

# WEM PROCEDURE: FREQUENCY CO-OPTIMISED ESSENTIAL SYSTEM SERVICES ACCREDITATION

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## 1. INTRODUCTION

### 1.1. Purpose and scope

- 1.1.1. This WEM Procedure: Frequency Co-Optimised Essential System Services Accreditation (Procedure) is made in accordance with AEMO's functions under clause 2.1A.2(h) of the Wholesale Electricity Market Rules (WEM Rules).
- 1.1.2. The *Electricity Industry Act 2004*, the WEM Regulations and the WEM Rules prevail over this Procedure to the extent of any inconsistency.
- 1.1.3. In this Procedure, where obligations are conferred on a Rule Participant, that Rule Participant must comply with the relevant obligations in accordance with clause 2.9.7A or 2.9.8 of the WEM Rules, as applicable.
- 1.1.4. The purpose of this Procedure is to outline:
- (a) In respect to the transitional matters:
    - (i) the process to identify Synergy Facilities which are capable of providing Regulation Raise, Regulation Lower, Contingency Reserve Raise, Contingency Reserve Lower or RoCoF Control Service [Clause 1.49.5];
    - (ii) the process to accredit capable Synergy Facilities for the equivalent Frequency Co-Optimised Essential System Service [Clause 1.49.4];
    - (iii) the process to accredit LFAS Facilities which are not Synergy Facilities for Regulation Raise and Regulation Lower [Clause 1.49.1]; and
    - (iv) the process to accredit Facilities contracted to provide Spinning Reserve or Load Rejection Reserve under an Ancillary Service Contract at any time from 1 October 2020 to 30 September 2021, for Contingency Reserve Raise or Contingency Reserve Lower, as relevant [Clause 1.49.2]; and
  - (b) in respect to the provision of a Frequency Co-Optimised Essential System Service [Clause 2.34A.13]:
    - (i) the format of information which Market Participants must submit for the purpose of accreditation;
    - (ii) the performance parameters and requirements which must be satisfied in order for a Facility to be accredited to provide a particular Frequency Co-optimised Essential System Service (for example, minimum quantity, maximum response time, control facilities, measurement facilities);
    - (iii) the manner and form of control system or communication arrangements required for the provision, and monitoring, of each Frequency Co-optimised Essential System Service;
    - (iv) the Maximum Contingency Reserve Block Size and the method used to determine the Maximum Contingency Reserve Block Size;
    - (v) the format and nature of data to be provided as evidence of performance after each Contingency Event;

- (vi) how AEMO will monitor and verify Facility performance against the Frequency Co-optimised Essential System Service Accreditation Parameters for the Facility including modelling and testing requirements;
  - (vii) how AEMO will determine a Facility Speed Factor for the Facility (so that it is possible for a Market Participant to estimate the Facility Speed Factor likely to be applied to its Facility);
  - (viii) the process for a Market Participant to seek to amend the Frequency Co-optimised Essential System Service Accreditation Parameters for a Facility;
  - (ix) the process AEMO will follow in considering whether to amend the Frequency Co-optimised Essential System Service Accreditation Parameters for a Facility, including examples of changes to Facility performance that would lead to an adjustment of the Frequency Co-optimised Essential System Service Accreditation Parameters;
  - (x) the processes to be followed by AEMO and Market Participants for any tests and re-tests of a Facility for the accreditation of a Facility to provide a Frequency Co-optimised Essential System Service;
  - (xi) timeframes for notification requirements and provision of information including updating any Standing Data or information in such other place as determined by AEMO and specified in the WEM Procedure; and
  - (xii) any other processes or requirements relating to the accreditation of a Facility to provide a Frequency Co-optimised Essential System Service that AEMO considers are reasonably required to enable it to perform its functions under section 2.34A of the WEM Rules; and
- (c) in respect to RoCoF Ride-Through Capability:
- (i) the type and form of supporting information which AEMO may request from Market Participants and Network Operators;
  - (ii) the processes AEMO must follow and the matters AEMO must take into account in determining whether to deem a Facility's RoCoF Ride-Through Capability as being equal to the RoCoF Safe Limit under clause 2.34A.12H;
  - (iii) the processes to be followed by Market Participants and Network Operators that wish to apply for the accreditation of RoCoF Ride-Through Capability for its Facility to be determined or re-determined by AEMO;
  - (iv) the processes to be followed by AEMO to determine or re-determine the accredited RoCoF Ride-Through Capability for a Facility;
  - (v) the processes to be followed by AEMO in considering whether to re-determine the RoCoF Ride-Through Capability accredited to a Facility, which may include examples of changes to a Facility's performance that would lead to an adjustment of the RoCoF Ride-Through Capability accredited to the Facility;
  - (vi) the processes to be followed by AEMO, Market Participants and Network Operators for any tests and re-tests of a Facility for the accreditation, or re-accreditation, of RoCoF Ride-Through Capability for a Facility; and
  - (vii) the timeframes, which must be reasonable, for notification requirements and provision of information, including updating any Standing Data or information in such other place as determined by AEMO and specified in the WEM Procedure; and

- (d) the processes to be followed by AEMO, including a consultation process with Market Participants and Network Operators, in determining or re-determining the RoCoF Ride-Through Cost Recovery Limit.

1.1.5. Appendix A of this Procedure outlines the head of power clauses that this Procedure is made under, as well as other obligations in the WEM Rules covered by this Procedure.

## 1.2. Definitions

1.2.1. Terms defined in the *Electricity Industry Act 2004*, the WEM Regulations and the WEM Rules have the same meanings in this Procedure unless the context requires otherwise.

1.2.2. The following definitions apply in this Procedure unless the context requires otherwise.

**Table 1 Definitions**

| Term                               | Meaning  |
|------------------------------------|--|
| Accreditation                      | The process for AEMO to accept or reject an application to accredit a Facility for a Frequency Co-optimised Essential System Service or RoCoF Ride-Through Capability.   |
| Accreditation Parameters           | Frequency Co-optimised Essential System Service Accreditation Parameters.  |
| Automatic Generation Control (AGC) | Equipment operated by AEMO, which sends signals to Facilities participating in the AGC scheme to automatically adjust their output so as to maintain frequency or restore frequency within the SWIS Operating Standards.   |
| AGC Base Assist                    | An AGC control mode, as specified in the Technical Specification: Operational Data Points for Registered Facilities.   |
| Block Response                     | A manner of providing a Contingency Reserve Raise where that response delivers a specific amount of service when one or more specified conditions are met, where each Block Response is a quantity independently capable of responding to Contingency Events.  |
| Continuous Response                | A manner of providing a Contingency Reserve Raise or Contingency Reserve Lower where that response delivers a variable amount of service commensurate with the size of the frequency disturbance (including using Droop Response).   |
| Droop Deadband Setting             | <p>The band defined by two frequency settings <math>DB_+</math> and <math>DB_-</math>, in Hz, used in calculating the frequency deviation <math>DB(\Delta f)</math> in Hz for droop control as follows:</p> $DB(\Delta f) = \begin{cases} \Delta f - DB_+, & \Delta f > DB_+ \\ \Delta f + DB_-, & \Delta f < DB_- \\ \text{else } 0 \end{cases}$ <p>Where:</p> <ul style="list-style-type: none"> <li>- <math>\Delta f = f - f_0</math>, the frequency deviation from nominal</li> <li>- <math>f_0</math> is 50 Hz</li> </ul> |

| Term  | Meaning   |
|---|---|
| Droop Setting                                   | <p>The proportional rate (expressed as a percentage) a Facility under droop control offsets its active power (MW) setpoint in response to frequency deviations:</p> $\text{Droop Setting (\%)} = 100 \times \frac{\Delta f / f_0}{\Delta P / P_N}$ <p>Where</p> <ul style="list-style-type: none"> <li>- <math>f_0</math> is 50 Hz, the nominal SWIS frequency</li> <li>- <math>\Delta f = f - f_0</math> is the frequency deviation from nominal</li> <li>- <math>\Delta P</math> is the Active Power offset, in MW</li> <li>- <math>P_N</math> is the total nominal (rated nameplate) power of all Energy Producing Systems delivering the service.</li> </ul>        |
| FCESS   | Frequency Co-Optimised Essential System Service   |
| High-Resolution Time Synchronised Data          | <p>Measurements of the following types of data but not limited to:</p> <ol style="list-style-type: none"> <li>1. Substation busbar voltage, current, real and Reactive Power output (MW and MVar) and frequency; and</li> <li>2. Circuit breaker and protection devices status.</li> </ol>  |
| High-Resolution Time Synchronised Data Recorder | Equipment installed to collect High-Resolution Time Synchronised Data.  |
| Inertial Component                              | The response of a Facility to a variation in Local Frequency due to the Facility's Inertia capability.  |
| Local Frequency                                 | The frequency of the electricity experienced by the Facility, measured by the High-Resolution Time Synchronised Data Recorder for that Facility, in Hz.   |
| Minimum Regulation Quantity                     | The minimum quantity of Regulation Raise or Regulation Lower service that a Facility may be accredited or offer.  |
| Operating Configuration                         | <p>A manner of operating a Facility providing a FCESS, which may modify the capabilities of that Facility, including but not limited to:</p> <ol style="list-style-type: none"> <li>1. Fuel type (where capable of operating using different fuels)</li> <li>2. Control mode</li> <li>3. Quantity of components of that Facility which are Available Capacity, In-Service Capacity or Un-available Capacity.</li> </ol>   |
| Performance Requirements                        | <p>FCESS requirements which must be met for a Facility to be accredited in accordance with paragraph 3 and must be met by a Facility when enabled for a FCESS.</p> <ol style="list-style-type: none"> <li>1. for Regulation Raise and Regulation Lower, the relevant Performance Requirements detailed in paragraph 4.1;</li> <li>2. for Contingency Reserve Raise, the relevant Performance Requirements detailed in paragraph 4.2;</li> <li>3. for Contingency Reserve Lower, the relevant Performance Requirements detailed in paragraph 4.2; and</li> <li>4. for RoCoF Control Service, the relevant Performance Requirements detailed in paragraph 4.3.</li> </ol> |
| Primary Frequency Response                      | The response of Energy Producing Systems and loads to arrest and correct locally detected changes in frequency by changing their Injection or Withdrawal.   |



| Term                              | Meaning   |
|-----------------------------------|---|
| Re-Accreditation                  | The process of varying the Facility's Accreditation Parameters or RoCoF Ride-Through Capability, as a result of the fact that the Facility has varied, is varying or is likely to vary significantly from that Facility's capability to: <ol style="list-style-type: none"> <li>1. deliver FCESS in accordance with that Facility's Accreditation Parameters and the relevant Performance Requirements.</li> <li>2. operate in accordance with that Facility's accredited RoCoF Ride-Through Capability.</li> </ol> |
| Reference Profile                 | The theoretical Primary Frequency Response of a Facility to Local Frequency excursions, calculated in accordance with paragraph 7.2.5.  |
| RoCoF Sensitive Equipment         | Equipment identified by AEMO which may be sensitive to high RoCoF.  |
| Standing Operating Configurations | The Operating Configurations under which that Facility intends to most often deliver the relevant FCESS.  |

### 1.3. Interpretation

- 1.3.1. The following principles of interpretation apply in this Procedure unless the context requires otherwise.
- (a) Clauses 1.3 to 1.5 of the WEM Rules apply in this Procedure.
  - (b) References to time are references to Australian Western Standard Time.
  - (c) Terms that are capitalised, but not defined in this Procedure, have the meaning given in the WEM Rules.
  - (d) A reference to the WEM Rules or WEM Procedures includes any associated forms required or contemplated by the WEM Rules or WEM Procedures.
  - (e) Words expressed in the singular include the plural and vice versa.
  - (f) A reference to a paragraph refers to a paragraph of this Procedure.
  - (g) A reference to a clause refers to a clause or section of the WEM Rules.
  - (h) References to WEM Rules in this Procedure in bold and square brackets [Clause XXX] are included for convenience only, and do not form part of this Procedure.
  - (i) Text located in boxes and headed as Explanatory Note X in this Procedure is included by way of explanation only and does not form part of this Procedure.

