Australian Energy Market Commission

AEMC
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RULE

Draft rule determination

Efficient provision of inertia

Proponent

Australian Energy Council

26 June 2025

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About the AEMC

The AEMC reports to the energy ministers. We have two functions. We make and amend the national electricity, gas and energy retail rules and conduct independent reviews for the energy ministers.

Acknowledgement of Country

The AEMC acknowledges and shows respect for the traditional custodians of the many different lands across Australia on which we all live and work. We pay respect to all Elders past and present and the continuing connection of Aboriginal and Torres Strait Islander peoples to Country. The AEMC office is located on the land traditionally owned by the Gadigal people of the Eora nation.

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Summary

1 The Commission has decided not to make a draft rule in response to the Australian Energy Council's (AEC's) proposal to introduce a spot market for inertia that would price, bid, and dispatch inertia as a distinct service in real time. While the Commission considers that operational procurement of inertia has merit in principle, and could achieve benefits for consumers in the future, our analysis has shown that there is unlikely to be material net benefits in the near term.

2 We do not consider that we would be missing out on benefits or value to consumers by not implementing operational procurement of inertia at this time, because technical work required to support the implementation of operational procurement, and components of this work are already progressing. Further, outcomes from the recent *Improving security frameworks* (ISF) reforms will deliver benefits and should have time to play out before initiating further change.

3 Therefore, rather than introducing new rules, the Commission's draft determination focuses on improving the implementation of existing frameworks and supporting targeted technical progress to support continuous improvement under the existing framework. This will help maintain flexibility and support future readiness.

The Commission considers operational procurement of inertia has merit, but there are not material net market benefits at this time

4 Inertia plays a critical role in maintaining power system security by limiting the rate of change of frequency (RoCoF) following a contingency event. As the generation mix shifts towards higher levels of inverter-based resources, the secure operation of the power system is becoming increasingly reliant on alternative sources of inertia. Historically, inertia has been provided as a by-product of synchronous generation, but this is declining with the retirement of thermal generators.

5 To address this, the Commission has already strengthened the long-term procurement framework through the ISF rule change. These reforms established a NEM-wide inertia requirement for the mainland and clarified planning obligations for TNSPs. This draft determination builds on those changes by assessing whether a new operational procurement mechanism for inertia is warranted now and whether existing frameworks can be further improved.

6 The Commission has concluded that the case for operational procurement of inertia has not yet been made. While it may offer value in the future, our modelling did not indicate material net benefits in the near term.

7 Modelling undertaken for the Directions Paper for this rule change, published in December 2024, which included analysis by HoustonKemp, indicated that benefits could arise through co-optimisation with frequency control services, reduced reliance on directions, and improved dispatch efficiency.

8 However, the Commission found that in the most likely scenario, the benefits would not outweigh the upfront and ongoing costs of designing, implementing and operating a spot market. Alternative scenarios that showed greater net benefits relied on optimistic assumptions not expected to reflect near-term conditions. The Commission has considered stakeholder feedback on this modelling and, even taking this into account, considers the conclusions still valid.

9 Based on current information, the Commission considers that foreseeable minimum inertia needs are likely to be met through solutions provided to address system strength issues, including installation of synchronous condensers and uptake of other technologies that also provide inertia, such as grid forming batteries. Although these solutions are not supplied explicitly for inertia, their

incremental contribution is expected to be sufficient in the near term.

10 Given this outlook, the Commission has determined that introducing a spot market or real-time procurement mechanism now would not promote the long-term interests of consumers. To support efficient outcomes under the current inertia frameworks and continue progressing technical understanding, the draft determination identifies targeted opportunities to improve how the current frameworks are applied, including:

- enhancing the transparency and consistency of procurement decisions - for example, by providing clearer justification and explanation of procurement decisions by TNSPs;
- clarifying the role of emerging technologies in providing these services; and
- strengthening AEMO's technical work program to support future reform readiness - for example, by progressing the development and operational integration of real-time inertia measurement.

11 The Commission intends to ask the Reliability Panel to monitor system conditions as part of the National Electricity Market Reliability and Security Report (RASR) (formerly known as the Annual Market Performance Review (AMPR)) by amending its terms of reference. This includes reviewing infrastructure rollout, emerging inertia shortfalls, FCAS market trends, and the technical maturity of enabling tools such as real-time inertia measurement. If these indicators shift materially, the Commission will reconsider the case for reform through the most appropriate process at that time.

12 This approach represents a proportionate and low-regrets response. It strengthens the operation of existing frameworks while preserving optionality for future reform, and maintains alignment with broader system security reforms introduced through the ISF rule change.

13 The Commission invites stakeholder submissions on this draft determination by **7 August 2025**.

We would reconsider operational procurement if system conditions indicate it is likely to deliver net benefits

14 Our analysis indicated that operational procurement may provide net benefits to consumers under different conditions. We acknowledge that such conditions could materialise in the future. Specifically, operational procurement may deliver net benefits if:

- minimum regional inertia requirements increase materially
- significant additional TNSP procurement needs to occur to meet future inertia requirements
- the 1-second FCAS price increases substantially over the next decade compared to our estimate, or
- additional RoCoF constraints are formulated as part of the secure technical envelope of the system.

15 The Commission intends to ask the Reliability Panel to monitor system conditions as part of the RASR. The Commission would reconsider operational procurement if and when it is likely to deliver net benefits, based on indicators such as:

- material inertia shortfalls or elevated FCAS costs;
- early retirement of synchronous generators;
- delays or changes in the delivery of planned infrastructure;
- increased constraints related to RoCoF;
- and improved technical capability to support real-time procurement.

16 This approach maintains a flexible and proportionate response. It avoids premature change, preserves regulatory certainty for recent reforms, and supports future reform by continuing to improve information, planning tools, and system capability. The Commission considers this the most efficient way to address the challenges of a changing generation mix while maintaining power system security.

Consumers would continue to benefit from recent reforms to the inertia framework

17 The Commission considers that a decision not to implement operational procurement at this time does not mean that consumers miss out on near-term benefits. Outcomes from the recent ISF reforms will deliver benefits to consumers, and should have time to play out before initiating further change.

18 Current system needs can be met through long-term procurement frameworks recently strengthened through these ISF reforms. In particular, solutions to meet system strength needs, such as installation of synchronous condensers, are expected to provide sufficient inertia over the short to medium term. While these solutions are required for system strength, many are expected to contribute inertia as a co-benefit. This reduces the likelihood of inertia shortfalls and diminishes the potential benefit of a separate operational procurement mechanism in the near term.

19 Given that TNSPs are currently in the process of meeting inertia requirements under the existing framework, and AEMO is developing its enablement tool, the Commission considers it important to promote regulatory certainty by not amending the existing long-term framework. The Commission considers that significant changes to the inertia procurement framework or to AEMO enablement in this rule change process would not promote the National Electricity Objective (NEO). Any changes to either would likely increase system security contracting costs, may result in consumers incurring costs for tools that may not be used, and would leave industry with an unclear direction as to how to procure and provide inertia throughout the transition, risking system security.

20 The Commission also considers that valuable learning can be undertaken in parallel with these new reforms playing out, through continuing to undertake technical work to support continuous improvement under the existing framework. This work will support readiness for the implementation of operational procurement (should benefits arise in the future). We need to build the technical enablers to manage inertia in the future system, including real-time inertia measurement, improved dispatch integration, and improved locational understanding of inertia needs. These technical enablers are not yet mature enough to support real-time procurement with sufficient confidence or value. We also need to build confidence related to relying on synthetic inertia to meet security needs. Continuing to focus on improvements in these areas is a 'low regrets' system learning exercise that can inform future procurement reforms if and when they are pursued. The existing regulatory framework already allows this work to occur. For example, the recent ISF reforms, introduced the ability for AEMO to use 'Type 2' transitional services contracts to conduct trials for new methods of managing security.

The Commission has identified targeted opportunities to improve how existing inertia frameworks are applied

21 While the Commission is not proposing to make changes to the National Electricity Rules (NER) through this draft determination, it has identified targeted opportunities to improve how the existing inertia procurement frameworks are applied. Stakeholders expressed broad support for

retaining the existing long-term procurement framework for minimum inertia, but raised concerns about how decisions are applied in practice.

22 These concerns - and so improvements that we've identified - focus on clarifying how procurement decisions are assessed and justified, enhancing the visibility of AEMO's technical work, and enabling innovation through continued use of Type 2 contracts. We consider that improvements can be made through improved application of existing obligations, rather than introducing additional obligations or amending the rules for the existing framework. This is because the existing framework already includes the appropriate regulatory measures and tools. For example, TNSPs are already required to publish Project Assessment Draft Reports (PADRs) and Project Assessment Conclusions Reports (PACRs) under the Regulatory Investment Test for Transmission (RIT-T), which provide a formal structure for consultation and justification. Improving the clarity and consistency of these documents can help address stakeholder concerns and support stronger regulatory oversight.

23 The Commission considers that this approach will support greater transparency, maintain flexibility, and improve future readiness for operational procurement without introducing new regulatory obligations at this time.

24 The Commission also sees an opportunity to improve visibility of AEMO's technical work on inertia. Stakeholders emphasised the importance of progressing key technical capabilities such as real-time inertia measurement, locational visibility, and better integration into dispatch tools. The Commission sees positive and material improvements in these areas, such as:

- the most recent update to the Inertia Requirements Methodology, which includes better integration of Fast Frequency Response (FFR) to recognise its complementary role to inertia
- the Inertia Network Services Specification, outlining the minimum technical requirements for both synchronous and inverter-based plant to provide inertia network services
- the Transition Plan for System Security (TPSS) which provides a suitable platform for reporting progress in improving operational management of inertia and
- as part of the ISF reforms, AEMO will develop and publish real-time minimum inertia and system strength requirements in the form of constraints

25 These reforms are improving stakeholder awareness and will help demonstrate how operational readiness is being built over time.

26 The Commission also supports AEMO's continued use of Type 2 contracts as a tool for system learning and innovation. While not a substitute for operational procurement, Type 2 contracts enable AEMO to trial new capabilities, such as synthetic inertia or grid-forming inverter responses, and identify implementation risks under real-world conditions. The Commission notes that AEMO is required to report on findings from these trials under its ISF reporting obligations and considers that continued, targeted use of this mechanism will help inform future market design.

27 The Commission does not consider that we would be missing out on benefits or value to consumers by not implementing operational procurement of inertia at this time, because work is already underway to help support the implementation of operational procurement of inertia. This includes strengthening the use of existing frameworks, clarifying reporting expectations, and increasing transparency around AEMO's technical work. These measures also support future readiness by preserving flexibility and optionality should system conditions change and the case for operational procurement become stronger.

28 The Commission considers that practical steps to implement these improvements can occur through existing processes underway. These include AEMO's ongoing reporting on technical

development through its annual TPSS and ISF reporting obligations for Type 2 contracts, the Reliability Panel's review of AEMO's TPSS, and TNSPs' existing reporting obligations under the RIT-T, supported by AER's oversight role. Collectively, as we gain more experience in these frameworks and improve our knowledge, we consider that these processes can effectively implement the intended improvements to the application of the existing frameworks and ensure readiness to revisit operational procurement if system conditions materially change in the future. We consider it is appropriate to allow these developments to progress further before considering further change.

We assessed our draft determination against five assessment criteria

29 The Commission has considered the NEO,[1] the issues raised in the rule change request, and the feedback received through consultation. To assess whether operational procurement of inertia would contribute to the NEO, the Commission applied five assessment criteria, as outlined in the Directions Paper and reaffirmed in this draft determination.

30 The draft determination contributes to the achievement of the NEO by:

- **Safety, security and reliability** - The draft determination retains the long-term procurement framework for inertia, while identifying targeted improvements to its application. It also supports continued progress on AEMO's technical work to enhance real-time inertia measurement, locational understanding, and system integration. This approach maintains system security under evolving conditions without introducing a new operational procurement mechanism for inertia that does not yet have material net benefits.
- **Emissions reduction** - The draft determination maintains a technology-neutral framework that supports the integration of low-emission technologies such as grid-forming inverters. Existing tools, including long-term contracting and Type 2 contracts, support innovation by enabling demonstration and technical integration. This provides a proportionate and flexible pathway for enabling emissions reduction in the short term, while preserving the flexibility to scale up when needed.
- **Principles of market efficiency** - The Commission found that introducing operational procurement for inertia now would be unlikely to deliver material net benefits. The draft determination avoids the implementation costs and risks of premature reform, while supporting more efficient procurement through improved guidance and better application of current frameworks.
- **Innovation and flexibility** - The draft decision preserves the option to implement operational procurement for inertia in the future if system conditions justify it. In the meantime, improved transparency, better documentation, and targeted reforms to technical planning processes would help build readiness and support innovation. This enables the system to evolve without locking in suboptimal outcomes.
- **Implementation considerations** - The Commission has carefully considered implementation complexity, regulatory interactions, and market readiness. Further development of key technical elements, such as real-time measurement, is needed before operational procurement can be implemented effectively. The draft determination allows this continual improvement work to continue maintaining a low-regrets pathway for future reform.

1 Section 7 of the NEL

How to make a submission

We encourage you to make a submission

Stakeholders can help shape the solution by participating in the rule change process. Engaging with stakeholders helps us understand the potential impacts of our decisions and contributes to well-informed, high-quality rule changes.

