



Primary Frequency Response Requirements Review

Consultation paper -
Standard consultation for the
National Electricity Market

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New South Wales | Queensland | South Australia | Victoria | Australian Capital Territory | Tasmania | Western Australia

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Explanatory statement and consultation notice

This consultation paper (**paper**) commences the first stage of the standard rules consultation procedure conducted by AEMO to update the Primary Frequency Response Requirements (**PFRR**) as required by National Electricity Rules (**NER**) 11.152.3 (the **proposal**).

The PFRR will have effect under NER 3.15.6AA, which commences on 8 June 2025 in accordance with the National Electricity Amendment (Primary frequency response incentive arrangements) Rule 2022 (**PFRR incentives rule**)¹.

The standard rules consultation procedure is described in NER 8.9.2.

This paper includes information on the proposal and AEMO's reasons for making it. An early draft of the PFRR reflecting the proposal is published with this consultation paper to provide context.

Consultation notice

AEMO is consulting on the proposal and invites written submissions from interested persons on the issues identified in this paper to pfr@aemo.com.au by 5:00pm (Melbourne time) on 16 January 2023.

Submissions may propose alternative or additional arrangements if they are better at meeting the objectives of this consultation and the national electricity objective in section 7 of the National Electricity Law. Interested persons are requested to include supporting reasons for those alternative or additional proposals.

Please note the following important information about submissions:

- All submissions will be published on AEMO's website, other than confidential content.
- Interested persons must identify any parts of their submission they wish to remain confidential, and explain why. AEMO may still publish that information if it does not consider it to be confidential, but will consult with affected interested persons before doing so. Material identified as confidential may be given less weight in the decision-making process than published material.
- Submissions received after the closing date and time will not be valid, and AEMO is not obliged to consider them. Interested persons providing a late submission should explain the reason for lateness and the detriment to them if AEMO does not consider their submission.

Interested persons can request a meeting with AEMO to discuss any particularly complex, sensitive or confidential matters relating to the proposal. Please refer to NER 8.9.1(k). Meeting requests must be received by the end of the submission period and include reasons for the request. AEMO will try to accommodate reasonable meeting requests but, where appropriate, may hold joint meetings with other persons or convene a meeting with a broader industry group. Subject to confidentiality restrictions, AEMO will publish a summary of matters discussed at these meetings.

¹ Final determination and amending rule available on the Australian Energy Market Commission's website at: <https://www.aemc.gov.au/rule-changes/primary-frequency-response-incentive-arrangements>

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1. Stakeholder consultation process

As required by NER 11.152.3, AEMO is consulting on the Primary Frequency Response Requirements (PFRR) in accordance with the standard rules consultation procedure in National Electricity Rules (NER) 8.9.2.

Note that this document uses terms defined in the NER, which are intended to have the same meanings. There is a glossary of additional terms and abbreviations in Appendix A.

AEMO’s indicative process and timeline for this consultation are outlined below. Future dates may be adjusted, and additional steps may be included, if necessary, as the consultation progresses.

Consultation steps	Dates
Consultation paper published	6 December 2022
Submissions due on consultation paper	16 January 2023
Draft report published	20 February 2023
Submissions due on draft report	21 March 2023
Final report published	8 May 2023

2. Background

2.1. Context for this consultation

On 8 September 2022, the Australian Energy Market Commission (**AEMC**) made the National Electricity Amendment (Primary frequency response incentive arrangements) Rule 2022 (**PFR incentives rule**) and published its final determination on that rule.

The PFR incentives rule provides enduring arrangements to support the control of power system frequency and incentivises plant behaviour that reduces the overall cost of frequency regulation during normal operation. This consultation concerns those provisions in the PFR incentives rule that apply to the PFRR only.

The PFR incentives rule requires AEMO to develop and publish the PFRR by 8 May 2023.

2.2. NER requirements

AEMO published the interim PFRR under NER 11.122.2 in accordance with the transitional provisions of the National Electricity Amendment (Mandatory primary frequency response) Rule 2020² (**Mandatory PFR rule**).