### 1.4. Related documents

- 1.4.1. The documents in Table 2 are associated with this Procedure.

**Table 2 Related documents**

| Reference                          | Title                              | Location                     |
|------------------------------------|------------------------------------|------------------------------|
| ABC and AGC Interface Requirements | ABC and AGC Interface Requirements | <a href="#">AEMO Website</a> |
| Communications and Control Systems | Communications and Control Systems | <a href="#">AEMO Website</a> |

| Reference               | Title  | Location                     |
|-------------------------|--|------------------------------|
| Operational Data Points | Technical Specification: Operational Data Points for Registered Facilities | <a href="#">AEMO Website</a> |
| Commissioning Tests     | Power System Operation Procedure: Commissioning Tests                      | <a href="#">AEMO Website</a> |
| Testing Guidelines      | Frequency Co-Optimised Essential System Service Testing Guidelines         | <a href="#">AEMO Website</a> |
| Application Form        | Frequency Co-Optimised Essential System Service Application Form           | <a href="#">AEMO Website</a> |

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## 2. PRE-MARKET START FREQUENCY CO-OPTIMISED ESSENTIAL SYSTEM SERVICE ACCREDITATION

### **E[A] Identification of Capable Balancing Portfolio Facilities**

#### **E[A1] Approach**

Clauses 1.49.4 and 1.49.5 of the WEM Rules require Synergy to consult with AEMO to identify Facilities registered to Synergy which are capable of delivering Ancillary Services and for Synergy to apply to AEMO for Accreditation of those Facilities for the equivalent Frequency Co-Optimised Essential System Services (FCESS).

Paragraph 2.1 outlines a process for Synergy to consult with AEMO to identify capable Facilities, which must then be accredited through the transitional Accreditation outlined in paragraphs 2.2, 2.3 and 2.4.

Non-Synergy Facilities currently certified or contracted to provide Ancillary Services must seek Accreditation for the equivalent FCESS in accordance with clauses 1.49.1 and 1.49.2 of the WEM Rules through the transitional Accreditation process outlined in paragraphs 2.2, 2.3 and 2.4.

Facilities which are not required to accredit for FCESS (those not currently providing Ancillary Services) may, prior to New WEM Commencement Day, apply to AEMO for Accreditation under the new Accreditation process outlined in paragraph 3, and must meet all relevant Performance Requirements for the relevant FCESS in order to be accredited.

### **2.1. Identification of Capable Balancing Portfolio Facilities**

- 2.1.1. In accordance with clause 1.49.4 of the WEM Rules, Synergy must identify which of its Facilities are capable of providing LFAS, Spinning Reserve, Load Rejection Reserve or RoCoF Control Service, and submit a request to AEMO to assess the capability of each Facility for each FCESS by nominating the Facilities and associated services by email to [wa.sm.operations@aemo.com.au](mailto:wa.sm.operations@aemo.com.au).
- 2.1.2. AEMO must determine, in accordance with paragraphs 2.1.3 and 2.1.4, the capability of each Facility nominated by Synergy under paragraph 2.1.1 to provide each FCESS and will use best endeavours to respond within 20 Business Days of receipt of Synergy's submission. AEMO may include partial results or a revised timeframe in its response where AEMO has yet to complete its full determination.
- 2.1.3. AEMO may determine a Facility is capable of:
- Regulation Raise and/or Regulation Lower where a Facility is capable of providing LFAS;
  - Contingency Reserve Raise where a Facility is capable of providing Spinning Reserve;
  - Contingency Reserve Lower where a Facility is capable of providing Load Rejection Reserve; and
  - RoCoF Control Service where a Facility has Inertia.
- 2.1.4. AEMO's determination under paragraph 2.1.2 may consider information gained through:
- analysis of historical enablement of a Facility for the services identified in paragraph 2.1.1;

- (b) analysis of historical submissions made by Synergy in accordance with clause 7.6A.2(a)iii. of the WEM Rules;
  - (c) analysis of historical data available to AEMO which demonstrates the capability of a Facility in delivering the services identified in paragraph 2.1.1;
  - (d) consultation with Synergy;
  - (e) consultation with Western Power; and
  - (f) other sources available to AEMO that it reasonably considers relevant in assessing the capability of Synergy's Facilities.
- 2.1.5. For each Synergy Facility which AEMO determines is capable of delivering Regulation Raise and/or Regulation Lower in accordance with paragraph 2.1.2, Synergy must apply for Accreditation for that Facility for Regulation Raise and Regulation Lower in accordance with paragraph 2.2.2.
- 2.1.6. For each Synergy Facility which AEMO determines is capable of delivering Contingency Reserve Raise in accordance with paragraph 2.1.2, Synergy must apply for Accreditation for that Facility for Contingency Reserve Raise in accordance with paragraph 2.3.2.
- 2.1.7. For each Synergy Facility which AEMO determines is capable of delivering Contingency Reserve Lower in accordance with paragraph 2.1.2, Synergy must apply for Accreditation for that Facility for Contingency Reserve Lower in accordance with paragraph 2.3.2.
- 2.1.8. For each Synergy Facility which AEMO determines is capable of delivering RoCoF Control Service in accordance with paragraph 2.1.2, Synergy must apply for Accreditation for that Facility for RoCoF Control Service in accordance with paragraph 2.4.1.

## **2.2. Load Following Services**

- 2.2.1. In accordance with clause 1.49.1 of the WEM Rules a Market Participant must apply to AEMO for Accreditation of each relevant Facility for Regulation Raise and Regulation Lower.
- 2.2.2. A Market Participant making an application under paragraphs 2.2.1 or 2.1.5 must submit a request to AEMO in accordance with the details on the WEM Website, identifying each Facility for which it is seeking Accreditation, including any relevant information required in the Frequency Co-optimised Essential System Service Application Form for Regulation Raise or Regulation Lower.
- 2.2.3. AEMO must determine the Accreditation Parameters listed in paragraph 4.4.1, for a Facility identified under paragraph 2.2.2. In determining the Accreditation Parameters, AEMO may consider the following information:
- (a) Standing Data available for that Facility;
  - (b) any other information available to AEMO that it reasonably considers relevant in assessing the capability of a Facility identified in paragraph 2.2.2; and
  - (c) additional information reasonably requested by AEMO from the Market Participant.

- 2.2.4. Where AEMO is unable to determine a Facility's Accreditation Parameters using the information available to it under paragraph 2.2.3, AEMO may request Facility testing to verify the capability of the Facility in delivery of Regulation Raise and Regulation Lower services.
- 2.2.5. Where AEMO requests Facility testing in accordance with paragraph 2.2.4, AEMO must specify the tests to be conducted in accordance with paragraph 9. AEMO must agree with the Market Participant a time and date by which the Market Participant must provide the test results.
- 2.2.6. A Market Participant must conduct all tests specified by AEMO under paragraph 2.2.5 and submit results of the tests by the time and date specified in paragraph 2.2.5.
- 2.2.7. AEMO must use best endeavours to notify the Market Participant of the Accreditation Parameters it has determined for its Facility within 20 Business Days of the later of:
- (a) receipt of an application under paragraph 2.2.2; or
  - (b) receipt of all test data submitted following testing conducted in accordance with paragraph 2.2.6,
- or otherwise a date reasonably specified by AEMO.
- 2.2.8. Where a Market Participant has been notified in accordance with paragraph 2.2.7, it must submit the Facility Accreditation Parameters to AEMO in accordance with paragraph 10.1.1.

### **2.3. Spinning Reserve and Load Rejection Reserve**

- 2.3.1. In accordance with clause 1.49.2 of the WEM Rules, a Market Participant or Ancillary Service Provider must apply to AEMO for Accreditation of each relevant Facility for Contingency Reserve Raise and Contingency Reserve Lower as applicable.
- 2.3.2. A Market Participant or Ancillary Service Provider making an application under paragraphs 2.3.1 or 2.1.6 must submit a request to AEMO in accordance with the details on the WEM Website to identify each Facility for which it is seeking Accreditation, including any relevant information identified in the Frequency Co-optimised Essential System Service Application Form for the Contingency Reserve Raise or Contingency Reserve Lower service.
- 2.3.3. AEMO must determine the Accreditation Parameters listed in the relevant paragraph 4.4.1 for a Facility identified under paragraph 2.3.2. In determining the Accreditation Parameters, AEMO may consider the following information:
- (a) Standing Data available for that Facility;
  - (b) any other information available to AEMO that it reasonably considers relevant in assessing the capability of a Facility identified in paragraph 2.3.2;
  - (c) information gained through consultation with Western Power;
  - (d) additional information reasonably requested by AEMO from the Market Participant or Ancillary Service Provider; and
  - (e) as applicable, at AEMO's discretion, the performance of similar Facilities.

- 2.3.4. Where AEMO is unable to determine a Facility's Accreditation Parameters using the information available to it under paragraph 2.3.3, AEMO may request Facility testing to verify the capability of the Facility in delivery of Contingency Reserve Raise and/or Contingency Reserve Lower services.
- 2.3.5. Where AEMO requests Facility testing in accordance with paragraph 2.3.4, it must specify the tests to be conducted in accordance with paragraph 9.2.1. AEMO and the Market Participant or Ancillary Service Provider must agree a time and date by which the Market Participant or Ancillary Service Provider must provide the testing results.
- 2.3.6. A Market Participant or Ancillary Service Provider must conduct all tests specified by AEMO under paragraph 2.3.5 and submit results of the tests, by the time and date specified in paragraph 2.3.5.
- 2.3.7. AEMO must use best endeavours to notify the Market Participant or Ancillary Service Provider of the Accreditation Parameters it has determined for its Facility within 20 Business Days of the later of:
- (a) receipt of an application under paragraph 2.3.2; or
  - (b) receipt of test data submitted following testing conducted in accordance with paragraph 2.3.6,
- or otherwise a date reasonably specified by AEMO.
- 2.3.8. Where a Market Participant has been notified in accordance with paragraph 2.3.7, it must submit the Facility Accreditation Parameters to AEMO in accordance with paragraph 10.1.1.