How to make a written submission

Due date: Written submissions responding to this draft determination must be lodged with Commission by **7 August 2025.**

How to make a submission: Go to the Commission's website, www.aemc.gov.au, find the "lodge a submission" function under the "Contact Us" tab, and select the project reference code **ERC0339.**[2]

Tips for making submissions on rule change requests are available on our website.[3]

Publication: The Commission publishes submissions on its website. However, we will not publish parts of a submission that we agree are confidential, or that we consider inappropriate (for example offensive or defamatory content, or content that is likely to infringe intellectual property rights).[4]

Next steps and opportunities for engagement

There are other opportunities for you to engage with us, such as one-on-one discussions or industry briefing sessions.

You can also request the Commission to hold a public hearing in relation to this draft rule determination.[5]

Due date: Requests for a hearing must be lodged with the Commission by 3 July 2025.

How to request a hearing: Go to the Commission's website, www.aemc.gov.au, find the "lodge a submission" function under the "Contact Us" tab, and select the project reference code **ERC0339.** Specify in the comment field that you are requesting a hearing rather than making a submission.[6]

2 If you are not able to lodge a submission online, please contact us and we will provide instructions for alternative methods to lodge the submission

3 See: https://www.aemc.gov.au/our-work/changing-energy-rules-unique-process/making-rule-change-request/our-work-3

4 Further information about publication of submissions and our privacy policy can be found here: https://www.aemc.gov.au/contact-us/lodge-submission

5 Section 101(1a) of the NEL.

6 If you are not able to lodge a request online, please contact us, and we will provide instructions for alternative methods to lodge the request.

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1 The Commission has made a draft determination

This draft determination is not to make a draft rule in response to a rule change request submitted by the Australian Energy Council (AEC) seeking to introduce a market-based procurement mechanism for inertia in the NEM.[7] The Commission supports operational procurement in principle and considers that it may deliver market and system benefits under certain conditions. However, as set out in Chapter 3, the Commission has concluded that there would not be material net benefits in the near term for operational procurement of inertia under current assumptions.

The draft determination focuses on clarifying and supporting the application of existing frameworks, rather than making new rules or amending the existing rules, to improve procurement transparency and enable technical work to support continuous improvement under the existing framework, as outlined in Chapter 4.

The Commission intends to ask the Reliability Panel to monitor system conditions through its RASR. If these system conditions shift materially, the Commission will reconsider the case for reform through the most appropriate process at that time. The Commission is seeking stakeholder feedback on this approach of ongoing monitoring to assess when an inertia market may be needed, as well as the broader draft determination.

This chapter provides a high-level summary of the rule change request and the Commission's draft decision. It outlines the proponent's proposal and the Commission's assessment of whether real-time operational procurement for inertia should be implemented now or reconsidered in the future. Chapters 2 to 4 provide further detail on the Commission's reasoning.

1.1 We received a rule change request proposing operational procurement of inertia

In December 2021, the AEC submitted a rule change request to the Australian Energy Market Commission (AEMC or the Commission) proposing the establishment of a spot market for inertia. The proposed mechanism would operate in real time and involve the pricing, bidding and dispatch of inertia as a distinct, standalone system service.

The AEC's rule change request stated that a spot market could replace the current TNSP-led framework as the primary mechanism for procuring both minimum and additional inertia[8] considered that introducing real-time price signals would improve operational efficiency, support investment in grid-forming technologies capable of delivering synthetic inertia, and enable co-optimisation with other frequency control services.[9] AEC submitted that this approach could enhance competition among providers and deliver better outcomes for consumers over time.[10]

The rule change request was submitted in the context of changing system conditions. The retirement of synchronous generators is leading to a steady decline in system-wide levels of synchronous inertia. At the same time, the NEM's generation mix is continuing to shift towards higher penetrations of inverter-based resources, which do not inherently provide inertia. The AEC noted that this transition raises ongoing challenges for maintaining secure system operation, and proposed the introduction of an inertia spot market as a way to help address these challenges.

7 AEC, Inertia Spot Market Rule Change Request, December 2021
8 Inertia Spot Market Rule Change Request, December 2021, p.3
9 Ibid.
10 Ibid.

The proposal forms part of a broader conversation across the NEM about how best to evolve procurement arrangements for system services.

1.2 We consulted with stakeholders through a consultation paper and a directions paper

In March 2023, the Commission published a consultation paper that explored a range of options to improve the inertia procurement framework. These included reforms to long-term planning arrangements and potential operational or market-based mechanisms.

Following consultation, the Commission prioritised reforms to the long-term procurement framework through the *Improving security frameworks (ISF) for the energy transition* rule change (ISF rule change), and determined that the inertia rule change would subsequently focus on assessing whether an operational procurement mechanism would be needed in the future.[11] Submissions to the consultation paper broadly supported the Commission further considering the AEC's proposal for an inertia spot market, but noted that further economic and technical analysis would be required to assess the need for reform, evaluate the costs and benefits of different options, and determine the most appropriate approach.

The ISF reforms introduced a NEM-wide inertia floor for the mainland, updated obligations for TNSPs to procure inertia three years ahead of forecast needs, clarified that regional procurement must support secure operation under credible islanding conditions, and expanded eligibility for synthetic inertia to contribute towards meeting minimum inertia requirements.[12]

With these reforms in place, the Commission published a Directions Paper in December 2024 to examine whether procuring inertia in operational timeframes could deliver system and market benefits beyond those provided under the enhanced planning framework.[13] The paper found that minimum inertia is not well suited to operational procurement due to the high risks and costs of undersupply, but that operational procurement may be more appropriate for additional inertia. The Commission concluded that further analysis of benefits, costs and implementation considerations for additional inertia was warranted ahead of the draft determination.

The Directions Paper received 20 submissions. Many stakeholders expressed support for developing operational procurement arrangements for additional inertia, citing the potential benefits of greater flexibility, transparency and efficiency.[14] These stakeholders noted that operational procurement could help unlock the value of emerging technologies such as grid-forming inverters and battery energy storage systems, and allow inertia to be co-optimised with other frequency services.[15]

However, many stakeholders also highlighted risks and preconditions that would need to be addressed before operational procurement could be introduced effectively. [16] These stakeholders raised concerns about technical complexity, implementation costs, and the maturity of supporting systems such as real-time inertia measurement, dispatch integration and locational forecasting.[17] Several submissions also emphasised the importance of coordinating procurement approaches across system security services to avoid duplication or fragmentation.[18]

11 AEMC, Improving security frameworks for the energy transition rule change
12 Ibid.
13 AEMC, Directions Paper - Efficient Provision of Inertia, December 2024
14 Submissions to the directions paper: AEC, EnergyAustralia, Snowy Hydro, Iberdrola, AGL, Akaysha Energy, CS Energy, Stanwell, Tesla, Origin.
15 Ibid.
16 Submissions to the directions paper: AEMO, ENA, Akaysha Energy, Tesla and Iberdrola.
17 Ibid.

Most stakeholders, including those who supported operational procurement of additional inertia, also supported continuing to use long-term contracts for minimum inertia in the near term.[19] Stakeholders generally supported the Commission's view that the long-term procurement framework is better suited to securing minimum system needs, given the high cost of under-procurement and limited opportunity for dynamic optimisation.

AEMO and ENA supported the direction of reform but did not consider operational procurement an immediate priority.[20] Both pointed to the limited near-term benefits identified in modelling and stakeholder analysis, and emphasised the importance of delivering the ISF reforms before introducing further structural change.

The Commission has carefully considered all stakeholder feedback received through this consultation process in developing its draft determination. Chapters 3 and 4 provide further detail on stakeholder views and the Commission's response.

1.3 We have made a draft determination not to implement the proposed spot market for inertia at this time

The Commission has made a draft determination not to implement an operational procurement mechanism for inertia at this time. The Commission supports operational procurement in principle and considers it may offer future system and market benefits under different system conditions. However, it does not consider that there would be material net benefits in the near term for operational procurement of inertia under current assumptions.

HoustonKemp's modelling,[21] commissioned for the Directions Paper, found that operational procurement could reduce overall system costs under certain conditions, including through co-optimisation with frequency control services and reduced reliance on directions. However, the estimated short-term benefits were modest and uncertain under current system conditions, and highly sensitive to assumptions, particularly around the rollout of synchronous condensers for system strength and the profile of FCAS costs.

Stakeholder submissions also raised a range of views on HoustonKemp's modelling. Some stakeholders considered it a useful input to assess potential efficiency gains, while others expressed some concern about key assumptions, such as procurement timing, generator retirements, and emissions impacts.[22] The Commission has considered these views in interpreting the modelling results and in forming its draft position, as discussed further in Chapter 3.

As set out in Chapter 3, the Commission assessed the future supply and demand for inertia, including forecast synchronous generator retirements and planned investments in synchronous condensers. This assessment drew on information from AEMO and publicly available TNSP planning documents. For the purpose of the modelling, the Commission adopted a scenario in which synchronous condensers are delivered in line with current TNSP timeframes and capacity forecasts. Under this assumption, the analysis suggests that minimum inertia needs would likely be met in the near term through co-benefits from system strength investments, without requiring a separate procurement mechanism.

18 Submissions to the directions paper: Akaysha Energy and Iberdrola.
19 Submissions to the directions paper: Iberdrola, Akaysha Energy, TasNetworks, SMA, AEMO, ENA and Tesla.
20 Submissions to the directions paper: AEMO and ENA.
21 HoustonKemp, Evaluating market designs for inertia services: A report for the Australian Energy Market Commission, December 2024.
22 Submissions to the directions paper: AEC, AGL, Tesla, AEMO and Snowy Hydro.

The Commission acknowledges that these outcomes are sensitive to assumptions, including the timing and scale of TNSP delivery and the potential for earlier-than-expected retirement of synchronous generation. The Commission considers our chosen scenario to be a reasonable scenario based on current planning information, while recognising it is subject to uncertainty. It was used to assess whether operational procurement would offer material additional benefits in circumstances where foreseeable inertia needs are met through existing frameworks. Under these conditions, the modelling indicates that short-term benefits would be modest, primarily reflecting reductions in frequency control costs during limited periods. These findings support the Commission's view that, under current system conditions, operational procurement of inertia would not deliver material net benefits.

Further detail on the Commission's analysis and stakeholder feedback is provided in Chapter 3.

1.4 We intend to ask the Reliability Panel to monitor system conditions that may support reconsidering operational procurement

The Commission considers that the current framework for procuring inertia remains appropriate under existing system conditions and based on reasonable forecasts, including information from AEMO and publicly available TNSP planning documents. However, we consider that an operational procurement approach has merit and may become more likely to deliver net benefits under different system conditions.

The Commission, therefore, intends to task the Reliability Panel to monitor key system indicators in its RASR by amending its terms of reference.

The Reliability Panel would not be asked to determine whether those conditions justify implementation. Any future decision to proceed with operational procurement would remain a matter for the Commission or a future rule change process.

Several developments may warrant the reconsideration of operational procurement of inertia. The Commission would ask the Panel to monitor and report annually on the following system conditions:

- a significant increase in minimum inertia requirements (for example, if larger contingencies become credible),
- a rise in the cost of meeting inertia needs through long-term procurement,
- sustained increases in contingency FCAS prices, especially for the 1-second service, and
- an increase in the number or materiality of RoCoF-related constraints, including if AEMO determines that many new constraints must be formulated to maintain secure operation.

If these or other structural changes occur, operational procurement may become more likely to deliver net benefits under changed system conditions.

To support visibility of these developments, the Commission would update the Reliability Panel's terms of reference for its RASR to explicitly set out that the Reliability Panel should include reporting on trends in these factors. If these conditions were to change, then the Reliability Panel would update the Commission on this. The Reliability Panel comprises representatives from across the sector and AEMO, and so different views will be taken into account in the process of reporting on these system conditions.

The Commission would then reconsider the case for operational procurement of inertia.

The Commission's consideration would occur in the context of the prevailing system conditions and the stakeholder feedback received throughout this rule change process, including views on potential design and implementation.

The Commission considers that a decision not to implement operational procurement at this time does not result in any loss of benefits for consumers, as the current frameworks are expected to continue delivering value and support system learning over time. This includes fostering continual improvement on technical outcomes. For example, outcomes from the recent ISF reforms will deliver benefits to consumers, and should have time to play out before initiating further change.

1.5 We have identified opportunities to improve the implementation of existing inertia frameworks and support future readiness for operational procurement

While the Commission is not proposing to introduce operational procurement for inertia at this stage, it has identified targeted opportunities to strengthen how existing inertia frameworks are applied and to improve the system's preparedness should operational procurement be reconsidered in the future. These changes are not being made through new rules but reflect improvements that are already underway or achievable through existing processes. This approach preserves the stability of existing frameworks while effectively enabling targeted improvements without introducing new obligations.

Stakeholders raised concerns about the transparency of procurement decisions under current frameworks, the ability of emerging technologies to participate, and whether current processes adequately accommodate non-synchronous technologies such as synthetic inertia.[23] Some submissions raised concerns relating to a range of submissions and raising questions about both implementation of current frameworks and future readiness for more dynamic approaches.[24]

Rather than introducing new obligations, the Commission considers that these issues can be addressed effectively through the existing frameworks. This includes increasing transparency of AEMO's technical work program through the Transition Plan for System Security, improving the clarity of procurement assessments by TNSPs and the AER, and the use of Type 2 contracts to support trials and innovation in emerging technologies.

