



WEM Reform Program

Frequency Co-Optimised Essential System Services Accreditation

WRIG - 02 September 2021

Agenda

1. Key Documents
2. Transitional Process
3. New FCESS Accreditation Process
4. Regulation Performance Requirements
5. Contingency Reserve Performance Requirements
6. RoCoF Control Service Performance Requirements
7. Validation/Re-accreditation of FCESS
8. RoCoF Ride-Through Cost Recovery Limit
9. RoCoF Ride-Through Accreditation

Frequency Co-Optimised Essential System Services

Key Documents - FCESS

Relevant Documents which support FCESS Accreditation and delivery include:

WEM Procedure: Frequency Co-Optimised Essential System Services Accreditation

- Covers Service Specifications/Process for Accreditation/Re-accreditation/Verification

WEM Procedure: Communications and Control Systems

- Covers High-Resolution Time Synchronised Data Recorder specs, and obligations for control systems/voice comms

WEM ~~Ancillary Services~~ [Frequency Co-Optimised Essential System Service Certification Testing](#) Guideline

- Covers testing requirements for each FCESS service

Frequency Co-Optimised Essential System Services Application Form

- Covers inputs to Accreditation process

Technical Specification: Operational Data Points for [Registered Facilities](#) ~~Generating Plant~~

- Covers all SCADA points required for participation by Facility, Technology and for AGC.
- Currently being updated post industry consultation

Transitional Process

AEMO has developed a Transitional ESS Accreditation Process in accordance with new transitional rules (Section 1.49 of the WEM Rules)

1. Identification of capable Synergy Facilities for new FCESS services, based on:
 - Standing Data, AS Parameters, equivalent units, past performance analysis
2. A Transitional Framework for capable Synergy Facilities and other Facilities obligated to seek accreditation (LFAS Facilities/contracted Spinning Reserve and Load Rejection Reserve providers)
 - Application via standard application form, including proposed Accreditation Parameters.
 - Review by AEMO including:
 - Assessment of other relevant data (equivalent units, Standing Data, AS Parameters, past performance analysis)
 - Requests for, as reasonably required (where application/data insufficient):
 - Additional information
 - Testing
 - AEMO notifies Market Participant of its Accreditation Parameters which must be submitted to AEMO in accordance with transitional Standing Data process (email).
 - Accreditation Parameters will be published on the WEM Website.

New FCESS Accreditation Process

AEMO has developed a new ESS Accreditation Process in accordance with (Section 2.34A of the WEM Rules).

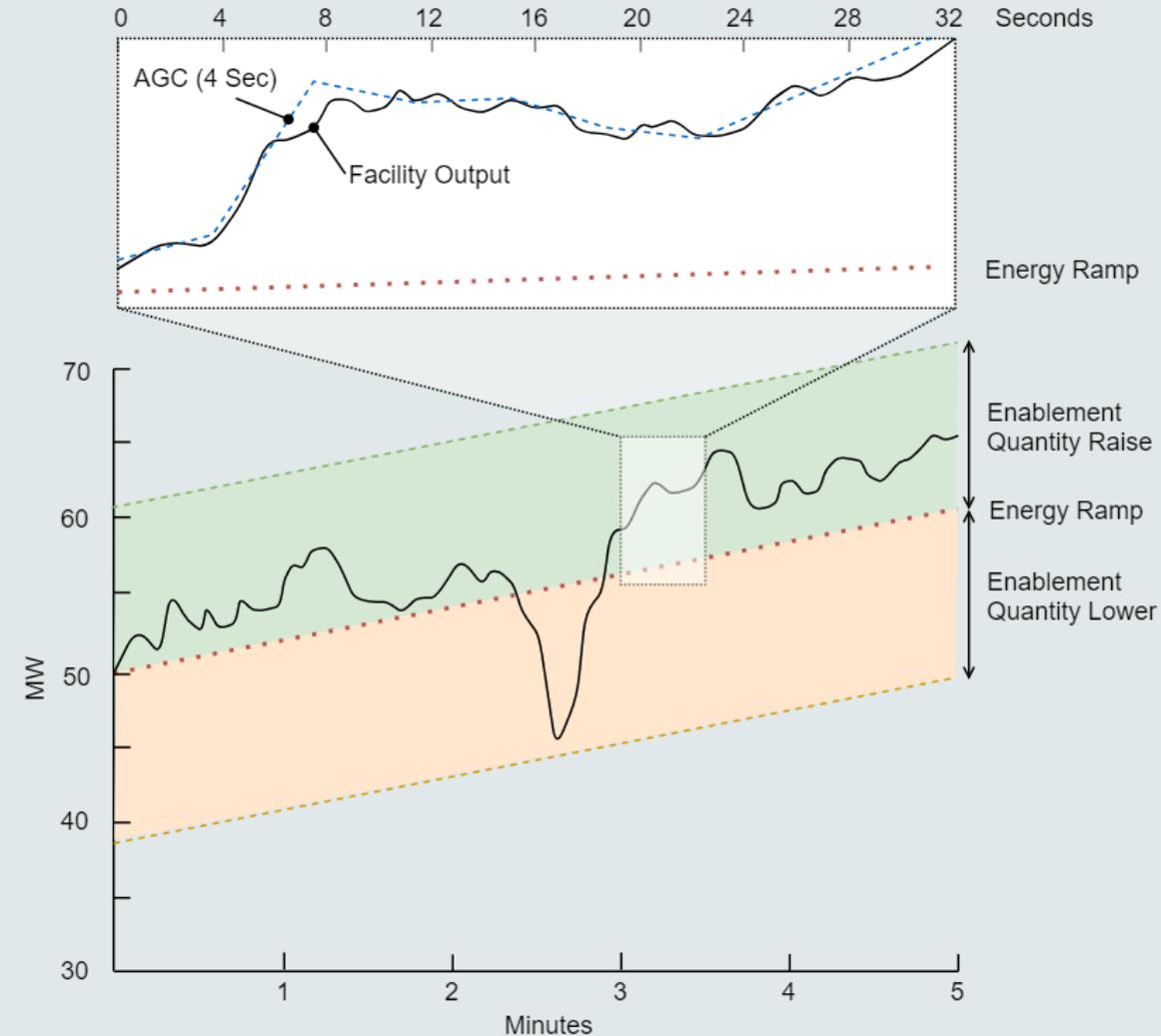
AEMO will prioritise transitional over new applications, but would welcome feedback from industry on intentions to participate in the new Markets.