## **2.4. RoCoF Control Service**

- 2.4.1. Synergy, where required to apply under paragraph 2.1.8 must submit a request to AEMO in accordance with the details on the WEM Website to identify each Facility for which it is seeking Accreditation, including any relevant information identified in the Frequency Co-optimised Essential System Service Application Form for RoCoF Control Service.
- 2.4.2. AEMO must determine the Accreditation Parameters listed in paragraph 4.4.1, for a Facility identified under paragraph 2.4.1. In determining the Accreditation Parameters, AEMO may consider the following information:
- (a) analysis of historical data available to AEMO which demonstrates the capability of a Facility to provide Inertia;
  - (b) information gained through consultation with Synergy;
  - (c) information under an approved Registered Generator Performance Standard, or equivalent data held by AEMO for the Facility;
  - (d) information gained from consultation with Western Power; and
  - (e) any other information available to AEMO that it reasonably considers relevant in assessing the capability of Facilities identified in paragraph 2.4.1.

- 2.4.3. AEMO must use best endeavours to notify Synergy of the Accreditation Parameters it has determined for its Facility within 20 Business Days following receipt of an application under paragraph 2.4.1 or otherwise a date reasonably specified by AEMO.
- 2.4.4. Where a Market Participant has been notified in accordance with paragraph 2.4.3, it must submit the Facility Accreditation Parameters to AEMO in accordance with paragraph 10.1.1.

### **3. ACCREDITATION PROCESS**

#### **3.1. Application for FCESS**

- 3.1.1. A Market Participant may apply to AEMO for Accreditation or Re-Accreditation of a Facility to provide one or more Frequency Co-optimised Essential System Services referred to in clause 2.34A.1 of the WEM Rules.
- 3.1.2. An application made under paragraph 3.1.1 for Accreditation or Re-Accreditation must be in the format detailed on the WEM Website, and include:
- (a) all items identified in clause 2.34A.3 of the WEM Rules.
  - (b) the Market Participants name;
  - (c) the FCESS for which the Market Participant is seeking Accreditation;
  - (d) the proposed FCESS Accreditation Parameters for each relevant FCESS detailed in paragraph 4.4.1; and
  - (e) any available evidence that the Facility can meet the Performance Requirements for the relevant FCESS.

- 3.1.3. AEMO must determine the capability of a Facility to meet the relevant FCESS Performance Requirements for which it has received an application under paragraph 3.1.1, by considering all information provided by the Market Participant as part of the application and, where relevant, testing data provided in accordance with paragraph 3.1.8.
- 3.1.4. For each Facility that meets the relevant Performance Requirements in paragraph 3.1.3, AEMO must determine the relevant Accreditation Parameters.

### **E[B] Proposed Accreditation Parameters**

Market Participants must submit proposed Accreditation Parameters for their Facility as part of an application for Accreditation. Through the determination process AEMO may identify alternative values for each Accreditation Parameter, for example:

- (a) increased values, where that Facility is capable of meeting the Performance Requirements for a greater quantity; or
- (b) decreased values, where that Facility is incapable of meeting the Performance Requirements under the proposed Accreditation Parameters.

This process will allow a Market Participant to accredit a Facility for the largest quantity for which it is capable of meeting the relevant Performance Parameters and for which that Market Participant wishes to be accredited.

- 3.1.5. In making the determination under paragraphs 3.1.3 and 3.1.4, AEMO may consider information received through:
- (a) assessing information provided under paragraph 3.1.2; and
    - (i) analysing historical data available to AEMO which demonstrates the capability of a Facility to deliver Frequency Co-optimised Essential System Services;
    - (ii) assessing data under an approved Registered Generator Performance Standard for that Facility;
    - (iii) assessing Standing Data for that Facility;
    - (iv) consulting with the Market Participant seeking Accreditation;
    - (v) consulting with Western Power; and
    - (vi) considering any other information available to AEMO that it reasonably considers relevant in assessing the capability of Facilities identified in paragraph 3.1.2; and
  - (b) in accordance with clause 2.34A.4 of the WEM Rules, requesting additional supporting information in support an application, specifying a time and date for the information to be provided;
  - (c) where reasonably required to assess the Accreditation of the Facility for the relevant FCESS, requesting Facility testing to verify the capability of the Facility in delivery of the relevant FCESS [Clause 2.34A.4A].



- 3.1.6. Where AEMO requests additional supporting information under paragraph 3.1.5(b) a Market Participant must provide that information by the time and date specified by AEMO under paragraph 3.1.5(b) or request the application is withdrawn in accordance with paragraph 3.1.9.
- 3.1.7. Where AEMO requests Facility testing in accordance with paragraph 3.1.5(c) it must specify the tests to be conducted in accordance with paragraph 9. AEMO and the Market Participant must agree a time and date by which the Market Participant must provide the test results.
- 3.1.8. A Market Participant must, where requested to undertake testing by AEMO under paragraph 3.1.5(c) either:
- (a) undertake all tests specified under paragraph 3.1.7 and submit results of the tests by the time and date agreed in paragraph 3.1.7; or
  - (b) request the application is withdrawn from Accreditation in accordance with paragraph 3.1.9.
- 3.1.9. A Market Participant may withdraw an application at any time prior to AEMO's determination in paragraph 3.1.3 by notifying AEMO in writing [Clause 2.34A.4C], unless that application relates to an application for Re-Accreditation.
- 3.1.10. Where AEMO determines, under paragraph 3.1.3, the capability of the Facility does not meet the relevant Performance Requirements for the relevant FCESS it must reject the application and notify the Market Participant, including reasons for its decision [Clause 2.34A.5].
- 3.1.11. Where AEMO determines, under paragraph 3.1.3, a Facility's is capable of meeting the relevant Performance Requirements for a relevant FCESS, AEMO must accept that application and notify the Market Participant of the results of its determination, including all Accreditation Parameters for which the Facility may be accredited, within 20 Business Days of the later of, as relevant [Clause 2.34A.4]:
- (a) receipt of a complete application under paragraph 3.1.2; or
  - (b) the time and date specified under paragraph 3.1.5(b); or
  - (c) receipt of testing data submitted following testing conducted in accordance with paragraph 3.1.5(c).

- 3.1.12. Where a Market Participant has been notified in accordance with paragraph 3.1.11 that its Facility is capable of meeting the relevant Performance Requirements for the relevant FCESS it must submit the Facility Accreditation Parameters to AEMO in accordance with paragraph 10.1.1.

#### **4. PERFORMANCE PARAMETERS AND REQUIREMENTS**

##### **E[C] Relevant Documents**

Paragraphs 4.1, 4.2 and 4.3 include relevant Performance Requirements that a Facility must meet in order to be accredited for Regulation Raise, Regulation Lower, Contingency Reserve Raise, Contingency Reserve Lower and RoCoF Control Service. These sections also reference other AEMO WEM Procedures and Technical Specifications for which that Facility must comply in order to be accredited. These include the Technical Specification Operational Data Points for Registered Facilities and the Communications and Control Systems WEM Procedure. Facility's providing Regulation Raise or Regulation Lower must also meet the relevant requirements of ABC and AGC Interface Requirements.

##### **E[C1] Technical Specification: Operational Data Points for Registered Facilities**

A Facility required to deliver a FCESS whilst under Automatic Generator Control must comply with the relevant requirements of the Technical Specification: Operational Data Points for Registered Facilities by meeting the requirements of Appendix C. Operational Data Point Requirements for AGC Operation. The Appendix C provides information on relevant SCADA points which must be provided for Facilities operating under AGC Control.

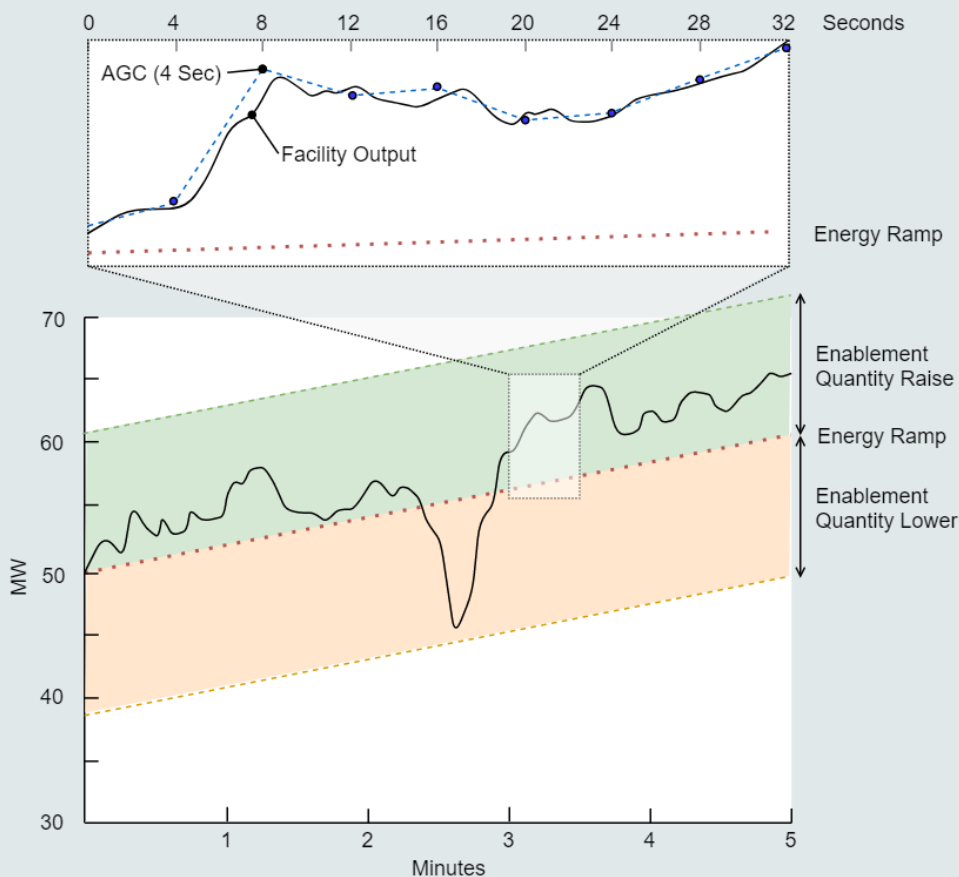
##### **E[C2] Communications and Control Systems WEM Procedure**

A Facility must comply with the relevant requirements of the Communications and Control Systems WEM Procedure. These requirements include the obligation to have a suitable High-Resolution Time Synchronised Data Recorder (Contingency Reserve services and RoCoF Control Service) and duplicate voice communications with AEMO.