These opportunities are set out in detail in Chapter 4:

- Section 4.2 outlines technical priorities that could improve the foundation for any future operational procurement mechanism. The Commission notes that this work would focus on improvements to system understanding and procurement frameworks already underway, such as AEMO's various work programs under its Engineering Roadmap and the use of Type 2 contracts. It would not encompass the specific work to implement operational procurement itself, including dispatch design, cost recovery, and pricing, which we do not propose should be progressed at this time.
- Section 4.4 discusses the role of Type 2 contracts in supporting innovation and system learning.
- Section 4.5 identifies opportunities to improve how procurement decisions are documented and justified to support greater confidence and technology-neutral outcomes.

23 Submissions to the Directions Paper from Iberdrola, Akaysha Energy and Tesla.

24 Ibid.

The Commission considers this approach to be a proportionate and flexible response to stakeholder feedback. It would improve the performance of current frameworks, support innovation, and strengthen system readiness without pre-empting the need for operational procurement. The Commission considers that this approach will continue to deliver value while supporting system learning and flexibility. If system conditions change, these actions would help ensure the market is better positioned to implement further reform in a timely and coordinated way.

2 The draft determination would contribute to the energy objectives

2.1 The Commission must act in the long-term interests of energy consumers

The Commission can only make a rule if it is satisfied that the rule will or is likely to contribute to the achievement of the relevant energy objectives.[25]

For this rule change, the relevant energy objective is NEO:

The NEO is:[26]

> 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; and
>
> (c) the achievement of targets set by a participating jurisdiction—
>
> (i) for reducing Australia's greenhouse gas emissions; or
>
> (ii) that are likely to contribute to reducing Australia's greenhouse gas emissions.

The targets statement, available on the AEMC website, lists the emissions reduction targets to be considered, as a minimum, in having regard to the NEO.[27]

2.2 We must also take these factors into account

2.2.1 We have considered whether to make a more preferable rule

The Commission may make a rule that is different, including materially different, to a proposed rule (a more preferable rule) if it is satisfied that, having regard to the issue or issues raised in the rule change request, the more preferable rule is likely to better contribute to the achievement of the NEO. For this rule change, the Commission has decided to make no rule. The reasons are set out in section 2.3 below.

2.3 How we have applied the legal framework to our decision

The Commission must consider how to address the risk that existing frameworks may not continue to efficiently support the secure and cost-effective procurement of inertia as system conditions evolve. This includes assessing whether it is necessary to introduce operational procurement at this time, or whether the current arrangements remain fit for purpose.

To assess whether to make the proposed rule, adopt an alternative approach, or maintain the current framework (no rule), the Commission applied the following five criteria from its established assessment framework:

1. **Safety, security and reliability** – The Commission considered whether each option would support the continued secure operation of the power system, including maintaining system

25 Section 88(1) of the NEL.
26 Section 7 of the NEL.
27 Section 32A(5) of the NEL

security under declining synchronous inertia conditions. The assessment included the extent to which inertia needs are currently being met and whether alternative approaches would materially improve system security outcomes.

2. **Emissions reduction** – The Commission examined whether each option would contribute to emissions reduction by supporting the integration of emerging low-emission technologies, consistent with broader emissions reduction objectives.
3. **Principles of market efficiency**—This criterion was used to assess whether each option would promote efficient investment and operational decision-making. The Commission considered each option's implications for allocative efficiency, incentives, and competitive neutrality in supporting least-cost outcomes over time.
4. **Innovation and flexibility** – The Commission assessed whether each option would maintain flexibility to respond to future system needs and support innovation in the supply of inertia, including enabling new technologies such as grid-forming inverters.
5. **Implementation considerations** – The Commission evaluated whether each option would be proportionate and timely, taking into account implementation complexity, interactions with other reforms, and the costs of change relative to likely benefits.

These criteria reflect the key costs and benefits of the rule change request and alternatives and are consistent with the National Electricity Objective (NEO). These were set out in Section 3.2 of the Directions Paper, which framed the Commission's evaluation of system security, economic efficiency, and the future supply and demand of inertia. No changes were made to the criteria following consultation on the Directions Paper, as no stakeholders raised substantive objections.

The Commission undertook extensive evidence-based analysis to evaluate the impacts of the proposed market design, the no-rule (business-as-usual) option, and other variants. This analysis included scenario modelling, qualitative system impact assessments, and consideration of technical, regulatory, and implementation issues. This analysis was presented in the Directions Paper, which contains further details on the assessment framework and key findings. [28]

The following sections explain why the Commission considers that not making a rule at this time, and pursuing targeted improvements within the existing frameworks, best promotes the long-term interests of consumers, when assessed against the five criteria set out above.

2.3.1 The draft determination supports the secure and reliable operation of the power system

The Commission considers that the draft determination would support secure and reliable system operation by retaining the long-term procurement framework and enabling targeted improvements to its application. While the Commission recognises that operational procurement of inertia may have a role in the future, it does not consider that there would be material net benefits in the near term under current assumptions.

As outlined in Chapter 3, the secure operation of the power system continues to be supported through the minimum inertia requirements established in the NER, informed by AEMO's projected inertia requirements and TNSPs' obligations to ensure sufficient inertia is available. The Commission found that foreseeable inertia needs are expected to be met in the short to medium term under the enhanced procurement framework introduced through the ISF rule change, which is still being implemented and assessed (see Section 3.4).

The Commission also considered whether an operational procurement mechanism for inertia would materially improve system security outcomes. As discussed in Section 3.3, the estimated

28 AEMC, Directions Paper - Efficient Provision of Inertia

benefits of implementing such a mechanism in the near term are modest and uncertain. Modelling and stakeholder feedback (including from AEMO[29] and ENA[30]) suggest that operational risks can continue to be managed under current frameworks, particularly as technical tools and system capabilities continue to improve. The Commission intends to task the Reliability Panel with monitoring system conditions that could suggest that operational procurement may be more likely to deliver net benefits. The Panel would not determine whether implementation is warranted. Any decision to proceed would remain a matter for the Commission.

As outlined in Chapter 4, the Commission has identified opportunities to strengthen procurement transparency and improve how existing frameworks are applied. (Section 4.5). These measures, along with AEMO's technical work programs related to inertia (Section 4.2), would further support secure operation without requiring the introduction of an operational procurement mechanism at this stage.

The Commission considers that this approach would maintain a proportionate and flexible pathway for reform. It would avoid introducing a new operational procurement mechanism that does not yet have material net benefits, given the modest and uncertain short-term gains and the material complexity of implementation.

2.3.2 The draft determination supports emissions reduction by enabling integration of emerging low-emission technologies

The Commission considers that existing frameworks, including the updated system strength and inertia procurement arrangements, sufficiently support emissions reduction objectives in providing inertia. Recent reforms have enabled TNSPs to procure synthetic inertia, and AEMO's updated Inertia Requirements Methodology now incorporates the contribution of fast frequency response in determining minimum inertia needs.[31]

Given these developments, the Commission does not consider that implementing operational procurement for inertia at this time would result in material emissions benefits. While the current framework allows for the use of low-emission technologies, including synthetic inertia and grid-forming inverters, stakeholders have indicated that confidence in these technologies is still evolving. Further operational experience and demonstration will likely be needed before these technologies can be rolled out more broadly. Importantly, there are no regulatory impediments to their participation.

Minimum inertia is expected to be met through long-term procurement processes, supported by planned investments in synchronous condensers and grid-forming inverter technologies that also address system strength requirements. Procuring additional inertia through operational procurement is unlikely to improve emissions outcomes in the near term, as the incremental emissions benefit from displacing contingency FCAS or enabling higher penetrations of inverter-based resources is expected to be limited. This is due to the projected availability of inertia from assets already committed under existing frameworks and the relatively low emissions intensity of contingency FCAS providers under current system conditions.

As outlined in Chapters 3 and 4, the Commission assessed whether introducing operational procurement of inertia at this time would better support the development and participation of technologies capable of providing synthetic or non-synchronous inertia. Several stakeholders, including Iberdrola, Akaysha Energy and Tesla, submitted that operational procurement of inertia

29 AEMO, submission to the directions paper, p.3
30 ENA Submission to the Directions Paper, p.2
31 AEMO - Inertia Requirements Methodology (1 December 2024).

could, over time, provide stronger signals for investment and help unlock the value of grid-forming inverters and battery-based solutions.[32]

The Commission agrees that operational procurement of inertia has merit and could play an important role in supporting emissions reduction in the long term. This is because a well-designed market-based mechanism may allow greater volumes of inverter-based resources to operate securely by reducing the need for constraining synchronous units online to maintain system security. Over time, this could reduce reliance on higher-emission generators and increase the share of zero-emission generation in dispatch.

However, the Commission found that these emissions benefits are only likely to become material if system conditions change substantially, such as through higher minimum inertia requirements, earlier retirement of synchronous generators, or a material increase in RoCoF-related constraints. Under current conditions, implementing operational procurement of inertia is not expected to meaningfully shift the generation mix or reduce emissions, given that inertia needs can be met through planned assets, and contingency FCAS providers are already relatively low emissions.

In the meantime, existing mechanisms, including long-term contracting by TNSPs and AEMO's ability to enter into Type 2 contracts to trial new applications of inertia-providing technologies, offer a credible pathway for supporting innovation and learning in lower-emissions sources of system security.

The Commission also considered stakeholder concerns that current procurement practices may favour established technologies and limit contestability. While acknowledging these concerns, the Commission considers there are opportunities to improve the application of existing frameworks that can help reduce barriers to participation by low-emission technologies, even in the absence of an operational procurement mechanism.

Overall, the Commission considers that retaining the current framework, while enhancing its application and supporting further technical development, would provide a proportionate and flexible pathway for enabling emissions reduction through innovation in inertia provision. This approach reflects the likely timing of benefits and preserves the opportunity to introduce operational procurement when system conditions justify it.

2.3.3 The draft determination promotes market efficiency

The Commission considers that the draft determination promotes market efficiency by maintaining a framework that enables efficient procurement decisions, while avoiding the costs and risks of implementing an operational procurement mechanism for inertia that does not have material net benefits under current assumptions.

Operational procurement of inertia has the potential to improve allocative and dynamic efficiency by introducing price signals, supporting co-optimisation, and broadening participation. The Commission acknowledges that these benefits may become more material over time. However, as outlined in Chapter 3, the Commission found that the likely efficiency gains in the short to medium term are limited and uncertain, and do not outweigh the implementation costs at this stage.

The HoustonKemp modelling commissioned by the Commission found that while operational procurement could reduce system costs under certain conditions, [33] the scale of potential savings is modest and highly sensitive to assumptions. Several stakeholders[34] questioned aspects of the

32 Submissions to the directions paper: Iberdrola, Akaysha Energy and Tesla.

33 AEMC Directions Paper - Efficient Provision of Inertia

34 Submissions to the directions paper: AEC, EnergyAustralia and Snowy Hydro.

modelling, while others supported a more cautious approach,[35] noting that the long-term procurement framework has only recently been enhanced through the ISF rule change. The Commission agrees that these points are important and has taken them into account in interpreting the modelling results and assessing the case for reform. A detailed discussion of these issues is provided in Chapter 3.

The Commission considers that the current framework can continue to support efficient procurement outcomes where it is applied transparently and proportionately. While it may not deliver the same level of price discovery as operational procurement, improved application of the existing frameworks, such as through clearer communication of procurement assumptions and better integration of emerging technologies, can help ensure that inertia levels align with secure operating thresholds, while avoiding excessive investment that does not materially improve outcomes for consumers.

For example, more transparent articulation of how FFR and IBRs are factored into procurement decisions can reduce the risk of TNSPs procuring more synchronous inertia than is needed, or deferring efficient investment due to uncertainty. These refinements, while modest, can meaningfully improve the alignment of procurement outcomes with system needs and consumer interests. They may also support more effective stakeholder engagement and contribute to improved price transparency over time by increasing visibility into how procurement needs are determined and valued.

The Commission also notes that, based on current TNSP procurement plans, a significant portion of foreseeable inertia needs is expected to be met by solutions delivered to address system strength needs. While multiple technologies may be used to meet system strength needs, many TNSPs are progressing projects involving synchronous condensers to meet system strength needs, which are likely to also provide inertia at a low incremental cost. This reduces the immediate need to establish separate operational procurement arrangements for inertia. While these plans are still evolving, the Commission considers this a relevant factor when assessing the relative efficiency of the current framework compared to operational procurement of inertia.

The Commission recognises the merit of operational procurement for inertia but considers that preserving the current framework offers greater option value for now. Maintaining a flexible, low-regret approach enables the regulatory framework to adapt efficiently as technologies mature, system needs evolve, and the benefits of real-time procurement for inertia become clearer.

2.3.4 The draft determination supports innovation and flexibility

The Commission considers that a decision not to make a rule at this time appropriately supports innovation and flexibility, as existing frameworks, including AEMO's ability to enter into Type 2 contracts, already provide a pathway for trialling new technologies in the provision of inertia. This approach also preserves the ability to implement operational procurement in the future if system conditions change.

Stakeholders, including Tesla,[36] Iberdrola,[37] and Akaysha Energy[38] highlighted the importance of providing pathways for grid-forming inverters and other emerging technologies to demonstrate capability and build commercial readiness. While operational procurement of inertia was seen as a potential long-term enabler of innovation, stakeholders acknowledged that further technical

35 Submissions to the directions paper: AEMO and ENA.
36 Tesla, submission to the directions paper, p 2.
37 Iberdrola, submission to the directions paper, p 2.
38 Akaysha Energy, submission to the directions paper, p 4.

work, operational tools and clear performance standards would be required before such a mechanism could be implemented effectively.