A framework for Facilities to apply for accreditation:

1. Application via standard form of relevant information, including proposed Accreditation Parameters.
2. Review by AEMO of:
 - A Facilities capability to meet the relevant service Performance Requirements:
 - The Accreditation Parameters associated with that service delivery.
3. Assessment of other relevant data (equivalent units, Registered GPS, Standing Data, past performance analysis)
 - Requests for, as reasonably required:
 - Additional information
 - Testing
 - A Market Participant may withdraw their application prior to AEMO completing its determination.
 - AEMO may reject a Facility which is not able to meet the relevant Performance Parameters for the service.
4. AEMO notifies Market Participant of its Accreditation Parameters which must be submitted to AEMO in accordance with transitional Standing Data process (email) and to Standing Data (post New WEM Commencement)
 - Accreditation Parameters will be published on the WEM Website.

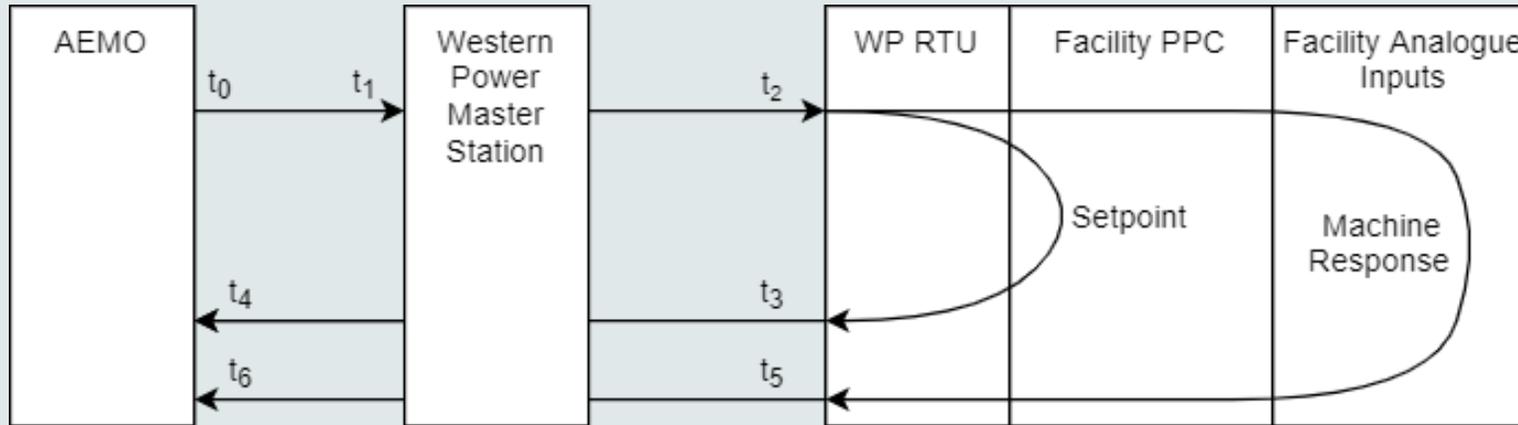
Regulation Performance Requirements

- Accreditation Quantity set by max ramp across 5 minute Dispatch Interval
- Minimum Regulation Quantity currently set at 10 MW, AEMO reviewing:
 - Studies to establish Minimum quantity that can be offered/accredited
 - AEMO initially proposing to retain 10 MW limit to be reviewed following Market Start and DER Roadmap progress
- Control via Automatic Generator Control (AGC) communicated through 4 Second setpoints, Facility to respond in <5 Seconds from receipt:
 - Communications latency under review to set a maximum lag time (Communication and Control WEM Procedure)
- Response delivered at or close to the relevant connection