## 4.1. Regulation Raise and Regulation Lower Performance Requirements

### E[D] Regulation Raise and Regulation Lower

Regulation Raise and Regulation Lower services are provided by Facilities responding to controls from AEMO's energy management system via the Automatic Generator Control (AGC) scheme. Figure E(1) provides a graph of a Facility enabled for energy, Regulation Raise and Regulation Lower. The energy ramp displayed shows the ramp associated with cleared energy in that Dispatch Interval, while the green and yellow regions show the enabled Regulation Raise and Regulation Lower regions within which AEMO may control the Facility through AGC. Control signals are issued every 4 seconds (subject to Facility deadbands), with an obligation for the Facility to begin ramping within a specified time period outlined in the Communication and Control WEM Procedure. The Facility must follow the AGC control to the maximum extent possible while accounting for its Droop Deadband Settings and response to Local Frequency based on its Droop Response.



**Figure E[1] Regulation Raise and Regulation Lower control.**

4.1.1. All Facilities providing Regulation Raise or Regulation Lower must:

- (a) be capable of continuously receiving and responding to a control signals in a manner that meets the requirements of AEMO's AGC scheme, to increase or decrease Injection or Withdrawal (as applicable), within the enabled Regulation Raise or Regulation Lower range for that Facility;

- (b) have a ramp rate sufficient to deliver the maximum quantity of Regulation Raise or Regulation Lower in 5 minutes;
- (c) meet the required ramp rate specified in paragraph 4.1.1(b) continuously for the full range of enabled Regulation Raise or Regulation Lower;
- (d) have a communication lag time less than the maximum communication lag time where specified in accordance with the Communication and Control Systems WEM Procedure;
- (e) as applicable, have a Minimum Regulation Raise Quantity and Minimum Regulation Lower Quantity of at least 10 MW; and
- (f) meet the relevant requirements of:
  - (i) Technical Specification: Operational Data Points for Registered Facilities; and
  - (ii) Communications and Control Systems WEM Procedure.

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**E[E] Regulation Raise and Regulation Lower Quantities**

AEMO undertakes system studies to set minimum Performance Requirements for Regulation Raise and Regulation Lower. These quantities include the Minimum Regulation Quantity, as the minimum quantity that any Facility may be accredited for, or offer, Regulation Raise or Regulation Lower. In setting these quantities AEMO undertakes system studies to consider:

- (a) the capability of AEMO's Automatic Generator Control systems to manage system frequency in accordance with the Frequency Operating Standards with Facilities enabled for a range of quantities of Regulation Raise and Regulation Lower;
- (b) the capability of AEMO's Automatic Generator Control systems to manage system frequency in accordance with the Frequency Operating Standards with varying communication lag times; and
- (c) errors due to SCADA measurement accuracy.

These quantities are expected to be reviewed by AEMO on an ongoing basis to ensure the Performance Requirements associated with Regulation Raise and Regulation Lower allow AEMO to maintain Power System Security and maintain frequency in accordance with the Frequency Operating Standards.

- 4.1.2. Regulation Raise and/or Regulation Lower must be measured at or close to the relevant connection point or, if otherwise agreed with AEMO, measurements may be provided to calculate the Injection or Withdrawal at the Facility connection point.
- 4.1.3. All Facilities providing Regulation Raise or Regulation Lower using multiple Operating Configurations must be capable of meeting the relevant Performance Requirements under all relevant Operating Configurations.

**4.2. Contingency Reserve Raise and Contingency Reserve Lower Performance Requirements**

- 4.2.1. All Facilities providing Contingency Reserve Raise must be capable of automatically responding to downward excursions of Local Frequency by one or more of:
  - (a) increasing Injection in proportion to a frequency deviation, or by a specified quantity for a Block Response;
  - (b) decreasing Withdrawal in proportion to a frequency deviation, or by a specified quantity for a Block Response; or
  - (c) moving from Withdrawal to Injection in proportion to a frequency deviation, or by a specified quantity for a Block Response.

**E[F] Block Response**

The Maximum Contingency Reserve Block Size applies to Facilities delivering Contingency Reserve Raise as a Block Response, supported by an application for Contingency Reserve Raise inclusive of an intent to deliver the service in a block manner [Clause 2.34A.3(f)].

Contingency Reserve Lower therefore must be only be delivered as a Continuous Response (continuous manner).

- 4.2.2. All Facilities providing Contingency Reserve Lower must be capable of automatically responding to upward excursions of Local Frequency by one or more of:
- (a) decreasing Injection in proportion to a frequency deviation;
  - (b) increasing Withdrawal in proportion to a frequency deviation; or
  - (c) moving from Injection to Withdrawal in proportion to a frequency deviation.

**E[G] Contingency Reserve Raise and Contingency Reserve Lower Quantities**

AEMO has set minimum Performance Requirements for Contingency Reserve Raise and Contingency Reserve Lower, including a minimum quantity that any Facility may be accredited for, or offer.

In setting the minimum quantity AEMO has considered the cost impact to both AEMO and to Market Participants in undertaking the required Accreditation, including testing requirements and subsequent monitoring and verification. AEMO will review the minimum quantity and request feedback from industry on the capability of Facilities to offer the service in accordance with the Performance Requirements in this paragraph 4.2.

- 4.2.3. All Facilities providing Contingency Reserve Raise or Contingency Reserve Lower must be capable of delivering a response under paragraph 4.2.1 or 4.2.2, determined in accordance with paragraph 7.1, of at least 5 MW;
- 4.2.4. All Facilities providing Contingency Reserve Raise or Contingency Reserve Lower must be capable of sustaining the response under paragraphs 4.2.1 or 4.2.2 or at least 15 minutes [Clause 7.10.18].
- 4.2.5. The response under paragraphs 4.2.1 and 4.2.2 must be controlled automatically through the following methods:
- (a) Droop Response (Continuous Response); or
  - (b) Automated under frequency relays (Block Response).

- 4.2.6. Where the response under paragraphs 4.2.1 is controlled by automated under-frequency relays, in accordance with paragraph 4.2.5(b), the Facility must be capable of adjusting the setpoint frequency at which the Facility responds to between 47 Hz and 49.8 Hz in accordance with AEMO telemetered setpoints.
- 4.2.7. Where the response under paragraph 4.2.1 is controlled by an automated under-frequency relay, in accordance with paragraph 4.2.5(b), the Facility must:
- respond within 400 ms;
  - be capable of disabling the response when not enabled for Contingency Reserve Raise or Contingency Reserve Lower subject to any relevant Registered Generator Performance Standard for that Facility; and
  - agree a Restoration Profile with AEMO.

### **E[H] Droop Settings**

The 2% Droop Setting requirement in paragraph 4.2.8 sets a minimum for service provision, AEMO may consider lower droop settings in the future to reflect the capability of high-speed technologies.

- 4.2.8. Where the response under paragraphs 4.2.1 and 4.2.2 is controlled by Droop Response, in accordance with 4.2.5(a) the Facility:
- may have asymmetrical Droop Settings for Contingency Reserve Raise and Contingency Reserve Lower; and
  - must have a minimum Droop Setting of 2%,
- and is not required to respond inside its Droop Deadband Setting.
- 4.2.9. All Facilities providing Contingency Reserve Raise or Contingency Reserve Lower must either:
- operate in AGC Base Assist while enabled for Contingency Reserve; or
  - be configured to deliver their full enabled quantity in response to an event.

- 4.2.10. Where a Facility operates in AGC Base Assist, in accordance with paragraph 4.2.9(a), that Facility must be capable of receiving and responding to AGC signals in accordance with Technical Specification: Operational Data Points for Registered Facilities.
- 4.2.11. All Facilities providing Contingency Reserve Raise as a Block Response must have Block Responses less than or equal to the Maximum Contingency Reserve Block Size, specified under paragraph 5.1.
- 4.2.12. All Facilities providing Contingency Reserve Raise or Contingency Reserve Lower must have a suitable High-Resolution Time Synchronised Data Recorder, located at or close to the relevant connection point, capable of disturbance recording in accordance with the Communication and Control Systems WEM Procedure.
- 4.2.13. All Facilities providing Contingency Reserve Raise or Contingency Reserve Lower must meet the relevant requirements of:
- (a) Technical Specification: Operational Data Points for Registered Facilities; and
  - (b) Communications and Control Systems WEM Procedure.
- 4.2.14. Where a Facility is unable to meet a Performance Requirement specified in paragraphs 4.2.6, 4.2.7(b) or 4.2.9, AEMO may determine that the Facility is exempt from the relevant Performance Requirements where it determines an alternative means of providing the service is available.
- 4.2.15. Where AEMO has determined that a Facility is exempt from a Performance Requirement, in accordance with paragraph 4.2.14, it may:
- (a) set a time period for that exemption; and
  - (b) may revoke that exemption at any time and request Re-Accreditation of that Facility in accordance with paragraph 8.2.1, where AEMO considers that the alternative means of providing the service is no-longer sufficient to allow AEMO to maintain Power System Security and Power System Reliability.

### **4.3. RoCoF Control Service Performance Requirements**

- 4.3.1. All Facilities providing RoCoF Control Service must have a quantity of Inertia, measured in rotational MWs at 50 Hz.
- 4.3.2. All Facilities providing RoCoF Control Service must have a suitable High-Resolution Time Synchronised Data Recorder, located at or close to the relevant connection point, capable of disturbance recording in accordance with the Communication and Control Systems WEM Procedure.
- 4.3.3. All Facilities providing RoCoF Control Service must meet the relevant requirements of:
- (a) Technical Specification: Operational Data Points for Registered Facilities; and
  - (b) Communications and Control Systems WEM Procedure.