As outlined in Chapters 3 and 4, the Commission agrees that operational procurement of inertia has merit, but found that it does not have material net benefits under current assumptions. However, the Commission considers that meaningful progress can still be made through continuing to refine and learn how best to use existing tools, particularly AEMO's use of Type 2 contracts to trial new applications of emerging technologies (see Section 4.4), and the ongoing refinement of technical standards and modelling capabilities (see Section 4.2).

Importantly, the draft determination preserves the flexibility to implement operational procurement for inertia in the future, if and when its net benefits become more material. As discussed in Section 3.5, the Commission intends to ask the Reliability Panel to monitor relevant indicators through the RASR. Depending on the outcomes of this monitoring, the Commission would then consider revisiting operational procurement of inertia if conditions warrant it.

This approach supports innovation by enabling system learning and capability-building while maintaining the existing inertia framework. It also maintains a flexible, low-regret pathway that can adapt to evolving technologies and market conditions.

2.3.5 The draft determination takes into account implementation considerations

The Commission has considered implementation timing, technical readiness, and interactions with other reforms in reaching its draft determination not to introduce an operational procurement mechanism for inertia at this stage.

As outlined in Chapter 3, we have found that there are not material net benefits in relation to an operational procurement mechanism for inertia under current assumptions. HoustonKemp's modelling found that while operational procurement of additional inertia could reduce system costs under certain conditions, the magnitude of benefits was modest and highly sensitive to input assumptions.[39] Some stakeholders, including ENA[40] and AEMO,[41] expressed broad support for the concept of operational procurement for inertia but noted that the value of such a mechanism would depend on system conditions and may not be justified in the near term.

The Commission also considered the power system's technical readiness to support operational procurement. As discussed in Sections 3.2 and 4.2, further knowledge and learning is needed in areas such as real-time inertia measurement, locational requirements, and dispatch integration into the NEM. AEMO and other stakeholders noted that progressing these technical capabilities would be a necessary precondition to implementing operational procurement effectively.

Coordination with other system planning and investment processes was also a relevant consideration. In particular, the plans to address system strength needs including the installation of synchronous condensers, will also help to provide inertia at a low incremental cost. This could therefore reduce the immediate need to establish a separate procurement mechanism for inertia. Implementing a new mechanism at this stage may complicate procurement coordination and introduce additional administrative burden, without delivering commensurate benefits.

The Commission considers that the draft determination allows time for these related reforms and technical work programs to progress, and continually improve, while preserving flexibility to revisit

39 AEMC, Directions Paper - Efficient Provision of Inertia
40 ENA, submission to the directions paper, p 5.
41 AEMO, submission to the directions paper, p 4.

operational procurement for inertia if conditions warrant it. This approach supports a more informed, coordinated and cost-effective implementation pathway in the future.

3 The Commission considers operational procurement of inertia has merit, but there are no material net market benefits at this time

Box 1: Key points in this chapter

- Inertia plays a vital role in power system security by instantaneously and inherently responding to frequency disturbances, which limits the rate of change of frequency following contingency events.
- Both synchronous plant and some grid-forming asynchronous plant provide inertia. Both synchronous and asynchronous plant (that is, grid-forming inverters) can contribute to minimum inertia requirements, subject to AEMO's new *inertia network service specification*.
- Due to changes in the generation mix of the NEM, the amount of inertia that is provided to the NEM has decreased over time, and is expected to continue decreasing - but only until TNSPs commission synchronous condensers or enter into contracts with registered participants to provide system strength through new gas clutches, grid-forming inverters or other non-network solutions.
- The *Improving security frameworks* rule improved the existing inertia procurement framework by establishing a system-wide inertia level for interconnected operation, aligning it with the system strength procurement framework (allowing for easier co-optimisation). It also introduced a new AEMO enablement procedure for operational timeframes.

The Commission considers that, currently, implementing operational procurement of inertia does not provide material net benefits to electricity consumers

- We assessed whether operational procurement would contribute to the National Electricity Objective. This assessment drew on modelling, stakeholder feedback and projected system needs.
- Based on a conservative estimate of the timing and number of synchronous condensers (or equivalent) that will be needed for system strength, as outlined by each mainland TNSP's PADR, there is likely to be a significant excess of supply against minimum inertia requirements - even without accounting for grid-forming inverter systems that are likely to be commissioned to meet system strength requirements.
- Under certain system conditions, operational procurement of inertia could deliver a more efficient, dynamic and transparent electricity market. However, the current likely benefits are very small, and the potential for larger future benefits depends on changes to how the electricity markets operate and/or departures from current trends in FCAS prices and technology.
- Our analysis, building off HoustonKemp's benefits analysis for our directions paper, suggests a spot market is unlikely to deliver material net benefits under current assumptions. In our most likely scenarios, operational procurement of inertia does not deliver benefits in excess of the costs of designing, implementing and operating a spot market.
- However, if FCAS prices increase, or demand for inertia significantly increases, then there may be material net benefits from operational inertia procurement in the future.

3.1 We considered the inertia needs of the transitioning power system and the existing framework for inertia procurement

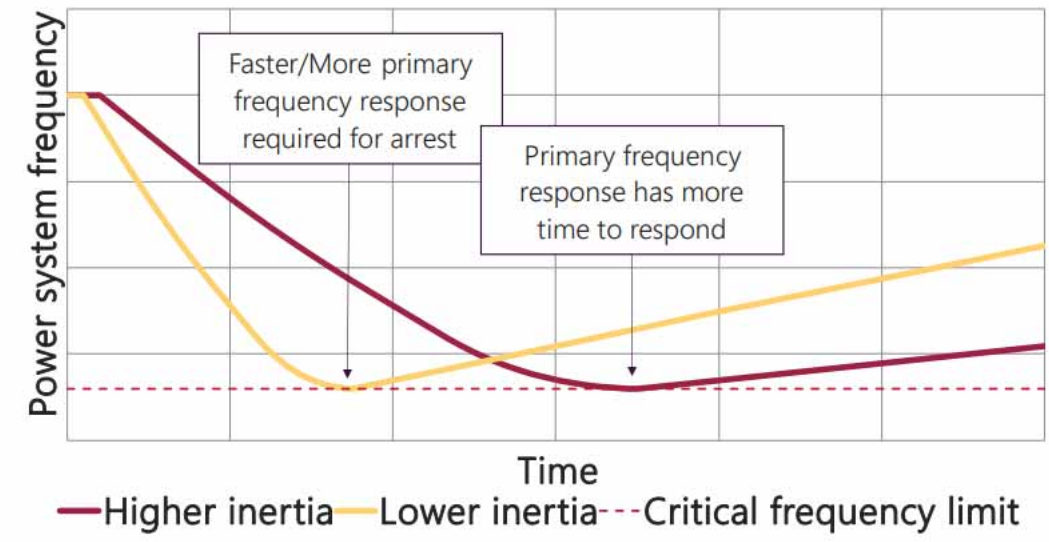
3.1.1 Inertia is essential to the power system

Inertia refers to the capability of the power system to instantaneously resist changes in frequency. It is essential for any alternating current (AC) power system as it helps maintain system frequency and voltages within secure and safe limits. If the frequency rises or falls beyond acceptable limits, either during normal operation or due to a contingency event, then plant or network equipment may trip. In the worst cases, if sufficiently widespread or large, these trips can cause their own large frequency disturbance, potentially leading to a cascading outage or black system event.

Although inertia is not the only characteristic of a power system that can help maintain system security, it plays a fundamental role by:

- providing an immediate and inherent response to any changes in frequency through active power exchanges that cannot be substituted by any other type of response.
- limiting the rate of change of frequency (RoCoF) following a large disturbance, providing enough time for other responses (for example, fast frequency response or emergency frequency control schemes) to act to return the frequency back to within the normal operating frequency band (between 49.85 and 50.15 Hz) – see Figure 3.1.
- decreasing the frequency of oscillations following a disturbance, which may reduce the likelihood of instability or trips.[42]

Figure 3.1: Inertia provides more time for fast frequency responses to respond to a disturbance



Source: AEMO, Inertia in the NEM explained, p 2.

Inertia can be provided by both synchronous plant and asynchronous plant. However, they provide inertia in distinct ways:

42 In response to the directions paper, Tesla noted that Figure 4.2 of the paper was mislabelled, pointing out that the diagram showed the same level of damping between the higher and lower inertia cases (see page 7 of Tesla's submission). It also noted that lower levels of inertia do not necessarily mean less damping is required, because damping requirements are generally very location- and network-specific. This is more accurate than what was described in the directions paper (see pp 11-12). The Commission acknowledges the technical error in the Directions Paper and thanks Tesla for its comment.

- All synchronous plant (including synchronous condensers) provide inertia through the inherent and instantaneous exchange of mechanical and electrical energy between the rotor of the plant and the power system. This occurs whenever the plant is synchronised to the grid. The amount of inertia that is provided depends solely upon the mass and shape of the plant's rotor and is independent of the plant's operating point or any other external influences.
- Some asynchronous plant can provide inertia through the use of grid-forming inverters, which are able to maintain a stable voltage waveform set locally by the inverter and do not rely upon external frequency or voltage measurements. Grid-forming inverters are able to inject and absorb current (and consequently, active power) in a similar manner to synchronous plant. This is commonly known as **synthetic inertia**.

For more information on the role of inertia in the power system and on how different types of plant provide inertia, see sections 4.1 and 4.2 of the Commission's directions paper.

Box 2: The 2025 Iberian Peninsula blackout highlights the importance of system security

On 28 April 2025, the Iberian Peninsula experienced a black system event, leaving Spain and Portugal without power for many hours. According to ENTSO-E, an association representing many European transmission system operators, the timeline of events was as follows:

- In the half-hour period before the black system event, two separate sub-synchronous inter-area oscillations (fluctuations in frequency and voltage) were observed. The Spanish and French system operators took actions to mitigate and damp these oscillations. Voltages in Spain increased, but not above the 435 kV nominal upper limit defined by the Spanish system operator.
- Thereafter, a series of generators in Southern Spain (Badajoz, Granada and Seville) tripped, leading to frequency decreasing and voltage increasing further in Spain and Portugal. Automatic load shedding schemes were activated due to the frequency decrease.
- The interconnectors between Spain and France were then disconnected by protection schemes, which was promptly followed by system collapse on the Iberian peninsula.

An expert panel formed by members of various European system operators, authorities and regulators is currently investigating the Iberian blackout, and will publish its factual findings and recommendations in due course. However, official reports suggest there was insufficient voltage control and reactive power absorption from generating units online, which subsequently tripped and destabilised the power system. The complexity of any major power system, especially one as large as the Continental Europe Synchronous Area, makes determining and investigating the root cause (or causes) of a black system event difficult, and the Commission will be monitoring any further official findings from the event.

The technical envelope, access standards and technical behaviour of plant are primary and critical for maintaining a secure system

Although official reports suggest insufficient or inappropriate voltage control was the primary factor in the Iberian Peninsula blackout, as discussed in section 3.1.1, inertia is also an important power system characteristic for ensuring system security and avoiding other kinds of system black events.

To avoid black system events, system and market operators ensure that the power system is secure by monitoring technical parameters (such as voltage and frequency) and ensuring that they remain within defined technical limits (known as a technical envelope). The technical envelope must be defined and continually modified to ensure that, following a credible disturbance, the system can recover to normal operation in a timely manner. The choice of procurement model for ancillary services or other system security services is separate from the technical envelope that is

managed and defined by system operators and regulators.

However, it is also vital that the technical characteristics of plant connected to the system (for example, inverter control algorithms, ride through capabilities, reactive power capability, protection systems, etc.) are appropriately defined, complied with by plant operators, and enforced by regulators. In the NEM, these are typically known as 'access standards', and plant owners and operators must ensure that their plant complies with their 'performance standards', as agreed between the NSP and AEMO during the connections process.[1]

The operational technical envelope and the technical requirements and behaviours of all plant must work together to ensure that power system security is maintained at all times. The adverse consequences of the Iberian peninsula provide a clear reminder of the vital importance of all aspects of system security to protect against costly damage and loss of life.

Source: ENTSO-E, ENTSO-E Expert panel initiates the investigation into the causes of the Iberian blackout; Fraunhofer ISE, Energy Chart Talks 05.05.2025 - Teil 2: Blackout in Spanien und Portugal 28.4.2025; Ministerio para la Transición Ecológica y el Reto Demográfico; 17 June 2025 Media Release and Press Release; Comite para el Analisis de las Circunstancias que Concurrieron en la Crisis de Electricidad del 28 de abril de 2025, Report; Red Eléctrica, Blackout in Spanish Peninsular Electrical System the 28th of April 2025.