AGC SCADA Latency

Still in development



- t_0 AEMO updates DESIRED MW
- t_1 Western Power receives DESIRED MW
- t_2 Facility receives DESIRED MW
- t_3 Facility updates DESIRED MW RECEIVED
- t_4 AEMO receives updated DESIRED MW RECEIVED
- t_5 Facility updates MW Output for Facility
- t_6 AEMO sees results of facility movement on SCADA telemetry

4 Second updates to Desired MW point:

Requirement for total communications lag time:

$$t_4 - t_0 < X$$

Requirement for response time:

$$t_5 - t_2 < 5 \text{ Seconds}$$

Requirement for total response/lag time

$$T_6 - t_0 < X \text{ seconds}$$

Contingency Reserve Performance Requirements

- Accreditation quantity set based on expected maximum response via droop, accounting for droop deadband:
 - 48.975 Hz for Contingency Reserve Raise / 51.025 Hz for Contingency Reserve Lower (see next slide)
 - Sustain capability for 15 minutes
- Minimum Contingency Reserve Quantity:
 - There is likely to be a cost burden on the market in accrediting and ongoing compliance monitoring of the service, in addition to a cost imposition on smaller market participants, therefore as an initial value AEMO proposes 5 MW, to be reviewed following Market Start and DER Roadmap progress.
- Response to be delivered by:
 - Droop (a Continuous Response):
 - Must either operate in AGC Base Assist, or be configured to deliver the full response to an event*
 - Must have a maximum response via a minimum droop of 2%
 - Under Frequency Relay (a Block Response – **only for** Contingency Reserve Raise)
 - Must have individually triggerable quantities less than Maximum CR Block Size
 - Must be capable of disabling response when not enabled*
 - Must be capable of modifying trigger frequency in accordance with AEMO telemetry*
 - Must respond in <400ms from trigger
- Response delivered at or close to the relevant connection point, measured by a High-Resolution Time Synchronised Data Recorder

** Exemption criteria (revocable and with expiry) from these Performance Requirements where the Market Participant can demonstrate equivalent performance delivery through alternative means*

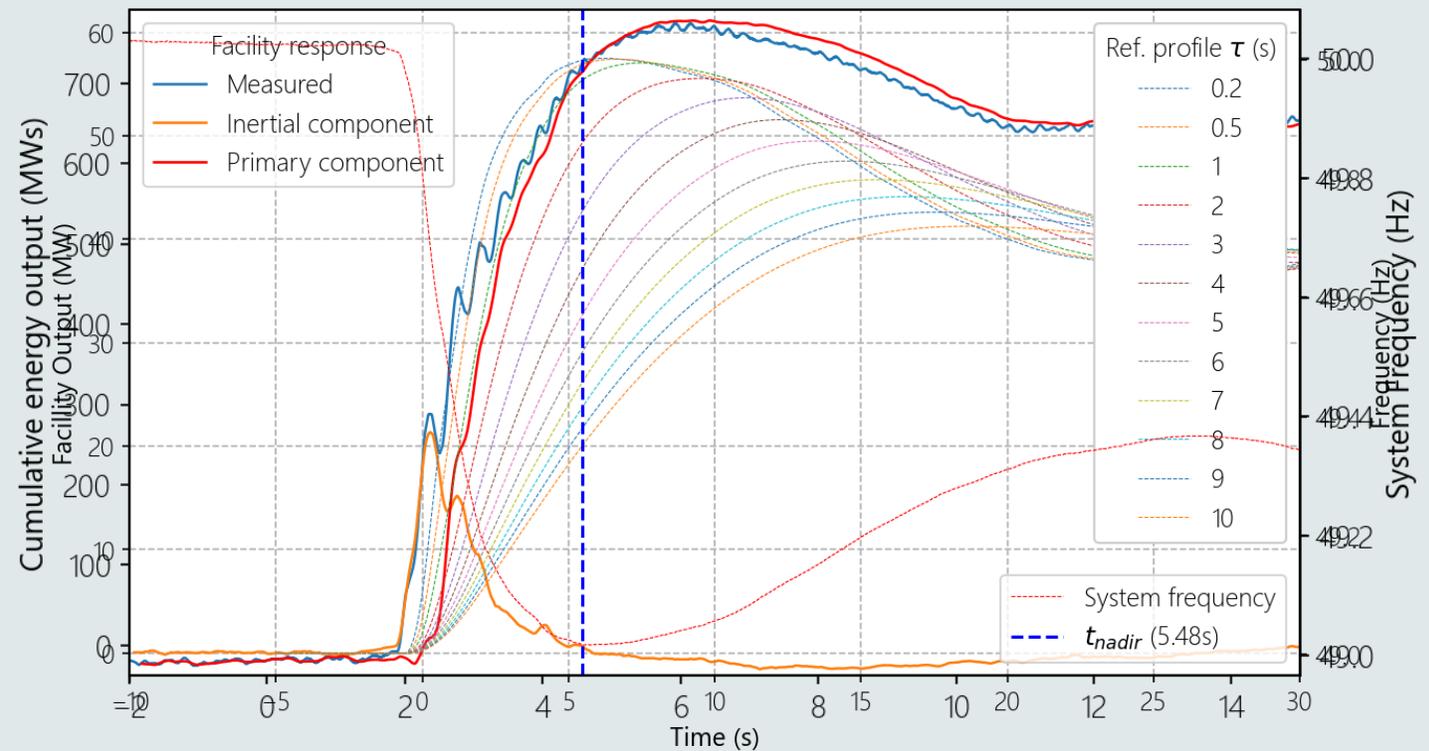
Contingency Reserve Performance Requirements