## 4.4. Accreditation Parameters

4.4.1. The Accreditation Parameters for all Facilities, for each relevant FCESS are detailed in Table 3.

**Table 3 Accreditation Parameters**

| Accreditation Parameter  | Regulation Raise | Regulation Lower | Contingency Reserve Raise | Contingency Reserve Lower | RoCoF Control Service |
|--|------------------|------------------|---------------------------|---------------------------|-----------------------|
| (a) the maximum quantity of FCESS that the Facility can deliver under any Operating Configuration  | Yes              | Yes              | Yes                       | Yes                       | Yes                   |
| (b) where relevant, alternative maximum quantities of FCESS that the Facility can deliver using its Standard Operating Configurations                          | Yes              | Yes              | Yes                       | Yes                       | Yes                   |
| (c) the Standing Enablement Minimum and Standing Enablement Maximum for the Facility under any Operating Configuration   | Yes              | Yes              | Yes                       | Yes                       | Yes                   |
| (d) where relevant, the alternative Standing Enablement Minimums and Standing Enablement Maximums for the Facility using its Standard Operating Configurations | Yes              | Yes              | Yes                       | Yes                       | Yes                   |
| (e) the Standing Low Breakpoint and Standing High Breakpoint for the Facility under any Operating Configuration  | Yes              | Yes              | Yes                       | Yes                       | Yes                   |
| (f) where relevant, the Standing Low Breakpoints and Standing High Breakpoints for the Facility using its Standard Operating Configurations                    | Yes              | Yes              | Yes                       | Yes                       | Yes                   |
| (g) whether the Facility will provide Contingency Reserve Raise response using a Block Response or a Continuous Response                                       |                  |                  | Yes                       | Yes                       |                       |

| Accreditation Parameter  | Regulation Raise | Regulation Lower | Contingency Reserve Raise | Contingency Reserve Lower | RoCoF Control Service |
|--|------------------|------------------|---------------------------|---------------------------|-----------------------|
| (h) whether the Facility will provide a Block Response and therefore is subject to the Maximum Contingency Reserve Block Size under paragraph 5.1                |                  |                  | Yes                       |                           |                       |
| (i) where a Facility is subject to the Maximum Contingency Reserve Block Size, the size of each relevant Block Response  |                  |                  | Yes                       |                           |                       |
| (j) where a Facility provides Contingency Reserve Raise or Contingency Reserve Lower response using Droop Response, the Droop Setting for that Facility          |                  |                  | Yes                       | Yes                       |                       |
| (k) where a Facility provides Contingency Reserve Raise or Contingency Reserve Lower response using Droop Response, the Droop Deadband Setting for that Facility |                  |                  | Yes                       | Yes                       |                       |
| (l) Any exemptions applying to that Facility in accordance with paragraph 4.2.14   |                  |                  | Yes                       | Yes                       |                       |
| (m) a Facility Performance Factor of 1   | Yes              | Yes              |                           | Yes                       | Yes                   |
| (n) the Facility Speed Factor for Contingency Reserve Raise for that Facility  |                  |                  | Yes                       |                           |                       |
| (o) for a Facility that is an Interruptible Load, the Restoration Profile of the Interruptible Load if applicable  |                  |                  | Yes                       |                           |                       |
| (p) any relevant exemptions granted by AEMO for that Facility  |                  |                  | Yes                       | Yes                       |                       |

### **E[I] Facility Performance Factor**

Facility Performance Factors are designed to dynamically reflect the value of a Facility's enabled quantity for an Essential System Service in contributing to the required Essential System Service quantity. Facility Performance Factors will vary by Dispatch Interval according to system conditions (System Inertia and Contingency Sizes alongside other factors).

From New WEM Commencement Day, only Contingency Reserve Raise will apply a Facility Performance Factor (based on Facility Speed Factor detailed under paragraph 7), and for all other services the Facility Performance Factor will be set at 1.

It is intended that inclusion of dynamic Facility Performance Factors for other Essential System Services will be considered by AEMO in the future.

## **5. SETTING OF FCESS PERFORMANCE REQUIREMENTS**

### **5.1. Maximum Contingency Reserve Block Size**

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## **E[J] Maximum Contingency Reserve Block Size**

The Maximum Contingency Reserve Block Size concept is designed to mitigate the risk associated with partially clearing Contingency Reserve Raise which is delivered as a Block Response. Facilities that provide Contingency Reserve Raise as a Block Response (Interruptible Loads for example) are only capable of delivering either the full quantity or zero. For example if a Facility provides 100 MW Contingency Reserve Raise as a Block Response the only delivery of that service would be 100 MW or zero.

However, if this Facility is the marginal provider of Contingency Reserve Raise, the system may not require 100 MW. The Dispatch Algorithm may clear 5 MW for that Facility and activation of the full 100 MW may result in an over-frequency event. To mitigate this risk, AEMO must set the Maximum Contingency Reserve Block Size, reflective of forecast system conditions.

This paragraph 5.1 provides the guidance for AEMO's assessment of the size of the Maximum Contingency Reserve Block Size and how it may be updated to reflect changing system conditions.

The proposed methodology considers a worst-case scenario, to determine the maximum block size that would cause frequency to exceed the Normal Operating Frequency Band. The Maximum Contingency Reserve Block Size then limits the quantity to be provided in each offered tranche.

Any Facility which delivers Contingency Reserve services in a block manner must be capable of independently triggering enabled tranches.

- 5.1.1. AEMO must determine the Maximum Contingency Reserve Block Size as the Block Response quantity of Contingency Reserve Raise which would cause the SWIS Frequency to exceed the Normal Operating Frequency Band assuming Power System conditions which would have the largest impact, per megawatt, on SWIS Frequency.
- 5.1.2. AEMO must publish the Maximum Contingency Reserve Block Size on the WEM Website.
- 5.1.3. AEMO may re-determine the Maximum Contingency Reserve Block Size at any time.
- 5.1.4. AEMO may determine that a Market Participant must seek Re-Accreditation under paragraph 8.2.1 where the Maximum Contingency Reserve Block Size is varied under paragraph 5.1.1.

## **6. PERFORMANCE VERIFICATION**

### **6.1. Performance verification for FCESS**

### **E[K] Monitoring Performance of providers of Regulation**

AEMO will monitor performance of Facilities providing Regulation Raise and Regulation Lower to track actual behaviour against Performance Requirements and relevant Facility Accreditation Parameters, to identify:

- (a) whether there is a persistent deviation above the threshold; and
- (b) rate of change of difference between desired and actual either increasing or not decreasing above threshold rate.

Each period identified as having a persistent deviation above the threshold is allocated a:

- (a) difference from desired (by MW and/or percentage); and
- (b) the length of the period.

AEMO will review ongoing data from this analysis under paragraph 6.1.1 and trigger a Re-Accreditation under paragraph 6.1.5 where AEMO considers a Facility is consistently failing to perform in accordance with the Performance Requirements. Where the Facility is failing to perform in accordance with its Accreditation Parameters AEMO will determine whether to trigger a Re-Accreditation based on the criteria in paragraph 6.1.6.

- 6.1.1. AEMO must monitor the Performance Requirements and Accreditation Parameters for each Facility accredited to provide FCESS by:
  - (a) for Regulation Raise and Regulation Lower, monitoring the degree to which a Facility follows AGC; and
  - (b) for Contingency Reserve Raise, Contingency Reserve Lower and RoCoF Control Service monitoring the response of that Facility to contingency events.
- 6.1.2. AEMO must undertake a review of the performance of Facilities accredited for FCESS where:
  - (a) AEMO becomes aware, through monitoring in accordance with paragraph 6.1.1 that a Facility's performance is varying from the required Performance Requirements or the Facility's Accreditation Parameters; and
  - (b) AEMO undertakes a scheduled review of Facilities' performance in accordance with paragraph 6.1.3.
- 6.1.3. AEMO must undertake a scheduled review of all Facilities accredited for any FCESS for any relevant Accreditation Parameter that has not been assessed within the last 2 years, every two years.
- 6.1.4. AEMO's review under paragraph 6.1.2 may include analysis of the extent to which each relevant Facility meets the relevant Performance Requirements and the Facilities Accreditation Parameters, through assessment of service delivery whilst enabled for the relevant FCESS, including:
  - (a) analysis of SCADA data collected for the relevant Facility;
  - (b) analysis of High-Resolution Time Synchronised Data;
  - (c) analysis of enablement quantities for the relevant Dispatch Intervals; and
  - (d) analysis of Forced Outage rates.

- 6.1.5. Where, following a review under paragraph 6.1.2, AEMO determines a Facility has not been consistently meeting the relevant Performance Requirements for the relevant FCESS, or has not been enabled for that FCESS over the review period, it must trigger a Re-Accreditation for that Facility under paragraph 8.2.1, and publish on the WEM Website that the Facility has been required to undertake Re-Accreditation.
- 6.1.6. Where, pursuant to the review under paragraph 6.1.2, AEMO determines a Facility has not been delivering the relevant FCESS in accordance with its relevant Accreditation Parameters AEMO must determine whether the variation is significant, by:
- (a) reviewing the magnitude of variance from the relevant Facility's Accreditation Parameters; and
  - (b) reviewing the regularity of variance from the relevant Facility's Accreditation Parameters, and
- establishing whether those variances limit AEMO's ability to maintain Power System Security or Power System Reliability.

- 6.1.7. Where AEMO determines a significant variation of a Facility from its Accredited Parameters under paragraph 6.1.6 it must trigger a Re-Accreditation of that Facility under Paragraph 8.2.1, and publish on the WEM Website that the Facility has been required to undertake Re-Accreditation.

## 7. FCESS ACCREDITATION PARAMETER DETERMINATION

### 7.1. Determination of Maximum Quantity for Contingency Reserve

#### **E[L] Determination of Maximum Quantity for Contingency Reserve**

AEMO will determine the maximum quantity for which a Facility may be accredited for Contingency Reserve Raise or Contingency Reserve Lower, as the maximum quantity under any Operating Configuration for which that Facility can deliver:

- (a) for Contingency Reserve Raise to a Local Frequency excursion of 48.975 Hz; and
- (b) for Contingency Reserve Lower to a Local Frequency excursion of 51.025 Hz.

This determination will be capped by the Facility's maximum response based on its characteristics, including the nominal size of relevant components of a Facility and their Droop Settings and Droop Deadband Settings.

For example, a Facility with a Droop Deadband Setting of 0.025 Hz and a Droop Setting  $s = 4\%$  will be able to accredit a theoretical maximum of half its nominal power capacity:

$$\frac{\Delta P}{P_N} = \frac{\Delta f}{f_0 s} = \frac{(1.025 - 0.025)\text{Hz}}{50\text{Hz} * 4\%} = 0.5$$

The same facility with a 2% Droop Setting will be eligible to accredit up to its full nominal power capacity.

This determination will also be capped at the maximum that can be delivered and sustained for 15 minutes, as demonstrated through Facility testing where operational data is insufficient for AEMO to reasonably determine a Facility is capable of delivering that response.

- 7.1.1. AEMO must determine a maximum quantity of Contingency Reserve Raise or Contingency Reserve Lower for each Facility seeking Accreditation or Re-Accreditation for Contingency Reserve Raise or Contingency Reserve Lower.
- 7.1.2. AEMO's determination under paragraph 7.1.1 must be to the lesser of:
- (a) the Facility's maximum theoretical response to:
    - (i) for Contingency Reserve Raise to a Local Frequency excursion from 50 Hz to 48.975 Hz; and
    - (ii) for Contingency Reserve Lower to a Local Frequency excursion from 50 Hz to 51.025 Hz.
  - (b) any proposed Accreditation Parameters, including those subsequently amended in consultation with AEMO; and
  - (c) the greater of:
    - (i) where the Facility was tested, the maximum response achieved through testing which meets the relevant Performance Requirements; and

- (ii) where the Facility's capability in response to system events can be determined from operational data, AEMO's reasonable determination of the Facility's capability.