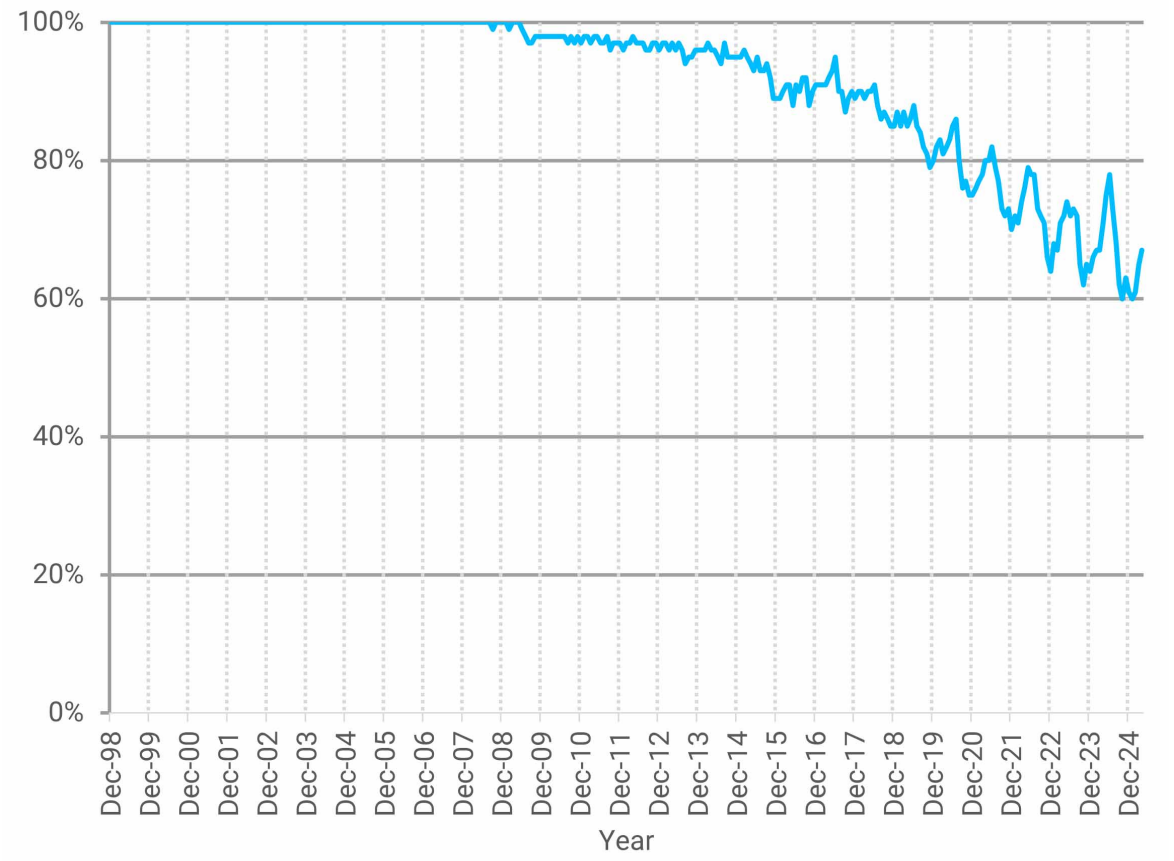
Note: [1] Following extensive consultation led by AEMO, the AEMC has recently introduced reforms to these access standards to improve power system resilience, support efficient investment in plant, and streamline the connections process: see AEMC, Improving the NEM Access Standards - Package 1.

3.1.2 In the past, inertia was predominantly provided by synchronous plant

Historically, the vast majority of generators in the NEM were synchronous plant. For example, when the NEM commenced operation in December 1998, 100 per cent of generation was synchronous. However, as the energy transition replaces thermal generation with renewable generation (predominantly wind and solar generation), the proportion of synchronous generation to total generation decreases.

For example, throughout the month of January 2025, only 60 per cent of generation output was synchronous, with the other 40 per cent provided by asynchronous plant (wind and solar). Figure 3.2 shows the decline in the proportion of synchronous generation output over the lifetime of the NEM, aggregated on a monthly basis.

Figure 3.2: Proportion of synchronous generation output to total generation output in the NEM



Source: Open Electricity, using the VRE/Residual filter and 'ALL' timerange.
Note: Based on a monthly aggregation of generation supply. Data excludes storage (for example, pumped hydro or battery discharge).

On a 5-minute dispatch interval basis, the proportion of synchronous generation to total generation can be as low as 27%, and is expected to continue to decrease.[43] South Australia is notable as it already operates with an extremely low proportion of synchronous plant. For example, on 31 December 2023, where distributed photovoltaic (DPV) systems provided 101.7% of underlying demand in South Australia, only 5% of the state's generation was from synchronous generators (coming solely from two Torrens Island B units).[44]

When there are high proportions of synchronous generation in the NEM, inertia is provided as an automatic byproduct when these synchronous plant produce active power. In other words, inertia is a positive externality[45] of synchronous generation.

Over time, as more asynchronous generation displaces synchronous generation, the total amount of inertia that is available in the NEM has generally decreased. This can make it more challenging for AEMO to be able to ensure that the rate of change of frequency is limited to within 1 Hz/s (or 3 Hz/s in Tasmania) following contingency events, as required by the Frequency Operating Standard.[46] If there is insufficient inertia to arrest the rate of change of frequency following a

43 AEMO, NEM Data Dashboard, Renewable Penetration tab, displaying the dispatch interval on 13:00 on Wednesday 6 November 2024.

44 AEMO, Quarterly Energy Dynamics Q4 2023, p 11; Engineering Roadmap FY 2025 Priority Actions Report, p 16; AEMO MMS data for 31 December 2023.

45 That is, an unavoidable byproduct that provides something of value.

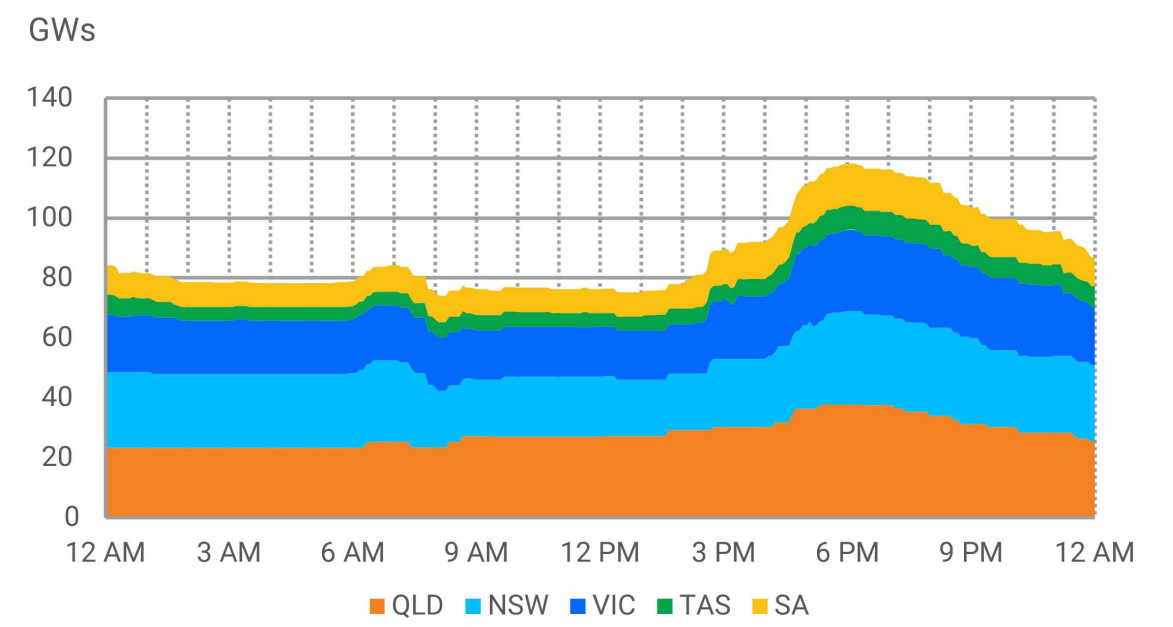
46 See the Frequency Operating Standard, pp 4-6.

contingency event (as demonstrated in Figure 3.1), then plant or network equipment may trip. In the worst cases, this may also lead to a cascading outage or black system event.

Due to advancements in inverter technology, inertia can also be provided by some asynchronous plant if they exhibit 'grid-forming' characteristics. After a frequency disturbance, a grid-forming inverter is able to instantaneously inject or absorb current (and consequently, active power) in a manner similar to synchronous plant. This is commonly known as **synthetic inertia**, which is already being used to manage system security in the NEM.[47] For more information on how grid-forming inverters provide inertia, see section 4.2.2 of the Commission's directions paper.

Today, as the output of the generation mix varies significantly throughout the day due to an increase in variable renewable energy sources, the amount of inertia that is provided to the system is more volatile and can vary from dispatch interval to dispatch interval. For example, see Figure 3.3, where on 16 April 2025, the total amount of inertia in the NEM varied between 73,890 MWs and 118,260 MWs, depending on the time of day.

Figure 3.3: Amount of inertia in the NEM on 16 April 2025



Source: AEMO MMS data from the DSNAP_INFO_NSW_INER, DSNAP_INFO_QLD_INER, DSNAP_INFO_VIC_INER, DSNAP_INFO_SA_INER, DSNAP_INFO_TAS_INER monitoring constraints.

Note: As of 23 May 2025, the monitoring constraints currently only consider the synchronous inertia from sufficiently large generating units and synchronous condensers.

If in any dispatch interval there is insufficient inertia in a particular region or in aggregate, or if it is not adequately distributed among regions, then the system would be insecure. To prevent this, AEMO can instruct any Registered Participants who hold a contract with a TNSP to be enabled and to either remain online, or to synchronise and provide inertia.[48] As a last resort, AEMO can issue directions to instruct a unit to come online or remain synchronised to provide inertia, so that the system remains in a secure operating state, pursuant to clause 4.8.9 of the NER or section 116 of the NEL.

47 Battery systems which are capable of providing synthetic inertia include the Dalrymple BESS, the Darlington Point BESS and the Hornsdale BESS.

48 See clause 4.4.4 of the NER. Note that this clause will be deleted by the *Improving security frameworks for the energy transition* Rule 2024 on 2 December 2025, where it will insert a new rule 4.4A that introduces a framework for AEMO to enable system security services. See section 3.4.1 for more information on this new framework.

3.1.3 New sources of inertia will emerge when meeting other system security needs

Although the amount of inertia in the NEM has generally decreased over time, the Commission expects that this will only continue until system strength, voltage control or other system security issues require TNSPs and AEMO to procure or contract for new sources of system strength or voltage control, before large synchronous plant can retire.[49]

When new interconnectors are operational (such as Project Energy Connect), new synchronous condensers commissioned and installed (or equivalent, such as new gas plant with clutches), or grid-forming plant contracted or commissioned to meet system strength obligations, then there will be new sources of inertia (or inertia shared more broadly between regions through new interconnectors, which reduces the likelihood of certain regions islanding). For example, Transgrid, AEMO Victorian Planning and Powerlink all intend to install equipment or contract with parties to meet their system strength obligations, and are very likely to install flywheels on any future synchronous condensers to simultaneously meet any future inertia obligations at low incremental costs.[50] In addition, grid-forming battery systems are expected to be used in order to meet stable voltage waveform requirements; these plant can also provide inertia at low incremental costs.

Therefore, the Commission considers that the decline in inertia sources will only continue to the extent that more constraining system security needs (such as system strength or voltage control) necessitates new plant to be installed, all of which also provide inertia, or reduce its demand.

3.1.4 The *Improving security frameworks* rule ensured that the long-term inertia procurement framework is fit-for-purpose for a transitioning NEM

The AEMC improved the inertia procurement framework (amongst other elements) through the *Improving security frameworks for the energy transition* Rule 2024. This was to make sure there is sufficient inertia provided as the energy system transitions. This rule:

- requires AEMO to determine a system-wide inertia level, which is the minimum amount of inertia required to securely operate the mainland NEM when it is interconnected
- requires AEMO to determine inertia sub-network allocations for each mainland NEM region, which determines how the system-wide level should be adequately distributed to ensure secure operation
- requires AEMO to publish an *inertia network service specification*, which sets out the minimum requirements for both synchronous and asynchronous plant to provide inertia, and removes restrictions on using synthetic inertia for minimum inertia requirements
- aligns elements of the TNSP inertia procurement framework with the system strength framework,[51] enabling greater co-optimisation of solutions to meet obligations[52] (this also

49 Until large thermal units retire, and before new sources of system strength are installed and commissioned, AEMO will likely continue managing the system using a minimum number of synchronous plant that must remain online. For example, currently in South Australia, AEMO operates the system with a minimum of two synchronous generators online at any given time, to maintain a secure operating state - see AEMO, Transfer Limit Advice - System Strength in SA and Victoria, April 2024; 2024 Transition Plan for System Security, December 2024. In NSW, currently, a minimum of seven large synchronous units is required to maintain a secure operating state. In NSW, currently, a minimum of seven large synchronous units is required to maintain a secure operating state - see Transgrid, New South Wales Synchronous Generation, Interim Advice for System Normal Requirement, February 2024.

50 In its guidance note on the system strength framework, the AER expects that including flywheels where a synchronous condenser has been found to be the preferred option (or port of a portfolio of solutions that form the preferred option) would be considered to be prudent and efficient expenditure - see pp 31-32.

51 AEMO now projects inertia needs for all sub-networks over 10 years, which is the same time period that AEMO must also project system strength needs. TNSPs are required to ensure that sufficient inertia is available to meet the amount stated in the inertia report three years prior, aligning the compliance timeline with the system strength framework. See clauses 5.20B.2 and 5.20B.4 of the NER.

52 In its guidance note on the system strength framework, the AER expects that including flywheels where a synchronous condenser has been found to be the preferred option (or port of a portfolio of solutions that form the preferred option) would be considered to be prudent and efficient expenditure - see pp 31-32.

removed the previous 'shortfall' declarations that had to be declared by AEMO before TNSP procurement could commence)

- allows the use of the NSCAS framework to procure inertia if it is required to meet an inertia gap within the next three years
- introduces a new enablement procedure, which will empower AEMO to enable system security contracts to meet gaps in minimum security requirements at least cost.

