it in the WEM Rules (will have the value assigned as per the table in Part C)
frequency operating standards	are the standards set out in Part B of this document (relocated to a relevant section in the WEM Rules)

WEM FOS – Complete

Part D – Definitions:

Term	Meaning
generation system	has the meaning given to it in the WEM Rules (Note that this is currently used in the WEM Rules but is not yet defined)
Island	means a part of the SWIS that includes generation systems (or other energy sources), networks and load, for which all of its alternating current network connections with other parts of the SWIS have been disconnected, provided that the part: a) is smaller than the rest of the SWIS that it has disconnected from, i.e. does not include more generation (or other energy sources) and load (determined by on-line quantities before dis-connection); and b) contains active generation (or other energy sources) capable of supplying the load within the part of the SWIS that has been disconnected.
island separation band	means in respect of an island, the credible contingency event frequency tolerance band.
Load	has the meaning given to it currently in the WEM Rules: Load: Has the meaning given in clause 2.29.1(d).
multiple contingency event	means either a contingency event other than a credible contingency event, a sequence of credible contingency events within a period of 15 minutes, or a further separation event in an island.
network	means either a transmission system or distribution system, or a combination of both a transmission system and a distribution system
normal operating frequency band	has the meaning given to it in the WEM Rules (will have the value assigned as per the table in Part C)

WEM FOS – Complete

Part D – Definitions:

Term	Meaning
normal operating frequency excursion band	has the meaning given to it in the WEM Rules (will have the value assigned as per the above table)
autonomous islands	means identified islands that are not covered by the frequency operating standards
power system security	has the meaning given to it in the WEM Rules: Power System Security: The ability of the SWIS to withstand sudden disturbances, including the failure of generation, transmission and distribution equipment and secondary equipment.
reliability standards	has the meaning given to it in the WEM Rules (Note that this is yet to be defined in the WEM Rules but will be as part of future PSSR work)
separation event	means either ~~a contingency event or~~ planned or unplanned switching that results in the formation of an island
system frequency	means the frequency of a part of the power system, including the frequency of an island as recorded by AEMO via its SCADA system.
system restart	has the meaning given to it in the WEM Rules (Note that this is currently used in the WEM Rules but is not yet defined)
transmission system	has the meaning given to it in the WEM Rules (Note that this is currently used in the WEM Rules but is not yet defined)

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Summary of Recommendations

- Recommendation 1 (retain normal frequency operating band of 49.8-50.2 Hz): general acceptance, though noting the general desire for periodic review
- Recommendation 2 (adopting the 'containment', 'stabilisation' and 'recovery' terminology, with translation of existing TR settings): general acceptance
- Recommendation 3 (defined terms for frequency bands and limits, with translation of existing TR settings): general acceptance
- Recommendation 4 (time error): general acceptance
- Recommendation 5 (credible contingency event): general acceptance
- Recommendation 6 (credible contingency event frequency tolerance band 48.75-51 Hz): general acceptance
- Recommendation 7 (network event to fall under credible contingency event definition): general acceptance
- Recommendation 8 (extreme frequency excursion tolerance limits of 47-52 Hz): general acceptance

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Summary of Recommendations cont..

- Recommendation 9 (performance definitions and metrics): general acceptance subject to investigation into the merit of including a lower stabilisation frequency ban.
  - Action: AEMO to analyse frequency stabilisation performance following recent contingency events.
- Recommendation 10 (definition of island): general acceptance, with the following considerations:
  - Impacts on dispatch and pricing if the island includes the reference node.
  - It was noted that islanding events will need further consideration through market operation, pricing, procurement of energy and ancillary services, etc.
  - Action: remove "the" from "capable of supplying the load"
  - Note that there will be challenges in defining the inclusions/exclusions.
- Recommendation 11 (separation event definition): general acceptance
- Recommendation 12 (island separation band definition): general acceptance
- Recommendation 13 (frequency performance for an island): initial discussion only, with no resolution
  - It was suggested that "reasonable endeavours" may be more appropriate than "best endeavours".
  - The merit of a credible contingency frequency band in an island would need further consideration.

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