The PFRR are required to be made under NER 4.4.2A(a), while the remainder of NER 4.4.2A details what the PFRR should contain, and is reproduced here for convenience:

- (b) The *Primary Frequency Response Requirements* must include:
 - (1) a requirement that *Scheduled Generators* and *Semi-Scheduled Generators* set their *generating systems* to operate in *frequency response mode* within one or more performance parameters (which may be specific to different types of *plant*), which:
 - (i) must include maximum allowable deadbands which must not be narrower than the *primary frequency control band* outside of which *Scheduled Generators* and *Semi-Scheduled Generators* must provide *primary frequency response*; and
 - (ii) may include (but are not limited to):
 - (A) droop; and
 - (B) response time,(the *primary frequency response parameters*);
 - (2) subject to rule 4.4.2B, the conditions or criteria on which a *Scheduled Generator* or *Semi-Scheduled Generator* may request, and *AEMO* may approve, a variation to, or exemption from, any *primary frequency response parameters* applicable to its *scheduled generating system* or *semi-scheduled generating system*;
 - (3) the process and timing for an application for a variation to, or exemption from, any *primary frequency response parameters* applicable to a *scheduled generating system* or *semi-scheduled generating system*, and the process for approval by *AEMO* of such variation or exemption; and

² Available at <https://www.aemc.gov.au/rule-changes/mandatory-primary-frequency-response>.

- (4) details of the information to be provided by *Scheduled Generators* and *Semi-Scheduled Generators* to verify compliance with the *Primary Frequency Response Requirements* and any compliance audits or tests to be conducted by AEMO.
- (c) The *Primary Frequency Response Requirements* must not require a *Scheduled Generator* or *Semi-Scheduled Generator* to:
 - (1) maintain stored energy in its *generating system* for the purposes of satisfying clause 4.4.2(c1); or
 - (2) install or modify monitoring equipment to monitor and record the *primary frequency response* of its *generating system* to changes in the *frequency* of the *power system* for the purpose of verifying the *Scheduled Generator's* or *Semi-Scheduled Generator's* compliance with clause 4.4.2(c1).
- (d) AEMO must publish on its website and maintain, a register of *Scheduled Generators* and *Semi-Scheduled Generators* who have been granted a variation or exemption from any *primary frequency response parameters* in the *Primary Frequency Response Requirements*.

NER 4.4.2B details the variation and exemption process, and requires the following:

- (a) In considering whether to approve an exemption from, or a variation to, any of the *primary frequency response parameters* applicable to a *Scheduled Generator's* or *Semi-Scheduled Generator's generating system*, AEMO must have regard to:
 - (1) the capability of the *generating system* to operate in *frequency response mode*;
 - (2) the stability of the *generating system* when operating in *frequency response mode*, and the potential impact this may have on *power system security*;
 - (3) any other physical characteristics of the *generating system* which may affect its ability to operate in *frequency response mode*, including (but not limited to) *dispatch inflexibility profile*, operating requirements, or *energy constraints*; and
 - (4) whether the *Scheduled Generator* or *Semi-Scheduled Generator* has been able to establish to AEMO's reasonable satisfaction that the implementation of the *primary frequency response parameters* applicable to that *Scheduled Generator's* or *Semi-Scheduled Generator's generating system* will be unreasonably onerous having regard to (among other things):
 - (i) the likely costs of modifying the *generating system* to be able to operate in *frequency response mode*; and
 - (ii) the likely operation and maintenance costs of operating the *generating system* in *frequency response mode*,
 relative to the revenue earned from the provision of *energy* and *market ancillary services* by the *generating system* in relation to its operation in the *NEM* during the 12 months prior to the date of the application for exemption or variation, as applicable.
- (b) A dispute between AEMO and a *Scheduled Generator* or *Semi-Scheduled Generator* relating to a variation or exemption from any of the *primary frequency response parameters* applicable to a *Scheduled Generator's* or *Semi-Scheduled Generator's generating system* may be determined under rule 8.2.
- (c) Information provided to AEMO by a *Scheduled Generator* or *Semi-Scheduled Generator* as part of an application for variation or exemption under clause 4.4.2B(a)(4) is *confidential information*.

The PFR incentives rule only made one amendment to NER 4.4.2A to clarify that the reference to a dispatch instruction in NER 4.4.2A(c1) is to a dispatch instruction in accordance with NER 4.9.2, which refers to dispatch in the energy market.

2.3. The national electricity objective

While the specific requirements applicable to the PFRR are stated in NER 4.4.2A, where there is more than one way of meeting those requirements, AEMO will seek to implement the option that is most aligned with the national electricity objective (**NEO**).

The NEO is expressed in section 7 of the National Electricity Law as:

to promote efficient investment in, and efficient operation and use of, electricity services for the long term interests of consumers of electricity with respect to:

- (a) price, quality, safety, reliability and security of supply of electricity; and
- (b) the reliability, safety, and security of the national electricity system.