To incorporate these reforms, AEMO updated its Inertia Requirements Methodology[53] in November 2024 and has published its latest annual Inertia Report in December 2025.[54] The methodology describes how AEMO must forecast and determine minimum inertia requirements over a ten-year horizon, which in turn, set the binding requirements that TNSPs are obliged to make available.[55] The updated methodology better incorporates the complementary role of fast frequency response (FFR) by:

- accounting for the amount of 1-second FCAS that is registered and typically provided in each region[56]
- determining inertia requirements as a function of the amount of contracted FFR in each region.[57]

The new methodology also incorporates the *inertia network service specification*, which sets out the minimum technical requirements for both synchronous plant and asynchronous plant (such as grid-forming inverters) to be able to provide inertia.[58] It also sets out the approval process for asynchronous plant to provide inertia network services, including the testing and quantification methodologies that AEMO will use in the process.[59]

In addition to the ten-year requirements as set out in its annual inertia reports, from 2 December 2025, AEMO will also determine real-time inertia requirements as part of its Security Enablement Procedures - see section 3.4.1 and AEMO's consultation on its Draft Security Enablement Procedures.

In submissions to our directions paper, some stakeholders noted their concerns that AEMO's determination of minimum inertia requirements was too conservative, not sufficiently dynamic or needed to incorporate obligations on TNSPs to source inertia from non-thermal sources.[60] The Commission considers that the updated Inertia Requirements Methodology addresses concerns about over-procurement through the determination of the system-wide inertia level and the development of inertia-FFR curves. While the annual inertia reports will likely not contain 'dynamic' inertia requirements, real-time or operational minimum inertia requirements will be publicly available through ISF constraints in the MMS - see section 4.2.2 for more information.

We do not consider that minimum inertia requirements, or the methodology for the requirements, should be determined or overseen by a different body to AEMO, such as the Reliability Panel.[61] The NER already requires that AEMO's determination of inertia requirements must comply with the Inertia Requirements Methodology, which in turn has been consulted on with industry stakeholders.[62] In addition, AEMO must also take into account the Frequency Operating Standard

53 See AEMO's updated Inertia Requirements Methodology, which includes the inertia network service specification at Appendix A.
54 See AEMO's 2024 Inertia Report.
55 For more information, see section 4.4.1 of the Commission's directions paper.
56 See AEMO's Inertia Requirements Methodology, p 18.
57 See AEMO's Inertia Requirements Methodology, pp 25-27.
58 AEMO, Inertia Requirements Methodology, Appendix A.
59 See clause 5.20.4 of the NER for more information.
60 Submissions to the directions paper: AGL, p 1; CS Energy, pp 2-3; Iberdrola, p 2.
61 As proposed in submissions to the directions paper: CS Energy, p 2; Snowy Hydro, p 3.

(FOS) set by the Reliability Panel, and the set of most significant credible contingency events when determining inertia requirements.[63] So, in that sense, the Reliability Panel already has some oversight or ability to guide AEMO's inertia considerations. If significant improvements to the Inertia Requirements Methodology are identified in the future, then potential amendments to the Methodology must be consulted on with industry stakeholders and interested persons.[64]

However, the Commission notes the importance of AEMO continuing to ensure that its determination of inertia requirements in future annual reports remains appropriate, and does not result in unnecessary over-procurement by TNSPs.

In the context of these reforms, and accounting for TNSP plans to meet system strength needs that have already commenced, the Commission has considered whether operational procurement of inertia (such as a real-time market) can complement TNSP procurement and AEMO enablement to provide long-term benefits for consumers.

3.2 We assessed the future demand and supply of inertia and whether operational procurement of inertia promotes the NEO

We consider that market-based solutions that drive competition are often the most effective and efficient way to deliver the best outcomes for consumers and promote productive, allocative, and dynamic efficiency.[65] The Australian Energy Council's rule change request for an inertia spot market would create a market mechanism to procure inertia as the supply of inertia from synchronous generation falls.

We assess all rule change requests against the relevant national energy objective, in this case the National Electricity Objective.[66] We split our analysis of inertia into two use cases of inertia:

- **minimum inertia**, which is the amount required for the secure operation of the power system[67]
- **additional inertia**, which can reduce reliance on fast frequency response services, relieve any rate of change of frequency constraints and lower overall system costs.[68]

3.2.1 We consider that long-term procurement should remain for minimum inertia

As put forward in our directions paper, we maintain our view that system security needs dictate that long-term procurement approaches should continue to apply to **minimum inertia**. That is, the proposed inertia spot market should not be used as the primary mechanism to ensure the minimum supply of inertia - at least in the near-term.[69] In particular, we considered that minimum inertia is not suitable to rationing, which could require load shedding or even large-scale blackouts at a great cost to consumers. This means that the cost of undersupply are significant and led us to the conclusion that operational procurement of minimum inertia is not preferable.

We received mixed feedback from stakeholders on this direction, with some stakeholders supporting long-term inertia procurement to ensure regulatory stability and avoid an undersupply

62 AEMO, Amendments to the Inertia Requirements Methodology. See also clause 5.20.4 of the NER, which describes how AEMO must set the relevant inertia levels and how it must follow the Inertia Requirements Methodology when it prepares its annual inertia reports.

63 See clause 5.20.4(d1)-(e) of the NER and AEMO, Inertia Requirements Methodology, sections 4.1 to 4.6.

64 See NER, clause 5.20.4(c).

65 AEMC, *How the national energy objectives shape our decisions*, Final Guidelines, 28 March 2024, p 6.

66 Section 7 of the NEL.

67 For more information, see section 4.3.1 of the Commission's directions paper.

68 For more information, see section 4.3.2 of the Commission's directions paper.

69 We noted that operational procurement, including a spot-market mechanism, could be used as a top-up mechanism in the case of any minimum inertia shortfalls on an operational timeframe.

of inertia during the current phase of the energy transition.[70] In contrast, other stakeholders either supported operational procurement of minimum inertia immediately, or for it to be considered in the future.[71]

We have considered this range of views; however, we maintain our view that at the current time introducing an inertia spot market as the primary mechanism to ensure the minimum supply of inertia would not meet the long-term interests of consumers. This view could change in the future depending on technology advancements and other changes in the market. For example, if the costs of supplying inertia were to fall dramatically, then that may support implementation of a mechanism for operational procurement of inertia for these levels.

In our directions paper, we identified that additional inertia may be more suitable for operational procurement through a spot market mechanism. Unlike minimum inertia, an undersupply of additional inertia does not pose immediate system security risks. Instead, additional inertia provides benefits by reducing frequency management costs and improving dispatch efficiency.[72]

In its economic assessment for our directions paper, HoustonKemp identified three possible benefits of procuring additional inertia in an operational timeframe:

1. Reducing system costs of frequency management by using additional inertia to reduce the required quantity of 1-second FCAS.
2. Reducing system costs of wholesale energy by using additional inertia to relieve inertia constraints on renewables output in Tasmania and South Australia.
3. Reducing system costs of wholesale energy by enabling greater output from the largest generating units in the NEM.

Additionally, HoustonKemp identified that if operational procurement of inertia exists, AEMO could use the spot market for operational top-up of minimum inertia when long-term procurement fails to cover the system demand for minimum inertia.[73] section 3.3 discusses HoustonKemp's and our analysis of the likely benefits and how the benefits of operational procurement would depend on future changes in supply and demand for inertia, and on the related electricity markets.

All submissions from market participants with generation assets supported operational procurement of inertia.[74] Some stakeholders advocated for a gradual implementation to allow time for technology integration, regulatory adjustments and investment signals to evolve with system needs.[75] AEMO and ENA agreed that, conceptually, additional inertia is suitable for operational procurement through a spot market, but advocated for reconsidering implementation in a future rule change process.[76] We discuss our plans to monitor system conditions to assess whether operational procurement is needed in the future in section 3.5.

3.2.2 Substantial inertia capacity is likely to be available over the forecast horizon without operational procurement

In our directions paper, we mapped AEMO's 2024 determination of minimum inertia requirements to 2035 and estimated inertia requirements based on the generator retirement schedule in the

70 Submissions to the directions paper: AEMO, Energy Networks Australia, SMA, Tesla, Australian Coal Energy Council and Rainforest Reserves Australia.

71 Submissions to the directions paper: Iberdrola, pp 2-3; EnergyAustralia, pp 2-3; Snowy Hydro, pp 1-2.

72 AEMC, *National Electricity Amendment (Efficient provision of inertia) Rule 2025*, directions paper, 12 December 2024, p v.

73 For example, in a situation where a scheduled inertia source is unexpectedly offline.

74 Submissions to the directions paper: Australia Energy Council, p 3; AGL, p 1; Akaysha, pp 1-2; CS Energy, p 2; EnergyAustralia, pp 1-3; Engie, p 1; Hydrostor, p 3; Iberdrola, p 3; SMA, p 1; Snowy Hydro, p 1; Stanwell, p 3; Tesla, p 5; Hydro Tasmania, pp 1-2, 6.

75 Submissions to the directions paper: EnergyAustralia, p 2; CS Energy, p 5; Akaysha Energy, p 4; Iberdrola, pp 2-3; Engie, pp 2-4; Justice and Equity Centre, p 4; and Rainforest Reserves Australia, pp 5-7.

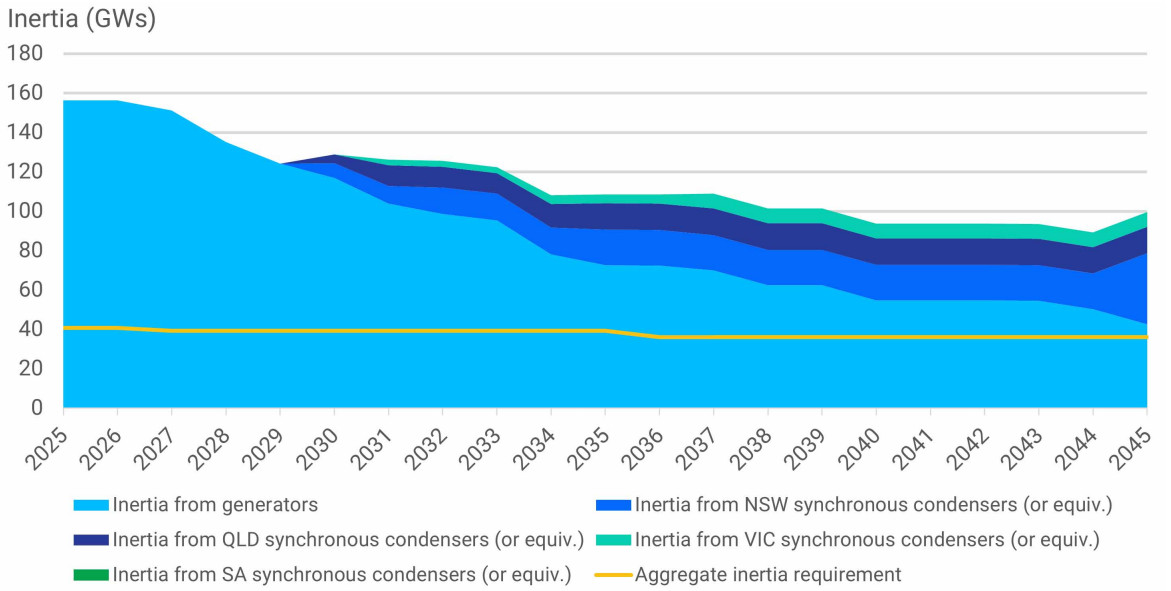
76 Submissions to the directions paper: AEMO, p 8; ENA, p 2.

2024 Integrated System Plan. We found that existing sources of synchronous inertia would be sufficient to cover aggregate demand to 2035.[77] We also found that there would likely be sufficient inertia to meet minimum demand until 2045, based on investment that is required for TNSPs to meet their system strength obligations, as published in their Project Assessment Draft Reports (PADRs).

We have updated our estimates of inertia capacity from synchronous sources between now and 2045 (see Figure 3.4). We derived inputs from:

- forecast synchronous generation retirements from AEMO's 2024 ISP and its Generating Unit Expected Closure Year spreadsheet from April 2025[78]
- the most recent PADRs, including ElectraNet's revision that it does not require any new synchronous condensers to meet its system strength obligations[79]
- AEMO's forecast inertia requirements to 2034, as outlined in its 2024 Inertia Report.

Figure 3.4: Expected inertia supply in the NEM mainland exceeds minimum needs to 2045



Source: AEMO, 2024 Inertia Report, 2024 ISP, Generating Unit Expected Closure Year April 2025, inertia provision amounts from MMS DSNAP constraint data; Transgrid, Meeting system strength requirements in NSW, Portfolio option 3; Powerlink, Addressing system strength requirements from Dec 2025, Portfolio 2 and 3; Victorian System Strength Requirement RIT-T PADR, Portfolio 3; ElectraNet, Meeting System Strength Requirements in SA, RIT-T PADR.

Note: The four existing synchronous condensers in South Australia are included in the 'inertia from generators' area. All future synchronous condensers are assumed to deliver about 1500 MWs of inertia (see Transgrid PADR, p 31). From each TNSP PADR, the portfolio with the least number of synchronous condensers (or synchronous condenser equivalents, such as new clutched gas turbines, which provide comparable amounts of inertia), was selected. If an investment was listed for a financial year (e.g. for 2027/28), then it was assumed that it would only be delivered in time for the next calendar year (e.g. 2029). That is, we have accounted for any delays that last between 6 and 18 months. The graph excludes any inertia that may be provided from future GFM BESS that are needed for stable voltage waveform requirements.