Accreditation Quantity is assessed on the minimum of:

- maximum PFR for a Facility assuming a 1.025 Hz frequency excursion
- maximum proposed quantity by Market Participant
- maximum achieved through testing (or reasonably determined through operations)

Facility Speed Factor determined by:

- for a given contingency event (and resulting frequency excursion), a range of response profiles will be generated for varying Speed Factors and enablement quantity
- The Tau exceeded before the nadir sets the tau for the Facility (assessed by energy injected)



Maximum Contingency Reserve Block Size

AEMO assessment of the size of overprovision of Contingency Reserve Raise (as a Block Response) that would cause frequency to reach 50.2 Hz

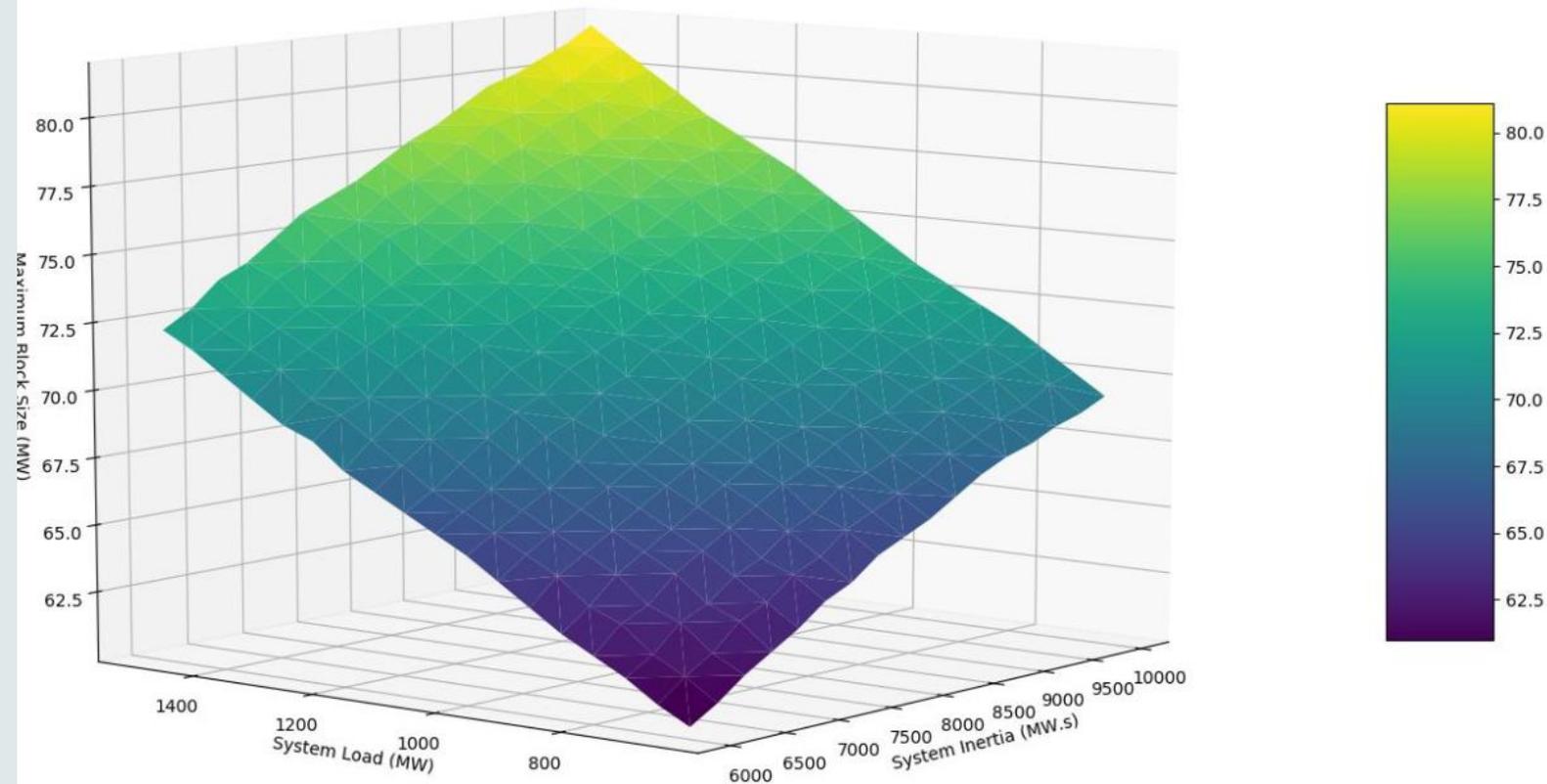
Worst case system conditions:

- Low Load (forecast based on 2021 ESOO 680 MW)
- Low inertia (6,000 MWs)

This study sets the Maximum Contingency Reserve Block Size at 60 MW

A Facility delivering Contingency Reserve Raise must have individually triggerable quantities less than 60 MW.