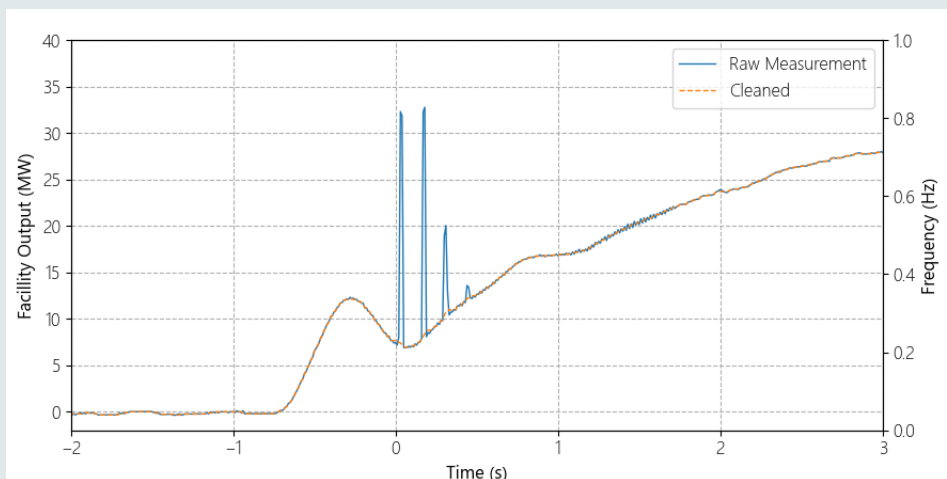
## 7.2. Speed Factor Determination

- 7.2.1. AEMO must determine a Facility Speed Factor for each Facility seeking Accreditation or Re-Accreditation for Contingency Reserve Raise as:
- (a) where that Facility delivers Contingency Reserve Raise controlled by Droop Response in accordance with paragraph 4.2.5(a) in accordance with paragraph 7.2.2; or
  - (b) where that Facility delivers Contingency Reserve Raise using an automated under-frequency relay in accordance with paragraph 4.2.5(b) as the smallest Facility Speed Factor, accounting for the capabilities of the Dispatch Algorithm.
- 7.2.2. In determining a Facility Speed Factor for a Facility, AEMO must identify the Primary Frequency Response from data captured from a High-Resolution Time Synchronised Data Recorder, following:
- (a) testing, for all required tests undertaken in accordance with paragraphs 2.3.4, 3.1.5(c) or 9.2.1 for the relevant Accreditation or Re-Accreditation; or
  - (b) two or more Contingency Events, with at least one occurring in the previous two years, where:
    - (i) the SWIS Frequency moved below the Normal Operating Frequency Band; and
    - (ii) the relevant Facility was enabled for Contingency Reserve Raise in the relevant Dispatch Intervals.
- 7.2.3. AEMO may filter, exclude, apply substitutions or other corrections to High-Resolution Time Synchronised Data under paragraph 7.2.2 where AEMO determines the data to be erroneous or non-reflective of Primary Frequency Response, including:
- (a) corrupt or missing data due to recording or communications device errors; and
  - (b) responses associated with switching transients and other local voltage phenomena.



## E[M] Data Filtering

Figure E[2] shows an example situation in which a recording with erroneous data can be identified, filtered and then still used for Accreditation under paragraph 7.2.3(a). In this instance, the “spikes” can be attributed to device errors through cross-referencing with other near-by recorders, and then removed by applying a rolling median filter to the data.



**Figure E[2] Example of filtering erroneous data from a high-speed recording**

## E[N] Inertial Component

Where AEMO determines a Facility Speed Factor it will subtract the Inertial Component from a Facility’s Primary Frequency Response. AEMO will use the Inertial Component from that Facility’s generation system model under an approved Registered Generator Performance Standard or other available model where a Registered Generator Performance Standards is not available. It is therefore important for a Market Participant to verify the model prior to seeking Accreditation to ensure that its contribution is accurately reflected for a Rate of Change of Frequency Control Service and in the Facility Speed Factor assessment.

- 7.2.4. AEMO must estimate and exclude any contribution of the Facility’s Inertial Component to the Primary Frequency Response identified in accordance with paragraph 7.2.3, by using the Facility’s generation system model associated with an approved Registered Generator Performance Standard, or where this is unavailable, the most up to date model of the Facility that is available to AEMO.
- 7.2.5. AEMO must develop Reference Profiles for each frequency profile tested or observed under paragraph 7.2.2, being the theoretical response of that Facility to Local Frequency and must include a range of profiles, accounting for the requirements of the Dispatch Algorithm, each corresponding to different reference Facility Speed Factors for the Facility to reach its full theoretical response to that frequency excursion.
- 7.2.6. For each Reference Profile developed in accordance with paragraph 7.2.5 AEMO must calculate the theoretical response to a frequency excursion with time, determined as the solution  $P(t)$  to:

$$\frac{dP}{dt} = \frac{P_{setpoint}(f) - P(t)}{\tau}$$

Where:

- $P_{setpoint}$  is the droop control setpoint offset (from basepoint) calculated in accordance with paragraph 7.2.7
- $P(t)$  is the increase (from base point) in Facility Active Power Injection
- $\tau$  is the Reference Speed Factor (in seconds)

7.2.7. When determining a Reference Profile in accordance with paragraph 7.2.6, AEMO must determine the droop control setpoint offset, as:

$$P_{setpoint}(f) = \max\left(PFR, \frac{-P_n}{s * f_0} DB(\Delta f) * PFR\right)$$

Where:

- $PFR$  is the cleared Contingency Reserve quantity
- $P_n$  is the total nominal (rated nameplate) power of all Energy Producing Systems delivering the service
- $f_0$  is the nominal frequency (50 Hz)
- $s$  is the Droop Setting for that Facility
- $DB$  is the effective frequency deviation after applying a symmetric Droop Deadband Setting for that Facility
- $\Delta f$  is  $f - f_0$ , or the frequency deviation from nominal

## E[O] Determination of Facility Speed Factor

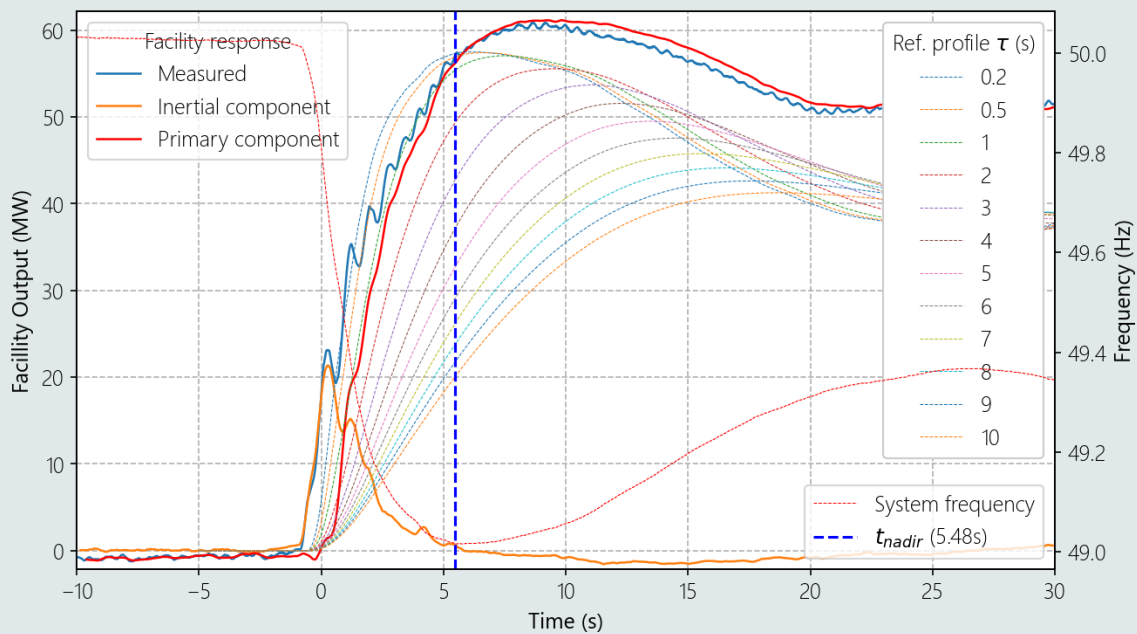
### E[O1] Reference Profiles

Determination of Reference Profiles under paragraph 7.2.5 allows AEMO to generate theoretical Facility response for a given Contingency Reserve Raise enablement, frequency excursion and Facility Speed Factor.

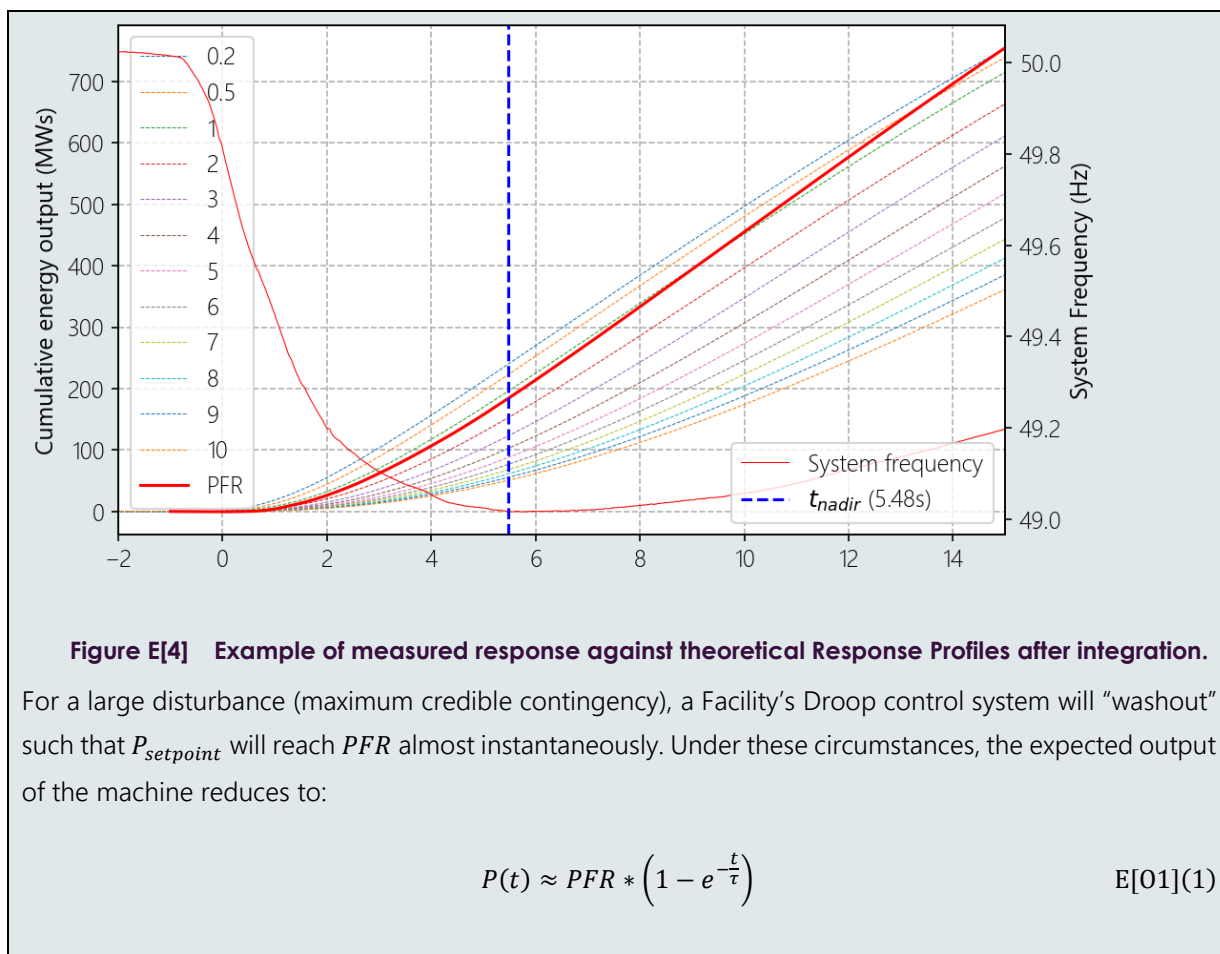
Figure E[3] shows a comparison of measured response against a range of Reference Profiles calculated in accordance with paragraph 7.2.6. Figure E[4] shows the same data as Figure E[3] with Active Power Injection integrated to energy.