3. Proposal discussion

3.1. Description and effect of proposal

AEMO's proposal is to make the PFRR by updating the interim PFRR to produce a final, enduring PFRR. AEMO proposes that the final PFRR will be based substantially on the interim PFRR, with updates focused on removing transitional processes that are redundant, and clarifying or extending provisions where experience indicates changes are appropriate.

3.2. How the proposal meets the objectives

The PFRR provisions in the PFR incentives rule have not materially changed from those in the Mandatory PFR rule.

By the time the PFRR are made, the interim PFRR will have been in effect for almost three years and the core requirements are familiar to participants and equipment manufacturers, several of whom have invested in facilities, firmware and processes to implement the requirements. Importantly, power system operating experience since late 2020 indicates that those core requirements are having their intended effect of improving control of power system frequency, with the variation and exemption framework providing a reasonable and balanced mechanism to account for individual circumstances where necessary.

AEMO believes the current key requirements relating to deadband, droop and response time are reasonable, and that the variation and exemption pathways deal adequately with facilities that may not be capable of meeting all of these requirements. For example, a plant that is unable to reliably meet the response requirements may request a variation with supporting evidence.

For these reasons, AEMO considers that its proposal to retain the core provisions of the interim PFRR represents an efficient and effective approach that is consistent with the NEO. The changes AEMO proposes are focused on making the PFRR an enduring document and addressing a small number of interpretation and implementation issues based on experience since the Mandatory PFR rule. However, AEMO is interested in whether consulted persons see aspects of the key PFRR technical requirements that could benefit from further refinement.

3.3. Proposed effective date

The PFRR will take effect on 8 May 2023.

3.4. Issues identified for change

Submissions may be made on any matter relating to the proposal. An early draft of the PFRR reflecting the proposal is published with this paper to provide context and assist consideration by interested persons.

AEMO has identified key areas for consideration described in the remainder of section 3.4.

3.4.1. Issue 1- transitional issues

Implementation of changes to PFR settings

In essence, the Mandatory PFR rule required all Scheduled Generators and Semi-Scheduled Generators (**Affected Generators**) to operate their generating systems (**Affected GS**) in frequency response mode in accordance with a deadband, droop and response time to be specified by AEMO in the PFRR.

The interim PFRR needed to address the initial implementation of mandatory PFR across existing scheduled and semi-scheduled generation to manage the impact on Affected Generators and the power system in an appropriate and co-ordinated way. In particular, it was necessary to minimise potential adverse impacts on Affected GS that would be amongst the first to apply these changes.

AEMO developed a timetable for implementation and a self-assessment, review and response process in the interim PFRR to meet these initial needs. In the PFRR, AEMO proposes to remove the following provisions, which were only necessary during the initial stages of implementation:

- The implementation timetable, which is included in Appendix G of the interim PFRR and referred to in sections 5.1 and 11 and in Table 2 in section 5.1.
- The universal requirement in section 5.1(a) of the interim PFRR for Affected Generators to submit self-assessments.
- The option afforded to Affected Generators in sections 3.2.2 and 5.1(b)(ii) of the interim PFRR to make stepped changes to their generating system deadbands.
- The requirement for AEMO and Affected Generators to enter into discussions about the proposed PFR settings in section 6.3.1 of the interim PFRR.

Affected Generators reliant on third parties to make changes to implement PFR settings

Having reached the point where approximately 72% of the registered capacity of Affected Generators is now operating in accordance with the Mandatory PFR rule, AEMO must consider how to address implementation across the remaining Affected GS. As noted in AEMO's latest implementation report³, a key issue affecting much of the remaining semi-scheduled generation is the need for updates to control system software across a multitude of original equipment manufacturers (**OEMs**), which has proved to be challenging for a variety of reasons.

AEMO proposes to continue working with Affected Generators whose OEMs have not yet identified suitable control system updates to resolve their issues, but this will take time.

Affected Generators who have not submitted self-assessments

There is a group of existing Affected Generators who have not yet complied with the requirement to submit their self-assessments or apply for exemption or variation, as required by section 5.1(a) of the interim PFRR.

Affected Generators are reminded that the obligation to provide PFR (subject to exemption or variation) in accordance with the PFRR remains a NER obligation, and the PFRR provide a process by which compliance can be achieved.

³ See <https://aemo.com.au/en/initiatives/major-programs/primary-frequency-response>.