Maximum Contingency Raise block size to limit over-frequency to 50.2 Hz

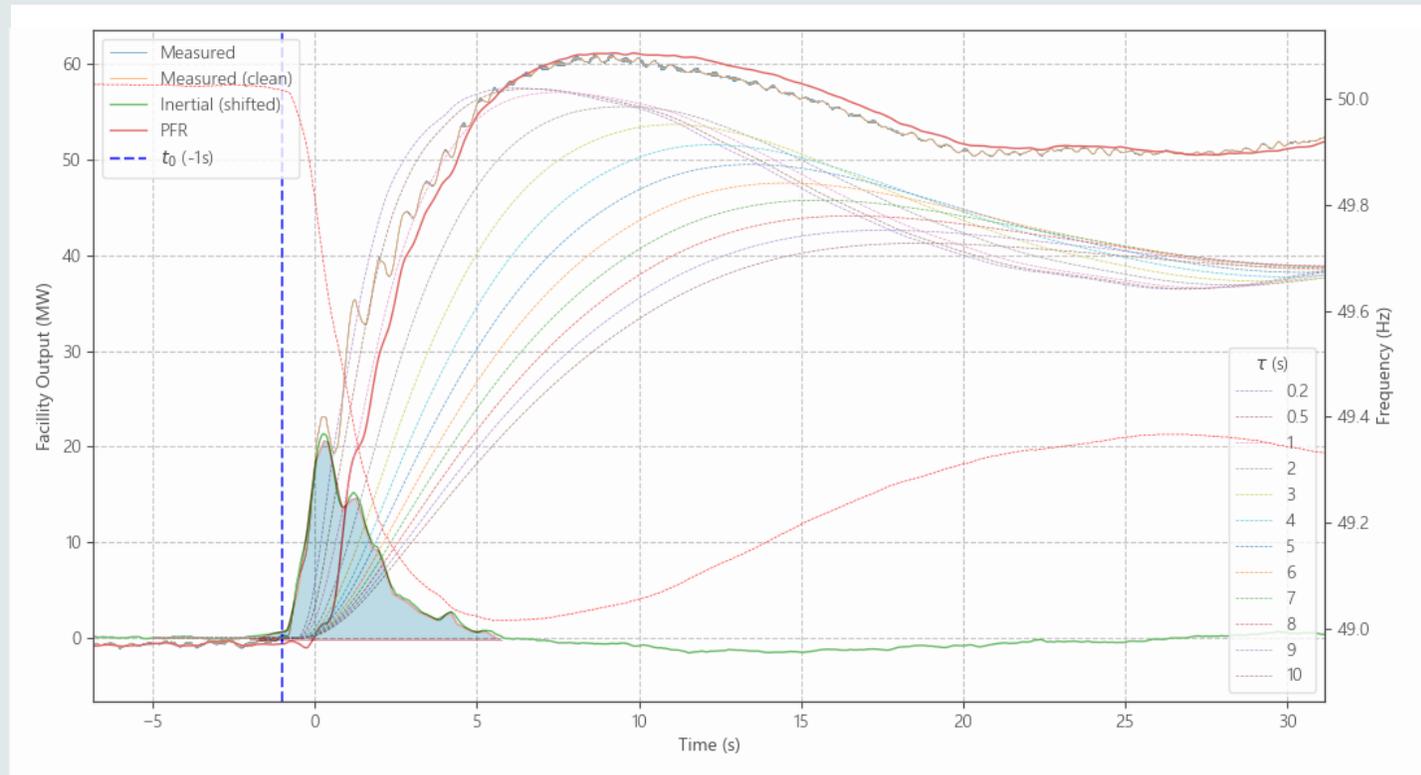


RoCoF Control Service Performance Requirements

- Facilities must have Inertia

Inertia: The kinetic energy (at nominal frequency) that is extracted from the rotating mass of a machine coupled to the power system to compensate an imbalance in the system frequency.

- A Facility must have a High-Resolution Time Synchronised Data Recorder located at or near the relevant connection point



Accreditation Parameters

- Accreditation Parameters are set for relevant “Operating Configurations”
Operating Configurations: A manner of operating a Facility providing a FCESS, which modifies the capabilities of that Facility, including but not limited to:
 1. Fuel type (where capable of operating using different fuels)
 2. Control mode
 3. Quantity of components of that Facility which are Available Capacity, In-Service Capacity or Un-available Capacity.
- Relevant Operating Configurations for Accreditation Parameters:
 - Maximum Operating Configuration: The configuration for which the Facility maximises its capability to deliver the service
 - Standard Operating Configurations: The configurations that the Facility most often intends to offer the service
- AEMO would test Facilities under a range of Operating Configurations to ensure the capability of the Facility is verified across all Configurations.
- Accreditation Parameters to be submitted to AEMO prior to New WEM Commencement via email, then through Standing Data submission.