Note: The aggregate requirement is equal to the binding inertia requirement in each region, which is either the inertia sub-network allocation or the secure operating level, depending on whether the region has a credible risk of islanding. See appendix D.1 for more detail on the binding requirements.

Note: For regional supply-demand graphs, see appendix D.2.

We note that the inertia provided from synchronous inertia in Figure 3.4 differs from Figures 6.2 to 6.4 in our directions paper. Specifically, in its analysis for our directions paper, HoustonKemp used

77 AEMC Directions Paper, pp 29-32.

78 See AEMO's generation information page. Where retirement dates conflict between the ISP and the Expected Closure Year spreadsheet, the earliest retirement date was chosen to reflect a 'worst-case' scenario for inertia supply. An exception to this is the closure date for Osborne, which is now reasonably expected to close in 2027.

79 ElectraNet, Meeting System Strength Requirements in SA, RIT-T PADR.

a capacity factor for each type of generator as a proxy for how much inertia would be available, on average, from normal energy market dispatch.[80] However, as noted by HoustonKemp, using capacity factors does not capture the fact that a synchronous generator provides the same amount of inertia, irrespective of its operating point.[81] Moreover, choosing any specific capacity factor for each type of generator is arbitrary, as capacity factors are expected to significantly change throughout the transition. Therefore, we have presented only the expected inertia capacity from synchronous generators, rather than estimating an 'average' amount of inertia that may be provided in the future.

The Commission acknowledges that, despite the oversupply indicated by Figure 3.4, there may be dispatch intervals where normal energy market outcomes result in an insufficient amount of inertia being online. In those cases, we would expect that, from 2 December 2025, AEMO would use its new enablement procedures to select the least cost combination of system security contracts to meet the inertia gap, as close as practicable to real-time. See section 3.4.1 for more information on AEMO enablement.

We heard from stakeholders in their submissions a variety of views, where they differed from our analysis of AEMO and transmission business data:

- some raised concerns that synchronous condensers may be delayed or more expensive than forecast[82]
- others noted that there may be less reliance on synchronous condensers than PADRs suggest[83]
- while others considered that contingency sizes are likely to increase due to renewable energy zones and offshore wind farms, rather than decrease as we had forecast.[84]

We consider that the concerns raised by stakeholders about our forecasts are valid, and the risks identified plausible. We consider the NEM is unlikely to face inertia shortfalls over the next 5 years (see Figure 3.4), and the risks identified, while plausible, remain unlikely. This allows monitoring of inertia levels and a future reconsideration of operational procurement if supply and/or demand diverge from forecasts. If, in the monitoring of inertia levels, we see major changes in the timing and role of synchronous condensers (or equivalent) that are installed to support system strength and inertia, and forecasts of increasing contingency sizes, then we would need to reconsider what is the most appropriate procurement mechanism. A higher reliance on dispatchable, non-baseload,sources of inertia and a need for further inertia supply could support a move to operational inertia procurement in the future.

So long as inertia capacity is significantly in excess of inertia demand, implementing operational procurement for inertia would not have material net benefits. This is because the benefits of operational procurement of additional inertia, with respect to investment in and the use of electricity system assets, is unlikely to exceed the costs to consumers and other stakeholders to implement a spot market (see Figure 3.5). Our analysis suggests that either large changes to how the electricity market is operated or unexpected divergence in frequency and inertia service costs are necessary for benefits to exceed costs. In this situation, we consider that the best course of action is to monitor developments and implement in future, should either or both eventuate.

80 HoustonKemp, Evaluating market designs for inertia services, p 8.

81 Ibid.

82 Submissions to the directions paper: SMA, Energy Australia, and Akaysha

83 Submissions to the directions paper: AGL, Snowy, Hydro Tas, SMA and Engie.

84 Submissions to the directions paper: CS Energy, Iberdrola, Justice and Equity Centre, Rainforest Reserves Australia, EnergyAustralia, Energy Networks Australia, and Stanwell.

3.3 We found that operational procurement would be unlikely to deliver material net benefits under current assumptions

Operational procurement of inertia is unlikely to deliver material net benefits under current assumptions. Our directions paper identified, and HoustonKemp modelled, four potential benefit streams from operational procurement of inertia:

- reducing total costs of frequency management by procuring additional inertia as a substitute for fast frequency response (particularly 1-second FCAS)
- reducing the costs of wholesale electricity by procuring additional inertia to relieve rate of change of frequency constraints that at times limit generation in South Australia and Tasmania
- increasing the output of the largest generators by co-optimising additional inertia procurement with the wholesale electricity market, and
- avoiding requirements for AEMO to direct synchronous generators on, out of merit order, to avoid shortages of minimum inertia.

HoustonKemp's modelling considered a wide array of input costs that created a wide range of potential benefits, and a narrower range of potential costs.

We received feedback from stakeholders on the likelihood of the benefits streams arising, and the scale of potential benefits.[85]

In the sub-sections below:

- In section 3.3.1, we outline our analysis of what we consider the most likely scenario
- In section 3.3.2, we consider potential deviations from the most likely scenario;
  - firstly where the market price for additional inertia falls by 90%, without any corresponding change to market prices for fast frequency response, and
  - secondly where the market price for additional inertia falls by 90%, the market price for fast frequency response increases, rule changes and AEMO processes allow greater co-optimisation of inertia, fast frequency response and wholesale market, and AEMO and market participants costs are at HoustonKemp's lower bound.

The scenarios do not capture every possible future, but identify what we consider the most likely scenario with key changes that deliver higher benefits. We did not include any potential scenarios where the benefits are lower than our most likely scenario. Based on our scenario analysis below, we consider that this further supports our conclusion that it is not justified to introduce operational procurement for inertia now.

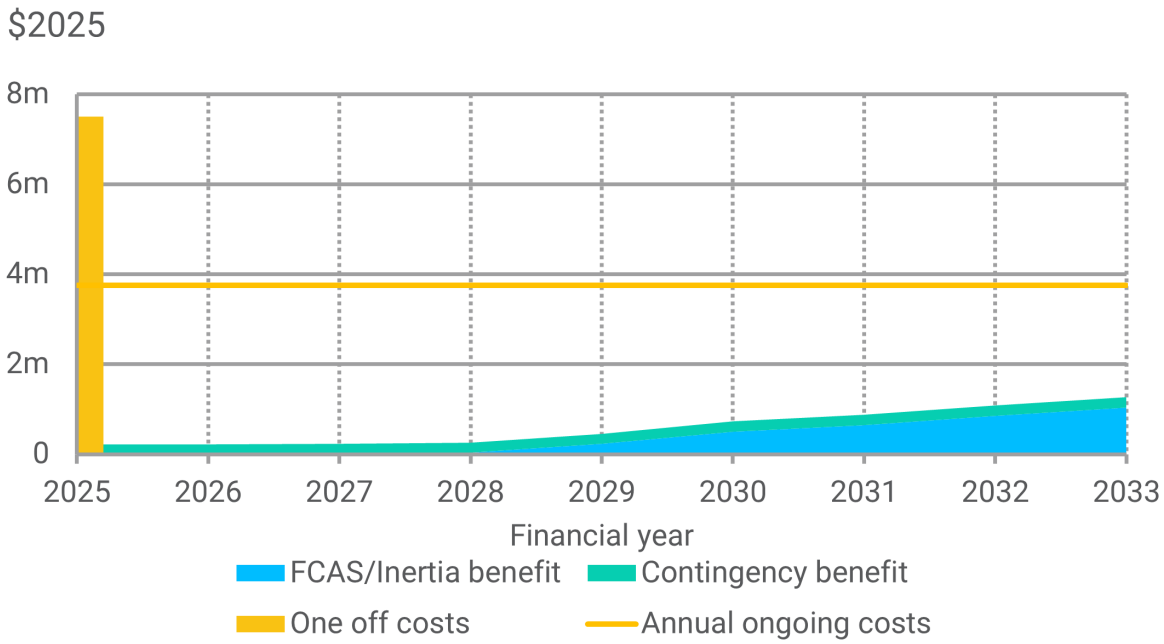
3.3.1 Our most likely scenario includes very limited benefits

We have identified a base case scenario representing what we consider is the most likely set of assumptions. As shown in Figure 3.5, the expected benefits from operational procurement of additional inertia are less than the costs throughout the 10 years modelled. The costs are estimated at approximately $30 million, while benefits are estimated at approximately $4 million. Most benefits come from:

- substituting inertia for fast frequency response, the light blue area, and
- inertia enabling bigger contingencies, the light green area.

85 Submissions to the directions paper: AEMO (expressing doubts on projected benefits related to contingency size), Australia Energy Council and Snowy Hydro (suggesting implementation costs are too high), and Tesla (expressing that battery storage would expect no capital cost recovery from an inertia market).

Figure 3.5: AEMC analysis of likely costs and benefits from operationally procuring inertia



Source: AEMC

Note: The benefits of relieving rate of change of frequency constraints in South Australia (royal blue area) and Tasmania (navy blue area) are very small (approximately $53,000 and $225,000 per year) and have not been shown on the graph above.

Table 3.1 below outlines the key assumptions we used in our most likely scenario.

Table 3.1: Types of benefits from operationally procuring additional inertia

Benefit source/cost	Most likely scenario description
Substitution of inertia for fast frequency response/Inertia benefit	• We have used a scenario based on FCAS prices remaining flat or falling. This is the trend most aligned with Intelligent Energy System's forecast of inertia prices provided for the Integrating Price Responsive Resources rule change.[1] • We have used HoustonKemp's average inertia cost of $0.44/MWs, based on the estimated cost of synthetic inertia from inverter based resources in both 2024 and 2030.[2] • We assigned 5% of the capital cost of inverter-based resources to inertia (the lowest modelled), reflecting feedback from Tesla that existing assets would have no fixed cost and future assets would not need to reserve capacity.[3]
Relieving the South Australian RoCoF constraint	We included the benefits of relieving the South Australian RoCoF constraint until the scheduled

Benefit source/cost	Most likely scenario description
	completion of Project Energy Connect in 2027.[4]
Relieving the Tasmanian RoCoF constraint	We included the benefits from relieving the Tasmanian RoCoF constraint indefinitely.[4]
Enabling larger contingencies	We assumed that AEMO could enable larger contingency sizes in 0.3% of intervals than currently,[5] noting that today AEMO does not co-optimise contingency size with inertia. Additionally, we reduced the benefits by two-thirds based on AEMO's submission to the directions paper.[6]
Avoiding direction	We understand all historic directions have been for system strength services. Therefore, we did not include any avoided directions benefits.
Implementation and ongoing costs	We used the midpoint of HoustonKemp's estimated costs - an upfront cost of $7.5 million to develop the market and ongoing costs of $1.5 million per year for AEMO, and $300,000 per year for each of the estimated 7 or 8 participants.[7]

Source: [1] Intelligent Energy Systems, *Benefit analysis of improved integration of unscheduled price-responsive resources into the NEM (ERC0352)*, Final Report, 24 June 2024, p 61; [2] HoustonKemp, *Evaluating market designs for inertia services*, December 2024, p 60 ; [3] Submission to the directions paper Tesla, pp 3-4; [4] AEMC analysis of NEM data; [5] HoustonKemp, *Evaluating market designs for inertia services*, December 2024, pp 34-35, 40-41, based on analysis of how frequently the largest generators are constrained today; Submission to the directions paper AEMO, p 2; [7] HoustonKemp, *Evaluating market designs for inertia services*, December 2024, pp 42-44.

We received feedback that the 10-year time horizon was too short.[40] We typically aim to assess rule changes over a 30-year period. We estimate that everything else held equal, the benefits of substituting inertia for fast frequency response would need to increase at an average of just over 17% per year for the benefits in 2033 to exceed the costs over a 30-year period.

It is difficult to assess how plausible a 17% annual growth rate is. However, with our estimates showing costs exceeding benefits in the near future, monitoring the factors that determine potential benefits will allow more informed decisions in the future. In Section 3.5, we discuss our draft decision to require the Reliability Panel to monitor minimum inertia requirements, costs of inertia procured, contingency FCAS prices and the prominence rate of change of frequency constraints. This information is needed to identify if, or when, operational procurement of additional inertia will provide the most benefits in the long-term interests of consumers.

3.3.2 We could see net benefits with less likely assumptions

It is possible, though unlikely, that we could see benefits from operational procurement within the 10-years modelled. We have included two scenarios below:

- Figure 3.6 shows our most likely scenario with a single change: the market price of operational procurement falls by 90% with no corresponding change to fast frequency response.