AEMO will process Reference Profiles for each relevant frequency profile in paragraph 7.2.2 and Primary Frequency Response for which a Facility is seeking Accreditation.

The Reference Profiles in Figure E[2] range from 0.2 (s) to 10 (s), where a faster response has a lower Facility Speed Factor. Figure E[3] shows the same Facility as an integrated response (in MWs) compared to integrated Reference Profiles, this shows the Facility response exceeding the two second Reference Speed Factor.



**Figure E[3] Example of measured response against theoretical Response Profiles.**



- 7.2.8. AEMO must take the integral of each Facility Response under paragraph 7.2.4 and each Reference Profile developed under paragraph 7.2.5.
- 7.2.9. For each integral of the Facility Response, which AEMO reasonably determines is representative of that Facilities capability, AEMO must determine the integral of the Reference Profile calculated for that frequency excursion which is exceeded by the Facility Response at the frequency nadir.
- 7.2.10. AEMO must determine the Facility Speed Factor as the Reference Profile with the highest Reference Speed Factor for all determinations under paragraph 7.2.9.

## 8. AMENDMENT OF ACCREDITATION PARAMETERS

### 8.1. Market Participant Identified Variation to its Facilities Accreditation Parameters

- 8.1.1. Where a Market Participant identifies that its Facility varied, is varying or is likely to vary significantly from its Accreditation Parameters or the Performance Requirements for the relevant FCESS it must notify AEMO [Clause 2.34A.8] in accordance with the details on the WEM Website, which must include details of:
- the name of the Facility;

- (b) the Accreditation Parameters which have varied, or are expected to vary; and
  - (c) the proposed Accreditation Parameters for which the Market Participant requests Re-Accreditation.
- 8.1.2. Where the notification in accordance with paragraph 8.1.1, has been made at least 12-months after Accreditation in accordance with paragraphs, 2.2.1, 2.3.1, 2.4.1 and 3.1.1 or a Re-Accreditation in accordance with paragraph 8, AEMO must request that Facility undertake Re-Accreditation in accordance with paragraph 3.1.1 [Clause 2.34A.10(a)].
- 8.1.3. Where the notification in accordance with paragraph 8.1, has been made less than 12-months following Accreditation in accordance with paragraphs 2.2.1, 2.3.1, 2.4.1 and 3.1.1 or a Re-Accreditation in accordance with paragraph 8 [Clause 2.34A.10(b)], AEMO must either:
- (a) decline the request in accordance with paragraph 8.1.5; or
  - (b) request that Facility undertake Re-Accreditation in accordance with paragraph 3.1.1.
- 8.1.4. AEMO's determination under paragraph 8.1.3 must consider:
- (a) whether the Market Participant for the Facility is requesting its Accreditation Parameters be reduced to a lower level of service;
  - (b) the magnitude of the variation to the Accreditation Parameters; and
  - (c) any other factor that AEMO deems relevant.
- 8.1.5. Where AEMO declines a request in accordance with paragraph 8.1.3(a), it must notify the Market Participant and provide the reasons for its decision [Clause 2.34A.11].

## **8.2. AEMO Identified Variation to its Facilities Accreditation Parameters**

- 8.2.1. If AEMO identifies a Facility has varied, is varying or is likely to vary from its Accreditation Parameters or Performance Requirements for the relevant FCESS, under paragraphs 4.2.15, 6.1.5 or 6.1.7, AEMO may reassess the Accreditation Parameters [2.34A.11] and may request the relevant Market Participant provide reasons for the variation or likely variation.
- 8.2.2. Any response to a request under paragraph 8.2.1, must be provided to AEMO within 10 Business Days of that request, in accordance with the notification details on the WEM Website.
- 8.2.3. AEMO must determine, whether to amend the Accreditation Parameters for a Facility identified in paragraph 8.2.1 and may consider:
- (a) any information received under paragraph 8.2.2; and
  - (b) the magnitude of the variation to the Accreditation Parameters or Performance Requirements.
- 8.2.4. Where AEMO in accordance with paragraph 8.2.3 determines an amendment to a Facility's Accreditation Parameters, it must notify the Market Participant for that Facility, inclusive of:
- (a) the name of the Facility;
  - (b) the amended Accreditation Parameters for the Facility;

- (c) the date that the amendments will take effect from; and
- (d) the reasons for its decision.

8.2.5. Where a Market Participant is notified under paragraph 8.2.4 it must submit the Accreditation Parameters to AEMO in accordance with paragraph 10.

## **9. TESTING AND RE-TESTING**

### **9.1. General Testing Requirements**

9.1.1. AEMO must develop a Frequency Co-Optimised Essential System Services Testing Guideline and publish on the WEM Website.

9.1.2. Tests included in the Frequency Co-Optimised Essential System Services Testing Guideline may include but are not limited to, for all relevant Operating Configurations:

- (a) for Regulation Raise and Regulation Lower:
  - (i) testing a Facility's ability to maintain  $\pm 5\%$  of ramp rate at the Facility's maximum ramp rate to the extent possible allowing for a Facilities Generator Performance Standards (including required Droop Response) over two consecutive dispatch intervals;
  - (ii) testing a Facility's ability to maintain  $\pm 5\%$  of ramp rate at 50% of the Facility's maximum ramp rate to the extent possible allowing for a Facilities Generator Performance Standards (including required Droop Response) over two consecutive dispatch intervals; and
  - (iii) testing a Facilities ability to meet the requirements of paragraphs 4.1.1, by following AGC control over an activation period of 2 hours.
- (b) for Contingency Reserve Raise, Contingency Reserve Lower and RoCoF Control Service;
  - (i) Injection of a frequency bias.

9.1.3. AEMO may amend the Frequency Co-Optimised Essential System Services Testing Guideline as required.

## **9.2. FCESS Tests**

9.2.1. Where AEMO requires a test or re-test of a Facility in order to assess its ability to deliver Regulation, or to tune a Facility in its Automatic Generation Control (AGC) system, or to deliver Contingency Reserve Raise, Contingency Reserve Lower or RoCoF Control Service, it must specify the tests to be conducted in accordance with the Frequency Co-Optimised Essential System Services Testing Guideline.

9.2.2. A Market Participant or Network Operator must conduct the tests required by AEMO in the specification 9.2.1 under an approved Commissioning Test Plan in accordance with the WEM Procedure: Commissioning Tests.

## **10. UPDATES TO STANDING DATA**

10.1.1. Where a Market Participant is required to;

- (a) submit Accreditation Parameters as part of a FCESS Accreditation or Re-Accreditation; or
- (b) submit an accredited RoCoF Ride-Through Capability,

it must:

- (a) prior to New WEM Commencement Day, submit in accordance with the details on the WEM Website; or
- (b) following New WEM Commencement Day submit into Standing Data in accordance with the details on the WEM Website,

within 5 Business Days of receiving Accreditation Parameters or an accredited RoCoF Ride-Through Capability from AEMO.

10.1.2. Where a Network Operator is required to submit an accredited RoCoF Ride-Through Capability it must submit it in accordance with the details on the WEM Website within 5 Business Days of receiving an accredited RoCoF Ride-Through Capability from AEMO.

10.1.3. Where a Market Participant or Network Operator submits Accreditation Parameters or an accredited RoCoF Ride-Through Capability, AEMO must publish the Accreditation Parameters or RoCoF Ride-Through Capability for that Facility on the WEM Website.

## **11. ROCOF RIDE-THROUGH CAPABILITY**

### **11.1. Deeming a Facility's RoCoF Ride-Through Capability**

11.1.1. Unless AEMO makes a determination under paragraph 11.2.6, AEMO must deem the RoCoF Ride-Through Capability for any Facility to be at the RoCoF Safe Limit.

### **11.2. Accreditation or Re-Accreditation of a Facility's RoCoF Ride-Through Capability**

11.2.1. AEMO must publish a list of RoCoF Sensitive Equipment on the WEM Website, which it may update from time to time.

11.2.2. A Market Participant or Network Operator may apply to vary the RoCoF Ride-Through Capability for a Facility at any time by submitting an application to AEMO in accordance with the details on the WEM Website.

11.2.3. An application under paragraph 11.2.2 must include:

- (a) for a Facility with a Registered Generator Performance Standard, confirmation that the Market Participant wishes to use the RoCoF for which the Facility can maintain Continuous Uninterrupted Operation over 1 second as specified under that Registered Generator Performance Standard, as the basis for Accreditation;
- (b) evidence that the Facility has maintained Continuous Uninterrupted Operation under a range of RoCoF events that demonstrate the ability of that Facility to ride through in accordance with the RoCoF Ride-Through Capability that the Market Participant is seeking Accreditation for; or
- (c) an engineering report, derived from an engineering study, that must contain details of the results and methodology of that engineering study.

11.2.4. An engineering report for a Facility under paragraph 11.2.3(c) must identify all types of equipment utilised as part of the operation of the Facility that is sensitive to RoCoF, and:

- (a) for a Network Operator, may include any type of equipment identified by AEMO as RoCoF Sensitive Equipment and, if applicable, any reasons it has chosen not to include a type of equipment identified by AEMO as RoCoF Sensitive Equipment; and
- (b) for a Market Participant, must include any type of equipment identified by AEMO as RoCoF Sensitive Equipment.

11.2.5. The engineering report must include, for each type of equipment identified under paragraph 11.2.4, the highest RoCoF for which that equipment can operate safely and reliably over any 500 millisecond period, and justification for that value which can be provided by:

- (a) manufacturer data for that equipment;
- (b) testing results for that equipment; or
- (c) any other supporting evidence.