FCESS Verification

The WEM Procedure outlines the processes for Facilities that fail to meet:

- Performance Requirements
- Accreditation Parameters

Which may result in the amendment of Accreditation Parameters (including to zero)

Triggers:

- Request from a Market Participant (to be assessed on basis of time (WR 2.34A.10))
- Ongoing performance monitoring undertaken by AEMO
- 2 Yearly reviews conducted by AEMO and the results published on the WEM Website

Process:

- Review of significance (magnitude/regularity/type of non-conformance)
- Where triggering amendment AEMO would seek to set new Accreditation Parameters or conduct testing

RoCoF Ride-Through Cost Recovery Limit

RoCoF Ride-Through Cost Recovery Limit

RoCoF Control Service is used to maintain RoCoF within the Operational Zone below the RoCoF Safe Limit.

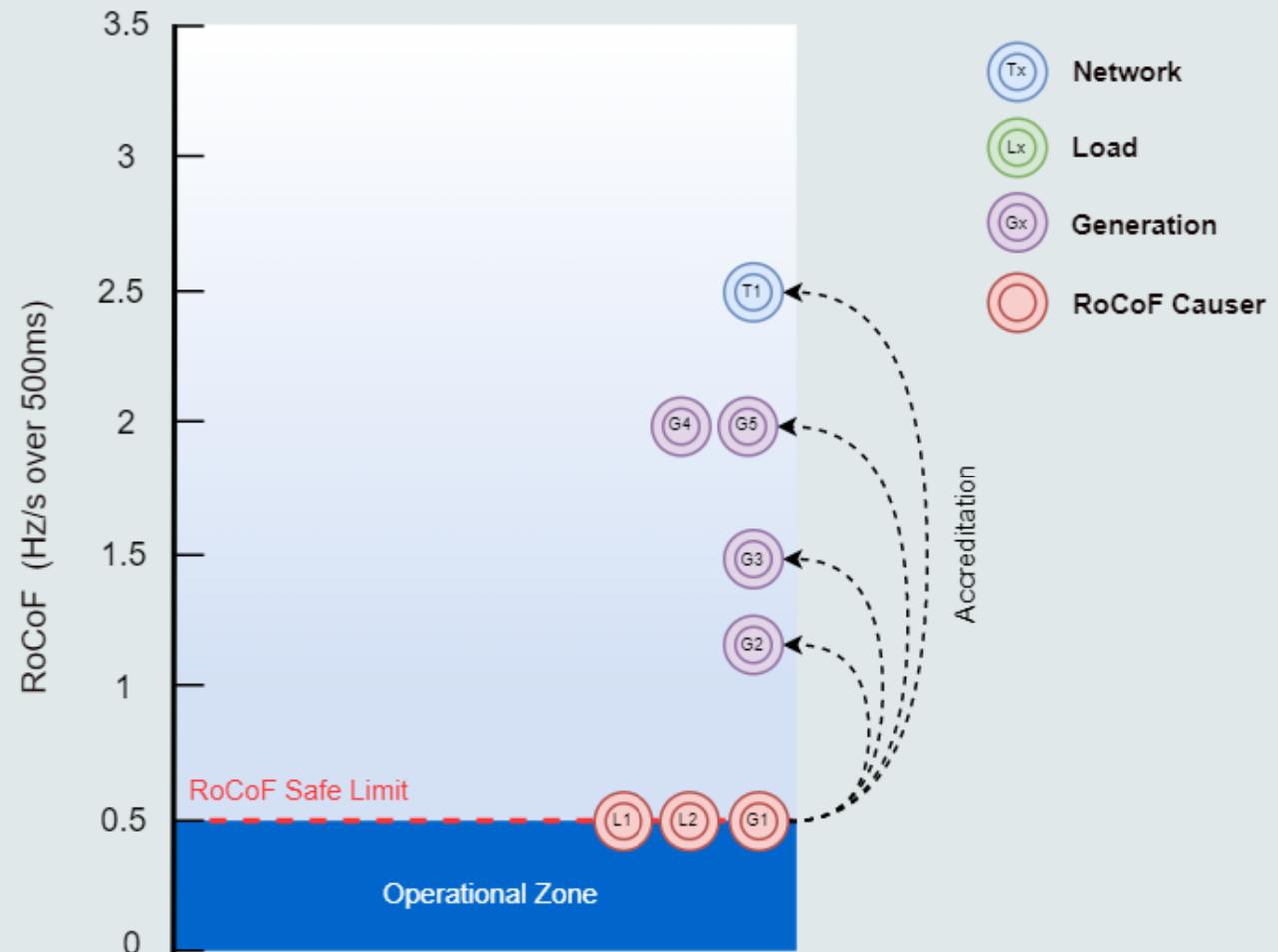
The **RoCoF Safe Limit** is set as 250 mHz over 500ms

- Or 0.5Hz/s over 500ms

AEMO must determine a **RoCoF Ride-Through Cost Recovery Limit**:

- Facilities with a RoCoF Ride-Through Capability between the Cost Recovery Limit and Safe Limit are RoCoF Causers for RoCoF Control Service

AEMO must determine (annually) a **RoCoF Upper Limit**, in order to set a maximum RoCoF for which it may set the RoCoF Ride-Through Cost Recovery Limit