AEMO intends to continue to pursue full compliance for all Affected GS, and urges existing Affected Generators who have not yet done so to submit either their self-assessments or an application for exemption or variation promptly to comply with their NER obligations.

Connection Applicants

Connection Applicants are addressing their need to comply with the PFRR through the connection process and AEMO considers this is being adequately addressed through that process.

AEMO is proposing that PFR settings for future Connection Applicants will be determined in a similar manner to all other control system settings; that is, as part of the connection application process. Specific communication in relation to PFR settings would only be required where a variation or exemption from the requirements of the Final PFRR was being sought.

Questions

1. **Is there any other way AEMO could address the issues that are currently impeding full implementation of the Mandatory PFR rule? If so, how should the PFRR be amended to achieve this?**
2. **Are there any other issues AEMO should consider in the context of the process that Connection Applicants must follow to assess PFR capability and settings?**
3. **Are there aspects of the key PFRR technical requirements that could benefit from further refinement?**

3.4.2. Issue 2 – exemptions and variations

Standing Exemptions and Variations

Standing exemptions and variations mean that Affected Generators do not need to apply for an exemption or variation in respect of Affected GS that meet the relevant criteria. AEMO does not propose to specify any further standing exemptions, but considers that there is a need to change the standing variations by:

- Varying the standing variation in section 7.6(e) of the interim PFRR, which provides temporary relief from compliance with the PFRR where this is impacted by other requirements or external conditions by broadening the reference to “ambient temperature” to “environmental conditions”. This change is in response to experience regarding the range of environmental factors that can affect PFR capability, particularly gas turbines.
- Varying the standing variation in section 7.6(k) of the interim PFRR, where tests are required, by providing a more precise notification process. This change is in response to participant queries regarding notification expectations.
- Adding a new standing exemption to address circumstances where the Affected Generator’s Local Network Service Provider (**LNSP**) requires their generating system to be operated temporarily in another mode, subject to a notification process. This change is in response to experience regarding some network operators’ requirements, particularly in relation to the operation of network runback schemes.

Applications for Exemption or Variation

Insofar as applications for exemption and variation are concerned, AEMO proposes to extend the timeframes for the provision of information and responses from those included in the interim PFRR. Now that a substantial proportion of generation capacity complies with the PFR obligations, there is no

longer the same urgency to assess and complete these applications, and practical experience has demonstrated that in some instances achieving the interim timeframes is difficult or unrealistic.

Exemptions and Variations after Changes to Affected GS

AEMO considers that, for clarity, the PFRR need to explicitly state that an existing exemption or variation will not automatically apply to an Affected GS if it is altered in the future. The Affected Generator will either need to comply with the PFRR as specified or apply for a new exemption or variation, if required, based on the plant's new characteristics and capabilities, which AEMO has included in the draft PFRR as a new section 6.8.

Questions

4. **Are there any other matters that should be included as standing exemptions or variations? If yes, why? What are the expected impacts of including them, and of excluding them?**
5. **Are the proposed amended timeframes for addressing applications for exemption or variation appropriate? If not, what should they be?**
6. **Is it appropriate that substantive changes to an Affected GS that is subject to variation or exemption result in a need to revisit the need for exemption or application? If not, why not?**
7. **Are there any other issues AEMO should consider in the context of exemptions and variations? If yes, why?**

3.4.3. Issue 3 – changes to Affected GS

A related issue to the last matter raised in section 3.4.2 is how to address changes in Affected GS where the Affected Generator makes substantial changes to the Affected GS.

AEMO considers that PFR settings (including variations and exemptions) approved under the interim PFRR apply to the Affected GS as at the date of the notice AEMO issues under section 6.3 of the interim PFRR. If the Affected GS is altered in a substantive way in the future relevant to its PFR performance, it will be necessary for Affected Generators to advise AEMO of their proposed new PFR settings and provide supporting evidence. This is something that AEMO proposes to address in the new section 6.8 of the draft PFRR.

Questions

8. **Is it appropriate that AEMO should consider PFR settings to be dependent on the configuration of the Affected GS as at the date the PFR settings are approved? If not, why not?**
9. **Are there any other issues AEMO should consider in the context of the longevity of PFR settings? If yes, why?**

3.4.4. Issue 4 – testing and demonstration of stability

Experience with PFR testing has identified that some semi-scheduled Affected GS can have undesirable interactions between delivery of PFR and overall control of active power.

