

Frequency operating standard review

Final determination and revised frequency operating standard published

The Reliability Panel has made a final determination to revise the frequency operating standard (FOS) that sets the operational requirements for the power system frequency.

In the context of the decarbonising power system, the Panel's determination supports the long-term interests of consumers by balancing the benefits of a secure and resilient power system with the costs of achieving this.

Power system equipment, including generators and associated plants, may disconnect from the power system if the system frequency becomes unstable and changes too quickly, or varies too far from 50 Hz. This can cause disconnections of load, regional separation, and further disconnection of generation, which, in the worst cases, can result in cascading failures leading to the full or partial collapse of the power system.

The core elements of the revised FOS

The revised FOS is intended to support system security as the NEM transitions away from synchronous thermal generators and towards inverter-based renewable (IBR) resources, such as renewable generators and batteries. Synchronous generators provide inertia to the power system, which slows the rate of change of frequency (RoCoF) and helps stabilise frequency during contingency events. As these generators retire and are replaced by IBRs, the FOS must evolve to account for reductions in the levels of inertia.

The key elements of the revised FOS are:

- the introduction of system limits for rate of change of frequency (RoCoF) following contingency events
- changes to the settings that relate to the limits and thresholds for contingency events
- changes to the FOS that applies during system restoration following a major system disturbance
- confirmation of the allowable ranges for frequency during normal operation, the primary frequency control band (PFCB) and that the target frequency is 50 Hz
- the removal of the limit for accumulated time error.

The revised FOS is largely consistent with the draft FOS, with the exception of the following additional changes made in response to stakeholder feedback to the draft determination:

- The minimum threshold for a generation event in Tasmania is revised to 20MW to align with the threshold for a load event in Tasmania
- The operational frequency tolerance band (OFTB) during system restoration be revised from 48 – 52 Hz to 49 – 51 Hz. This change resolves an inconsistency identified in the FOS and standardises the OFTB across all expected modes of system operation.

The revised FOS will take effect from **9 October 2023**. This date aligns with the commencement of the new market ancillary service arrangements for very-fast contingency FCAS, which provide fast frequency response.

Introduction of limits for RoCoF following contingency events

The revised FOS includes new requirements for the allowable RoCoF following contingency events. This new element of the standard defines the system operating limits in the face of the expected reduction in inertia. The revised FOS includes separate RoCoF requirements for the mainland and for Tasmania to reflect the different operational characteristics in each of these asynchronous regions.

The Panel considers that the RoCoF limits in the revised FOS are an initial step and will inform further regulatory reforms with the goal of developing market and regulatory arrangements for the efficient provision of inertia and RoCoF control services, such as the rule change request that the AEMC is currently considering on the efficient provision of inertia. The Panel expects that the initial RoCoF limits set out in the revised FOS could be increased in the future, subject to confirmation of increased RoCoF withstand capability of the generation fleet.

Changes to settings for limits and thresholds for contingency events

The revised FOS includes a number of changes with respect to the settings that relate to limits and thresholds for contingency events, these include:

- **Extension of the existing 144MW limit for generation events in Tasmania to also apply to load and network events** — this change reflects the challenges associated with managing the Tasmanian power system, including the expected interest in the connection of large commercial and industrial loads such as hydrogen electrolyzers and data centres.
- **No mainland contingency size limit in the FOS** — while AEMO expects increased operational risks associated with the connection of large generators and loads in the mainland NEM, AEMO advised that the existing arrangements in the NEM are sufficient for AEMO and TNSPs to manage these risks.
- **Revision of the threshold for a generation event in Tasmania from 50MW to 20MW** — this change aligns the definitions of generation and load events in Tasmania, reflecting the operational characteristics of the Tasmanian system.

Changes to the FOS during system restoration

The revised FOS makes changes to the standard that applies during restoration of load following load-shedding in the mainland power system or an island that has formed following separation from the mainland power system, these include:

- **Renaming of the “supply scarcity” operating condition to “system restoration”** — the renamed settings clarify and better reflect their original purpose to enable the timely restoration of load following a large contingency event.
- **Revision of the operational frequency tolerance band (OFTB) to 49 – 51 Hz during system restoration** — this change standardises the OFTB for interconnected, island, and system restoration conditions in the mainland NEM, as well as aligning the requirements for connecting generators with the expected system frequency outcomes in the NEM.

Confirmation of settings for frequency performance during normal operation

The settings in the revised FOS for normal operation build upon recent work by the AEMC on enduring arrangements for primary frequency response (PFR). The *Mandatory Primary frequency response* rule reinstated narrow band PFR and led to a dramatic improvement in frequency performance from late 2020. Subsequently, the *Primary frequency response incentive arrangements* rule confirmed mandatory PFR as an enduring requirement and established a framework for frequency performance payments, which will commence on 8 June 2025 and reward market participants whose plants help control frequency.

The revised FOS for normal operation includes:

- **Confirmation of 50Hz as the target for system frequency target** — this is consistent with the engineering assumptions that underpin the power system.
- **Confirmation of the allowable frequency range in the absence of contingency events** — the normal operating frequency band (NOFB) is confirmed at 49.85 – 50.15 Hz and the normal operating frequency excursion band (NOFEB) at 49.75 – 50.25 Hz.

- **Confirmation of the PFCB** as 49.985 – 50.015 Hz, consistent with the current settings in the NER.

This element of the revised FOS is supported by advice from AEMO and power system modelling from GHD which shows that provision of narrow band PFR by the bulk of the generation fleet delivers effective control of system frequency, increased power system resilience, and reduced aggregate frequency control costs.

The Panel is aware of a wide range of stakeholder views in relation to the settings in the FOS that apply during normal operation. The Panel considers that the settings determined in the FOS are necessary and appropriate under the current market and regulatory arrangements. Under the current arrangements in the NER, the mandatory PFR provisions are AEMO's primary mechanism to deliver the required level of aggregate frequency responsiveness that supports effective control of power system frequency. The Panel notes that new frequency performance payment arrangements will commence on 8 June 2025. These are expected to incentivise the provision of PFR beyond and in addition to the mandatory requirement. They will also provide a mechanism to allow AEMO to influence the level of aggregate frequency responsiveness provided by power system plant.

Removal of accumulated time error limit

The Panel has determined to remove the limit on accumulated time error from the FOS while retaining AEMO's monitoring and reporting obligations. AEMO will no longer be obligated to maintain time error within a preset range, providing AEMO with flexibility to adjust its systems over time. This change is unlikely to have any negative impacts on consumers or power system security, while keeping transparency for market participants who use time error as a frequency performance metric.

Background

The FOS defines the range of allowable frequencies for the national electricity market (NEM) under different conditions including during normal operation and following contingency events, such as generation, load or network events. When generation is equal to load, the frequency will be stable. However, when there is a mismatch between the demand for and supply of electricity, frequency will diverge from the nominal target of 50Hz.

Ongoing monitoring and a subsequent review of the FOS in 2027

The Panel will continue to monitor frequency performance and related developments through its *Annual market performance review*. In particular, the Panel intends to monitor and report on developments with respect to the new system limit on RoCoF and frequency performance during normal operation.

The Panel recommends that a subsequent review of the FOS should be completed by no later than the **end of 2027** and should include consideration of the normal operation settings and RoCoF settings. This timing allows flexibility about when the optimal time for the FOS to be reviewed, and would likely be informed by at least 12-18 months of monitoring of frequency outcomes following the frequency performance payments arrangements being implemented on **8 June 2025**.

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6 April 2023

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