RoCoF Ride-Through Cost Recovery Limit

Setting the RoCoF Upper Limit:

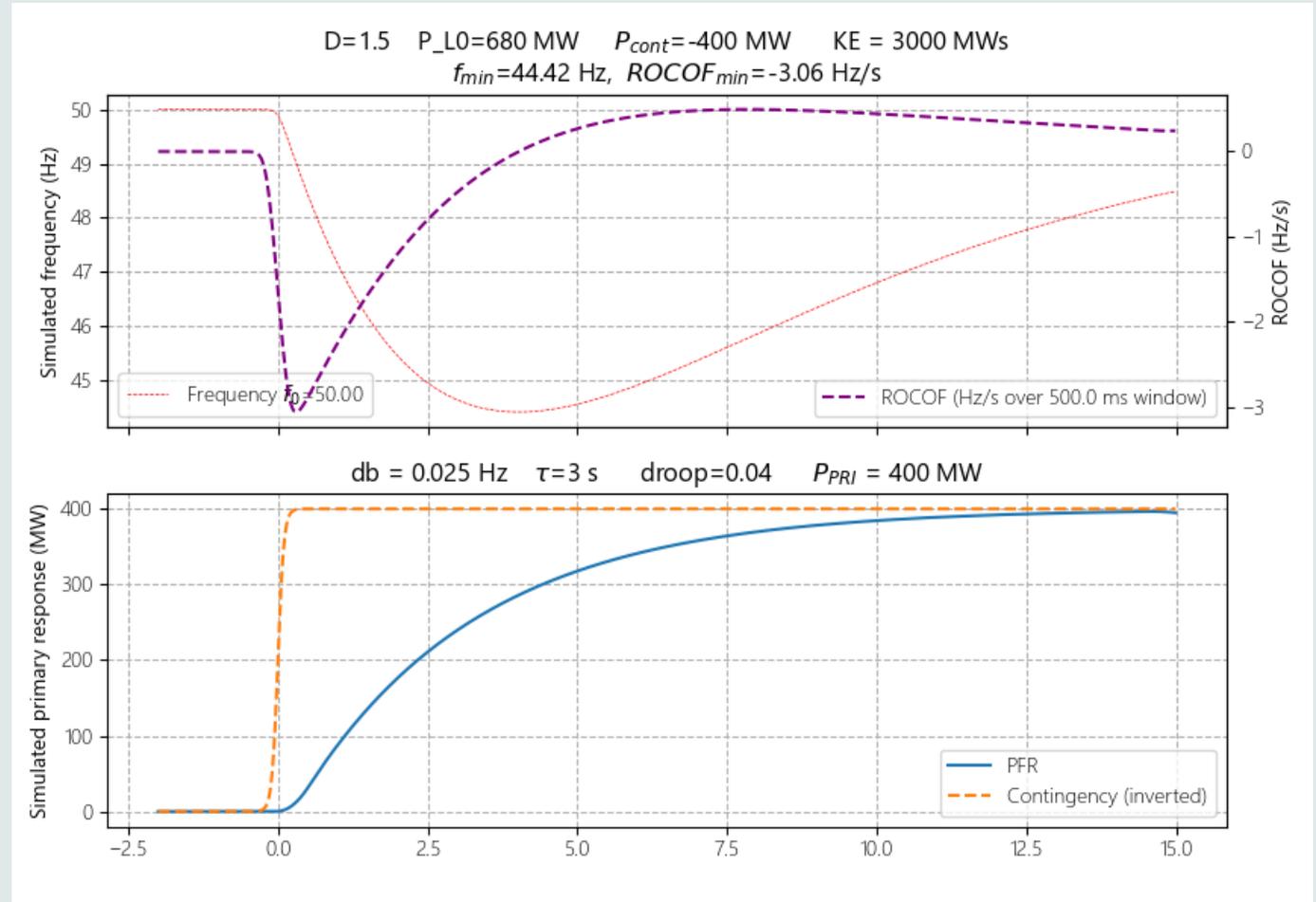
AEMO must set the RoCoF Upper Limit by assessing the maximum RoCoF that may be experienced in the SWIS considering where only Contingency Raise was used to manage frequency.

Worst case system conditions used to model:

- Low Load (forecast based on 2021 ESOO)
- Low inertia (Load inertia only)
- Contingency Reserve Response speed based on current fleet of providers

This assessment sets RoCoF at:

- 3.06Hz/s over 500ms (1.53Hz over 500ms)