Section 8.2 of the PFRR has been updated to identify that PFR testing should include simultaneous testing of PFR and control of active power output. Further information is available via AEMO's National Connections team.

Questions

10. Are there any other issues AEMO should consider in the context of tests and demonstration of plant stability? If yes, why?

3.4.5. Issue 5 – demonstrating compliance with the PFRR

AEMO is not proposing any changes to section 9 of the interim PFRR.

Questions

11. Are there any compliance issues AEMO should consider? If yes, why?

3.4.6. Issue 6 – clarification of relationship between PFR and MASS

Having recently updated the market ancillary service specification (**MASS**), AEMO considers that there should be closer cross-references between the PFRR and the MASS.

Section 2.3 of the interim PFRR addresses interaction between the PFR settings and dispatch instructions. This is consistent with the AEMC's final determination on the PFR incentives rule⁴.

Questions

12. Are there any other sections in the PFRR that should be cross-referred to the MASS? If yes, why?

3.4.7. Issue 7 – other drafting and technical considerations

AEMO is not proposing any further drafting or technical amendments.

Questions

13. Are there any other sections AEMO should redraft? If yes, why?

3.4.8. Issue 8 – provision of PFR in conjunction with energy dispatch

Section 4.3 of the interim PFRR requires that PFR must remain continuously enabled at the PFR settings, unless agreed with AEMO, independent of ancillary service enablement. As noted in section 2.2, the PFR incentives rule has clarified that PFR is to be provided by an Affected GS with a dispatch instruction to generate energy greater than zero MW⁵. Section 2.1(a) of the interim PFRR already specifies that the PFR requirement applies in respect of a dispatch instruction in the *spot market*, which is defined in the NER as the market for energy.

⁴ See page 29, AEMC, Primary frequency response incentive arrangements, Rule determination, 8 September 2022.

⁵ NER 4.4.2(c1)

Although the NER only mandate the provision of PFR when generating energy, they do not preclude the provision of PFR by BESS when charging. For clarification, AEMO proposes to expressly state in the PFRR that there is no requirement for BESS to inhibit the provision of PFR when charging. Indeed, consistent response from plant, including BESS, is very important to support the resilience and predictability of the power system's response to disturbances.

AEMO is considering a rule change proposal to address a number of issues relating to the continued application of PFR to BESS when the National Electricity Amendment (Integrating energy storage systems into the NEM) Rule 2021⁶ comes into effect in June 2024, including an explicit PFR requirement for bidirectional units when dispatched for generation and consumption of energy.

Questions

14. Do you agree that there is no need for further changes to the PFRR arising from the clarification in NER 4.4.2(c1)?

15. Is there anything else AEMO should consider in the context of the application of PFR to BESS? If yes, why?

3.5. Issues outside scope of consultation

Issues raised in submissions that are not directly related to the PFRR, as impacted by the PFR incentives rule, or issues that cannot be addressed in the absence of further rule changes, will be considered out of scope and will not be addressed by AEMO during this consultation, and could be addressed through other processes.

4. Drafting for proposed changes

To help interested persons respond to this paper, AEMO has published an early draft of the PFRR marked up from the interim PFRR to indicate how, subject to consultation, this proposal might be implemented.

⁶ Available at: <https://www.aemc.gov.au/rule-changes/integrating-energy-storage-systems-nem>. Substantive provisions commence 3 June 2024.

Appendix A. Glossary

Term or acronym	Meaning
Affected Generators	Scheduled Generators and Semi-Scheduled Generators, as those terms are defined in the NER.
Affected GS	Generating systems comprising scheduled generating units or semi-scheduled generating units, as those terms are defined in the NER.
BESS	Battery energy storage system.
LNSP	Local Network Service Provider, as that term is defined in the NER.
Mandatory PFR rule	National Electricity Amendment (Mandatory primary frequency response) Rule 2020. Available at https://www.aemc.gov.au/rule-changes/mandatory-primary-frequency-response .
MASS	Market ancillary service specification, as that term is defined in the NER.
NEMDE	National Electricity Market Dispatch Engine.
NEO	National electricity objective, as expressed in section 7 of the National Electricity Law.
NER	National Electricity Rules, and NER followed by a number refers to that numbered rule or clause of the NER.
OEM	Original equipment manufacturer.
PFR incentives rule	National Electricity Amendment (Primary Frequency Response incentive arrangements) Rule 2022. Available at https://www.aemc.gov.au/rule-changes/primary-frequency-response-incentive-arrangements .