- 11.2.6. For each application made under paragraph 11.2.2, AEMO must determine whether to set the RoCoF Ride Through Capability for the Facility as the value proposed in the application or to retain the last determined value.
- 11.2.7. AEMO must notify the relevant Market Participant or Network Operator of its determination under paragraph 11.2.6 within 20 Business Days of the later of:
- (a) receipt of the application; or
  - (b) additional information requested by AEMO under paragraph 11.2.9, or a date reasonably determined by AEMO.
- 11.2.8. In making a determination under paragraph 11.2.6, AEMO may consider 11.2.8, AEMO may consider:
- (a) the degree to which the engineering report and included data provided under paragraph 11.2.3(c) supports the proposed RoCoF Ride-Through Capability for that Facility;
  - (b) historical data available to AEMO which demonstrates the capability of a Facility to operate safely and reliably under high RoCoF events;
  - (c) a relevant Registered Generator Performance Standard.
- 11.2.9. Where AEMO requires additional information (which may include additional engineering studies) to support its determination under paragraph 11.2.5 it must request the relevant Market Participant or Network Operator provide that information in a specified manner and by a specified date.
- 11.2.10. Where a Market Participant or Network Operator receives a request under paragraph 11.2.9 it must provide the requested information in the manner and by the date specified by AEMO.
- 11.2.11. Where AEMO has notified the Market Participant or Network Operator under paragraph 11.2.7 that it has set the RoCoF Ride Through Capability for the Facility as the value proposed in the application, the Market Participant or Network Operator must submit the accredited RoCoF Ride-Through Capability for that Facility in accordance with paragraph 10.1.1 or paragraph 10.1.2 as appropriate within 5 Business Days of receiving the notification.

### **11.3. AEMO Triggers for Re-Accreditation of RoCoF Ride-Through Capability**

- 11.3.1. AEMO may review the performance of a Facility to determine whether the RoCoF Ride-Through Capability for which a Facility is accredited, is appropriate, where:
- (a) AEMO reasonably determines a Facility has not operated safely and reliably due to RoCoF;
  - (b) AEMO amends the list of RoCoF Sensitive Equipment in accordance with paragraph 11.2.1; and
  - (c) AEMO is notified by a Market Participant or Network Operator that its RoCoF Ride-Through Capability has varied, is varying or is likely to vary [Clause 2.34A.12D], as notified in accordance with the details on the WEM Website.

- 11.3.2. Where, in accordance with paragraph 11.3.1 AEMO identifies a Facility may have varied, is varying, or is likely to vary significantly from its accredited RoCoF Ride-Through Capability it must notify the relevant Market Participant or Network Operator for the Facility and request reasons for the variation.
- 11.3.3. Where a Market Participant or Network Operator is notified in accordance with paragraph 8.2.1, it must provide the relevant reasons for the variation, and any proposed rectification inclusive of timing for that rectification, to AEMO in accordance with the notification details on the WEM Website, within 20 Business Days.
- 11.3.4. AEMO must determine, for each relevant Facility under paragraph 8.2.1 whether to require Re-Accreditation of that Facility's RoCoF Ride-Through Capability by considering:
- (a) information received under paragraph 11.3.3;
  - (b) any rectification proposed by that Market Participant or Network Operator; and
  - (c) any other information available to AEMO;

- 11.3.5. AEMO must notify a Market Participant or Network Operator of its determination under paragraph 11.3.4, within 20 Business Days of receiving a response under paragraph 11.3.3 including reasons for its determination.
- 11.3.6. Where AEMO has notified a Market Participant under paragraph 11.3.4 that it must seek Re-Accreditation for that Facility's RoCoF Ride-Through Capability, that Market Participant must apply for Re-Accreditation in accordance with paragraph 11.2.2.

## **12. ROCOF RIDE-THROUGH COST RECOVERY LIMIT**

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### E[P] RoCoF Ride-Through Cost Recovery Limit

The RoCoF Ride-Through Cost Recovery Limit is a value, determined in accordance with paragraph 12, which in combination with the RoCoF Safe Limit (as prescribed under the Frequency Operating Standard) creates a range of RoCoF Ride-Through Capability for which Facilities with accredited or deemed capabilities are considered causers for the purposes of cost-recovery of the RoCoF Control Service.

Figure E[4] provides a simplified example of Facilities which may accredit their RoCoF Ride-Through Capability to a value greater than the RoCoF Ride-Through Cost Recovery Limit. In this example, the RoCoF Causers are deemed by AEMO to have a RoCoF Ride-Through Capability at the RoCoF Safe Limit. In this example those Facilities would be RoCoF Causers for the purposes of RoCoF Control Service cost recovery.

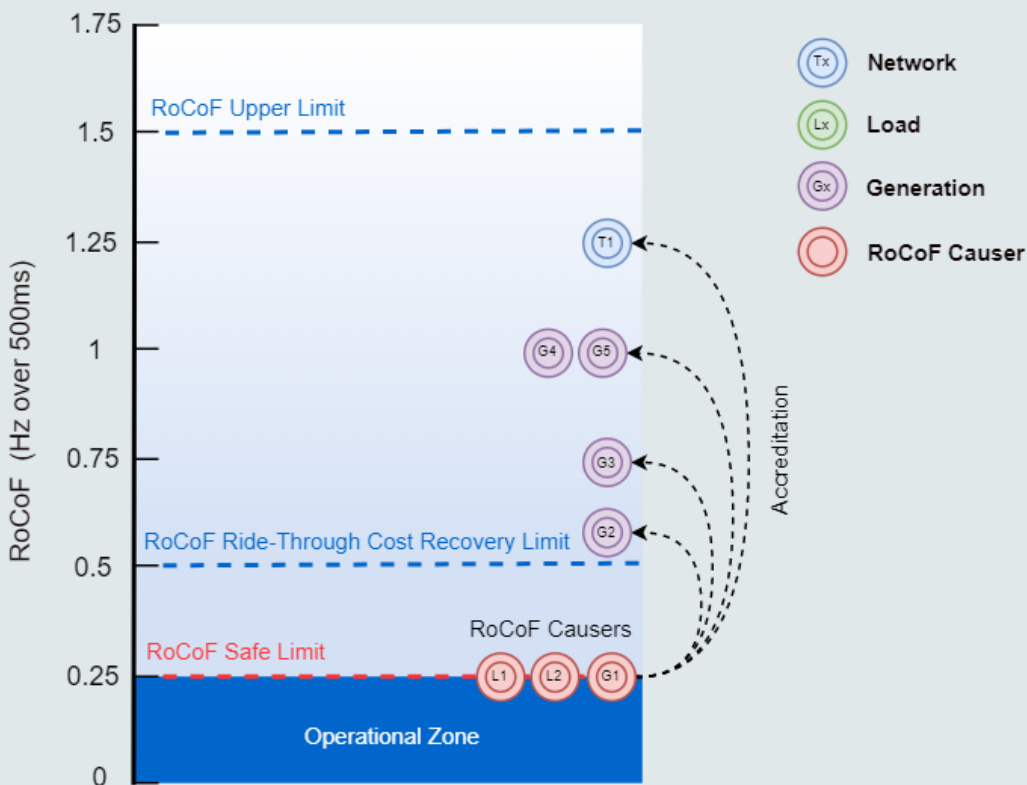


Figure E[5] RoCoF Ride-Through Cost Recovery Limit

- 12.1.1. AEMO must determine and publish on the WEM Website, the RoCoF Upper Limit at least annually [Clause 7.13A.1].
- 12.1.2. In determining the RoCoF Upper Limit, under paragraph 12.1.1 AEMO must consider:
  - (a) Power System conditions which would have the largest impact, per megawatt, on SWIS Frequency System conditions;

- (b) that only Primary Frequency Response is used to arrest system frequency (excluding any Inertial Component);
  - (c) any other factor AEMO considers relevant.
- 12.1.3. AEMO must set the initial RoCoF Ride-Through Cost Recovery Limit as 0.25 Hz per 500ms above the RocoF Safe Limit.
- 12.1.4. AEMO must determine the proposed RoCoF Ride-Through Cost Recovery Limit [Clause 2.34A.12] as the lesser of:
  - (a) at least 0.25 Hz over 500 milliseconds above the RoCoF Safe Limit; and
  - (b) the RoCoF Upper Limit,rounded up to the nearest 0.1 Hz.
- 12.1.5. AEMO:
  - (a) must re-determine the proposed RoCoF Ride-Through Cost Recovery Limit in accordance with paragraph 12.1.4, where the Frequency Operating Standard is amended to vary the RoCoF Safe Limit; and
  - (b) may re-determine the proposed RoCoF Ride-Through Cost Recovery Limit, in accordance with paragraph 12.1.4 where;
    - (i) the RoCoF Upper Limit is varied; or
    - (ii) AEMO is requested by a Market Participant to vary the RoCoF Ride Through Cost Recovery Limit and AEMO considers it appropriate to re-determine the RoCoF Ride-Through Cost Recovery Limit.
- 12.1.6. Where AEMO determines a proposed RoCoF Ride-Through Cost Recovery Limit in accordance with paragraph 12.1.4 it must publish the proposed RoCoF Ride-Through Cost Recovery Limit on the WEM Website.
- 12.1.7. Where AEMO publishes a proposed RoCoF Ride-Through Cost Recovery Limit in accordance with paragraph 12.1.6 it must notify, within 2 Business Days, any Market Participant or Network Operator where the proposed RoCoF Ride-Through Cost Recovery Limit would cause that Market Participant or Network Operators Facility to be a RoCoF Causer.
- 12.1.8. Market Participants and Network Operators may, in accordance with the details on the WEM Website submit a response to the proposed RoCoF Ride-Through Cost Recovery Limit within 20 Business Days of notification under paragraph 12.1.7, including:
  - (a) whether that Market Participant or Network Operator supports the proposed RoCoF Ride-Through Cost Recovery Limit, and the reasons why; or
  - (b) whether that Market Participant or Network Operator does not support the proposed RoCoF Ride-Through Cost Recovery Limit, and the reasons why.
- 12.1.9. AEMO must review and consider any issues raised from responses submitted in accordance with 12.1.8, and within 3 months of the closing date for submissions under paragraph 12.1.8, either:
  - (a) determine the proposed RoCoF Ride-Through Cost Recovery Limit as the RoCoF Ride-Through Cost Recovery Limit and publish on the WEM Website:

- (i) the RoCoF Ride-Through Cost Recovery Limit; and
  - (ii) the reasons for its decision, or
- (b) amend the proposed RoCoF Ride-Through Cost Recovery Limit, and publish on the WEM Website:
  - (i) the proposed RoCoF Ride-Through Cost Recovery Limit in accordance with 12.1.6; and
  - (ii) the reasons for its decision.

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## APPENDIX A. RELEVANT CLAUSES OF THE WEM RULES

Table 4 details:

- (a) the head of power clauses in the WEM Rules under which the Procedure has been developed; and
- (b) each clause in the WEM Rules requiring an obligation, process or requirement be documented in a WEM Procedure, where the obligation, process or requirement has been documented in this Procedure.

**Table 4 Relevant clauses of the WEM Rules**

| Clause   |
|----------|
| 1.49.1   |
| 1.49.2   |
| 1.49.4   |
| 1.49.5   |
| 2.34A.13 |

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