RoCoF Ride-Through Cost Recovery Limit

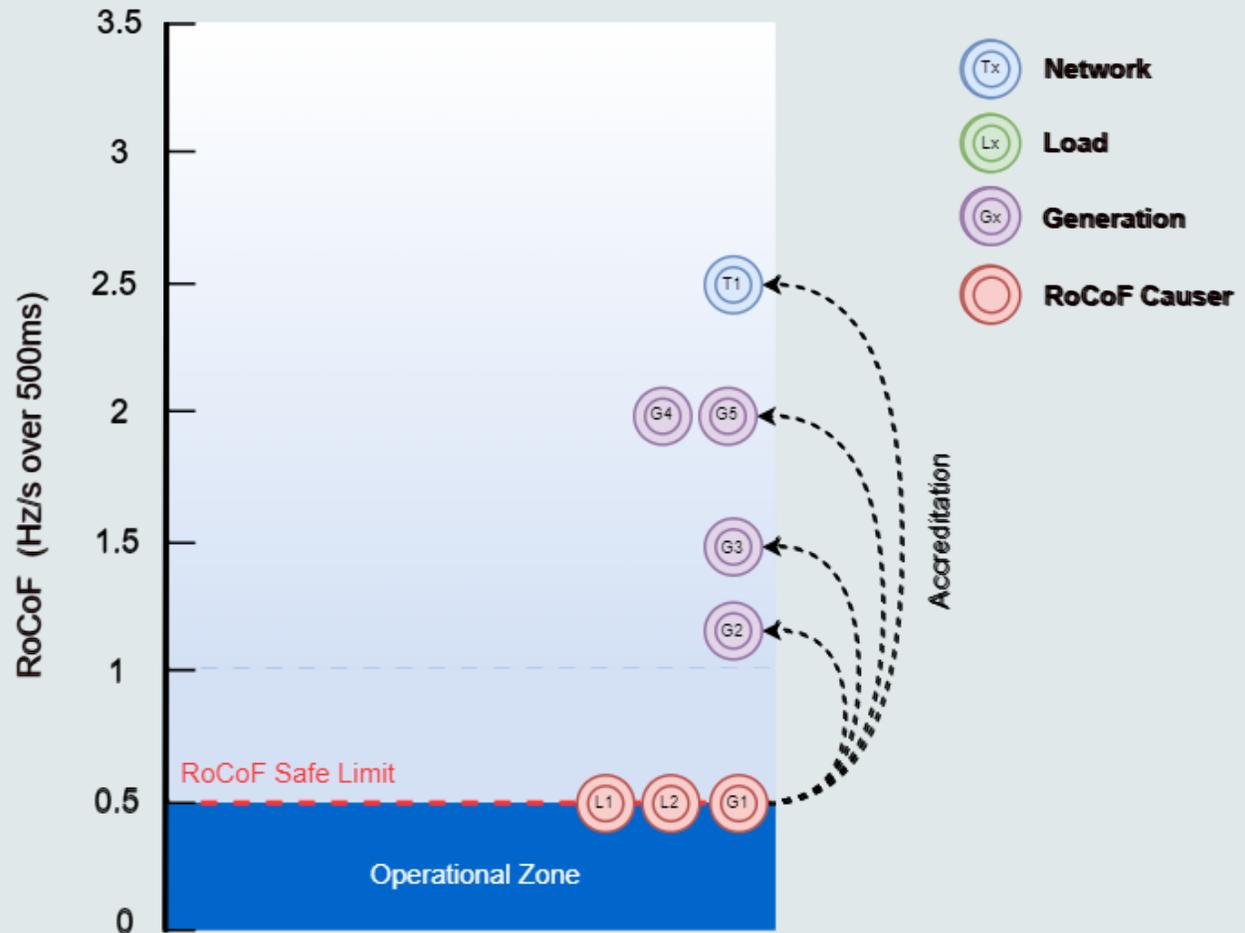
2.34A.12I. AEMO must determine a RoCoF Ride-Through Cost Recovery Limit in accordance with the WEM Procedure specified in clause 2.34A.13. In determining the RoCoF Ride-Through Cost Recovery Limit, AEMO must—

- not set the value higher than the RoCoF Upper Limit;
- set the limit to a precision of 0.1 Hz over 500 milliseconds; and (c) subject to clause 2.34A.12I
- set the limit above the RoCoF Safe Limit by at least 0.25 Hz over 500 milliseconds.

By setting the RoCoF Upper Limit at 3Hz/s, AEMO may set the Cost Recovery Limit:

- >1 Hz/s
- <3 Hz/s

AEMO proposes to set the RoCoF Ride Through Cost-Recovery Limit at 1 Hz/s over 500ms (0.5 Hz over 500 ms)



RoCoF Ride-Through Capability

Accreditation of RoCoF Ride-Through Capability

A standard process for Generators/Loads/Networks to seek accreditation, either:

- Based on a Registered GPS – Continuous uninterrupted operation (1 second), or
- Based on an Engineering Study and resultant Report:
 - Review of historical performance under high RoCoF conditions.
 - Review of RoCoF Sensitive Equipment (AEMO to publish a list of relevant equipment that may require assessment).
 - Manufacturer Data / Test Results.
- AEMO to confirm the Engineering Report/Registered GPS to approve accredited RoCoF Ride-Through Capability
- Facilities without an accredited RoCoF Ride-Through Capability to be deemed to have capability at the RoCoF Safe Limit
- AEMO/Market Participant to trigger a re-accreditation where:
 - A Facility disconnects / not operated safely or reliably due to RoCoF
 - AEMO updates the list of RoCoF Sensitive Equipment, and may seek confirmation from participants if re-accreditation is required.

Questions

Additional comments or questions can be provided to AEMO:

Specific queries to:

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Please CC: WA.ETS@aemo.com.au