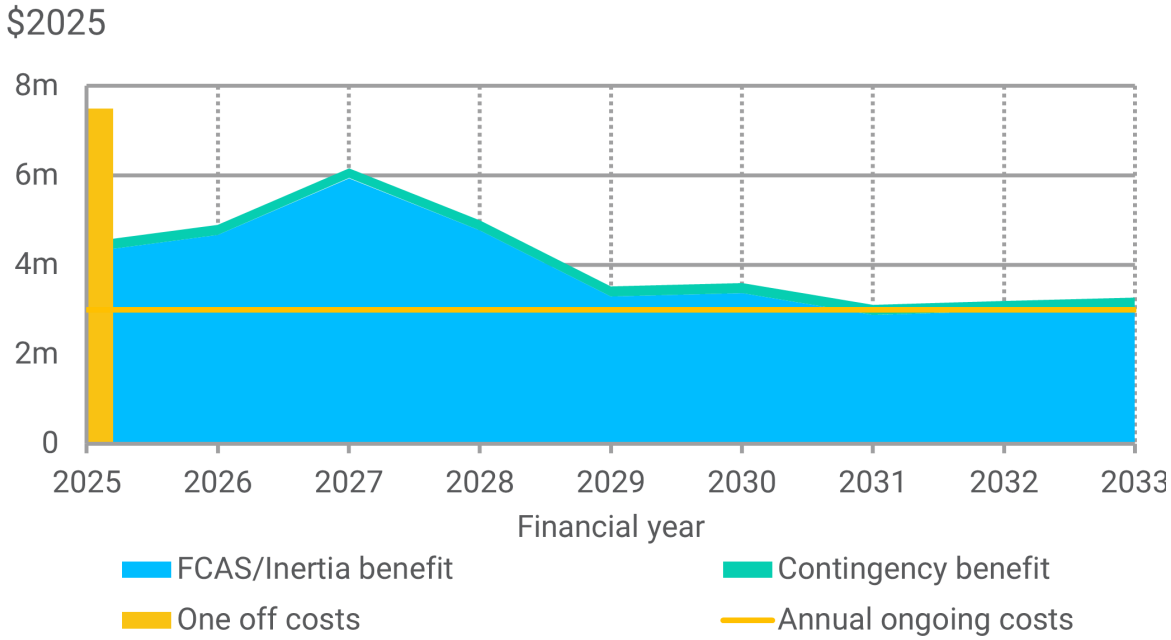
- Figure 3.7 shows the most optimistic scenario, where we have included the highest benefit generating assumptions from HoustonKemp's analysis for operational procurement of additional inertia,[86] with the least costs.[87]

These scenarios help highlight the potential benefits of implementing operational procurement of additional inertia in the future, if the factors we intend to require the Reliability Panel to monitor move in certain directions.

Reducing the market price of inertia by 90% is sufficient to create net benefits from operational procurement of inertia. As shown in Figure 3.6, this change (shown by the much larger light blue area) leads to net benefits of just under $2 million over the 10 year.

HoustonKemp's analysis included a scenario where the estimated inertia cost were 90 per cent lower at $0.04/MWs. Making only this adjustment to our most likely scenario, benefits from operational procurement of additional inertia exceed the costs and generate a net benefit over the 10-year horizon (see Figure 3.6). This increases the benefits of substituting inertia for fast frequency response by a factor of 12. This leads to benefits worth $28 million in net present value terms, represented by the large increase in the blue area of Figure 3.6. The other benefit sources and the costs are unchanged from Figure 3.5.

Figure 3.6: AEMC analysis of likely costs and benefits from operationally procuring inertia if cost of inertia provision decreases to $0.04/MWs



Source: AEMC

Note: The benefits of relieving rate of change of frequency constraints in South Australia (royal blue area) and Tasmania (navy blue area) are very small (approximately $53,000 and $225,000 per year) and have not been shown on the graph above.

We have not included this in our most likely scenario for two key reasons:

1. We consider that it is unlikely that HoustonKemp's best estimate of inertia costs is 90 per cent off the achievable average cost over the next 10 years, as this would likely require significant

86 We have not included avoiding directions, as this is technically operational procurement of minimum inertia.

87 We used least costs per participant, however due to the high benefits we used HoustonKemp's maximum number of participants.

productive efficiency gains over a short time period or a materially inaccurate estimate from HoustonKemp.

2. With a spot market in place, inverter based inertia sources could operate in either the FCAS market or the inertia market. Therefore, we would expect to see similar offsetting reductions in FCAS prices, minimising the benefits of substituting between the two services.

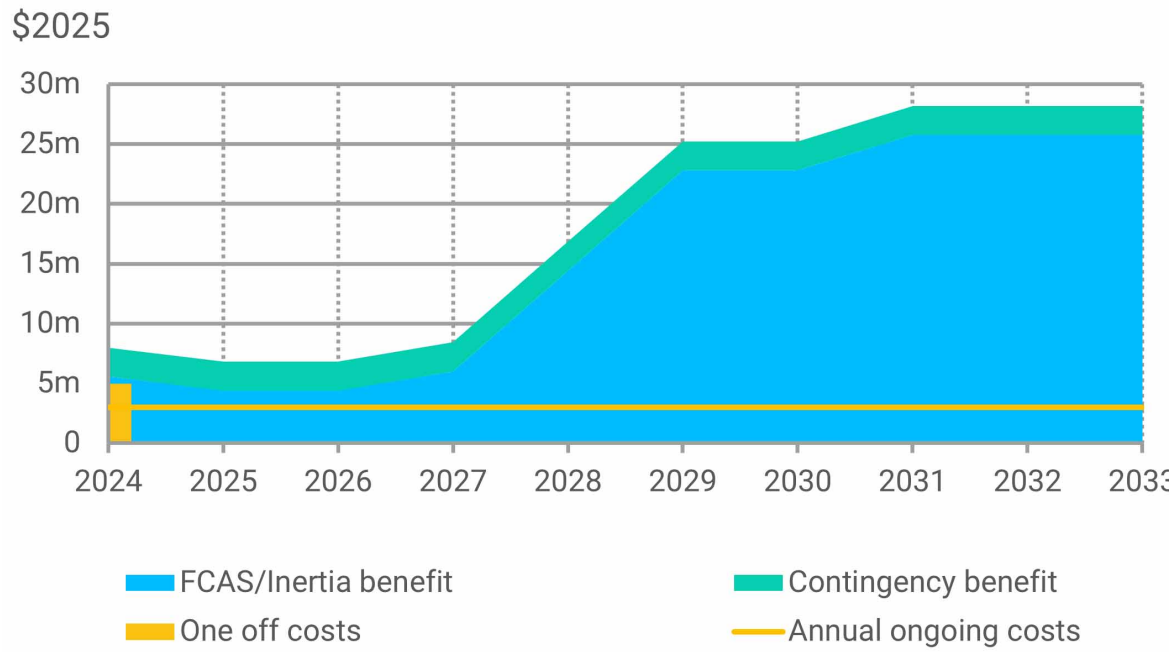
In the most optimistic scenario (Figure 3.7), we have additionally:

- Increased prices of 1-second FCAS, creating a further separation between the prices of inertia and 1-second FCAS in the respective markets. This increases the benefits of substituting inertia for FCAS to over $110 million in net present value terms, represented by the blue area in Figure 3.7, this is 49 times larger than in our base case.
- Allowing greater use of inertia to complement wholesale markets, assuming this could improve system costs in 2.9% of intervals across the NEM. This increases the benefits of allowing larger contingencies, represented by the teal area in Figure 3.7, to $17 million in net present value terms over 10 times larger than in our base case.
- Reduced costs to HoustonKemp's lower bound estimates of $5 million to set up the market, represented by the yellow bar, and $2 million per year for ongoing operations for AEMO and ongoing participation from inertia providers, represented by the green line in Figure 3.7.

This could generate benefits of $130 million with costs of $26 million in net present value terms, as shown in below. This final scenario is highly unlikely, and we do not consider it credible within the next 10-years based on current assumptions.

Although we currently do not consider these assumptions to be realistic currently, we have proposed an approach of monitoring system conditions to identify any time at which system changes mean that operational procurement of inertia would bring net benefits to consumers. Section 3.5 describes our proposal for the Reliability Panel to monitor specific system conditions in the RASR which would indicate when operational procurement could become beneficial.

Figure 3.7: AEMC analysis of costs and benefits from operationally procuring inertia if less likely system conditions arise



Source: AEMC

Note: The benefits of relieving rate of change of frequency constraints in South Australia (royal blue area) and Tasmania (navy blue area) are very small (approximately $53,000 and $225,000 per year) and have not been shown on the graph above.

3.4 We consider that near-term inertia needs can be best managed through the existing system security framework

3.4.1 In the short term, the current framework is best suited to meet minimum inertia requirements

As discussed in section 3.2, the Commission considers that long-term procurement remains suitable for meeting minimum inertia requirements at the current time, especially due to the extremely high cost of undersupply.[88] As previously mentioned in section 3.1.4, the ISF rule has enhanced the efficiency of the long-term inertia procurement framework, but it is also designed so that the enablement of system security contracts does not significantly distort the wholesale energy market, which would lead to consumers bearing highly inefficient costs.[89]

To ensure that all system security contracts are efficiently enabled, the ISF rule gave AEMO a new enablement power that aims to optimise the enablement of all system security contracts to meet any gaps in minimum security requirements in operational timeframes.[90] AEMO is currently consulting on its Security Enablement Procedures which will set out:[91]

88 See section 7.1 of the Directions Paper.

89 'Enablement' refers to AEMO selecting a Registered Participant who has a contract with a TNSP to provide system security services to either commit to come online, or to remain online where it would otherwise have decommitted.

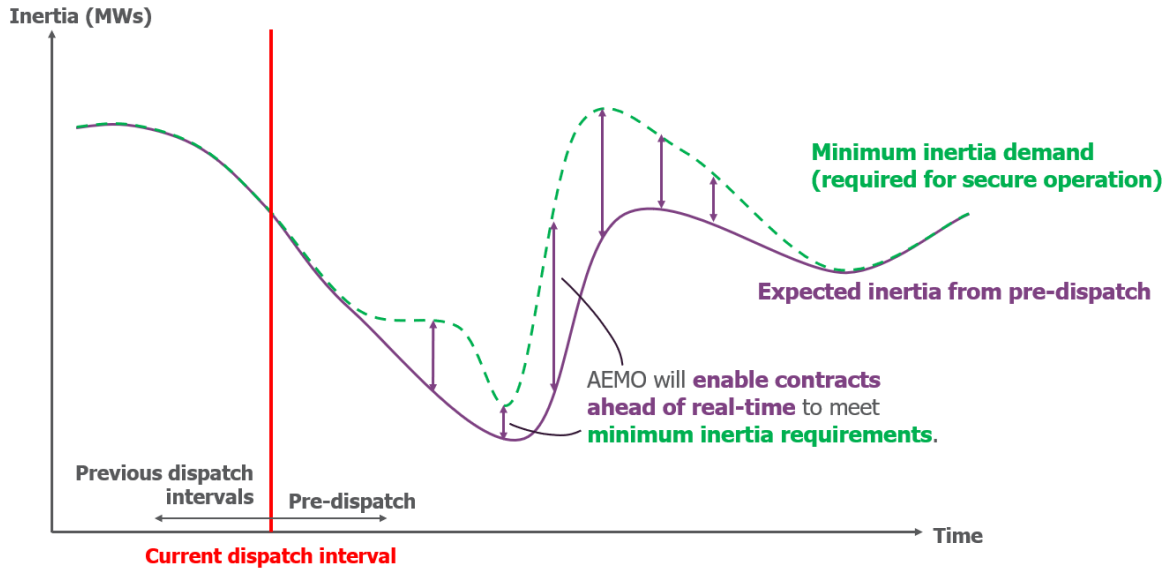
90 *System security services* will be defined in the NER as a *system strength service,* an *inertia network service*, an *NSCAS* or a *transitional service*; see clause 4.4A.2 of Schedule 5 of the ISF rule. The *minimum system security requirements* will also be defined as the aggregate of the minimum inertia requirements, system strength requirements, any relevant NSCAS needs and any transitional services required for secure operation; see clause 4.4A.3 of the ISF rule.

91 See AEMO's Security Enablement Procedures consultation which includes the Draft Security Enablement Procedures and the associated consultation paper.

- the determination of real-time minimum inertia, system strength and NSCAS requirements, which will be available to all market participants through constraints in the market management system (MMS)
- the assumptions that will be used when determining gaps against minimum security requirements
- the form and content of enablement instructions to Registered Participants
- the minimum financial parameters that must be given to AEMO and how those parameters will be incorporated for its optimisation of contracts
- the automated procedure and timelines by which AEMO will determine an enablement schedule, based on pre-dispatch information, financial information from contracts, and technical limitations of plant (for example, minimum start-up times).

Figure 3.8 shows a conceptual and simplified situation where the expected amount of inertia from pre-dispatch intervals will not meet the projected minimum inertia requirements, and AEMO enablement of system security contracts is required.[92]

Figure 3.8: AEMO enablement will meet minimum inertia requirements ahead of real-time



Source: AEMC
Note: This diagram is for illustrative purposes only and does not represent any intra-day inertia demand projections or forecasts.

This system security enablement procedure will allow AEMO to enable all system security contracts to meet all system security requirements, but only where there are shortfalls. This is preferable to alternative approaches, such as:

- enabling contracts ahead of real-time to meet the entirety of minimum security requirements, instead of only gaps that arise in pre-dispatch:
  - this approach would greatly distort the wholesale energy market, because a large proportion of the market would be 'locked-in' ahead of time, likely leading to higher costs for consumers

92 The ISF rule requires that no contract must be enabled more than 12 hours ahead of the dispatch interval for which it is required; see clause 4.4A.4(b) of the ISF rule.

- enabling inertia and system strength contracts to meet inertia and system strength requirements separately:
  - this does not allow for efficient optimisation of contracts where a system strength service (for example, system strength provided by a synchronous unit) also provides inertia as a byproduct, or vice versa.

3.4.2 Maintaining the existing framework provides regulatory certainty while preserving flexibility for future reform

Current system needs can be met through long-term procurement frameworks recently strengthened through these ISF reforms. In particular, investments in synchronous condensers and other system strength solutions are expected to provide sufficient inertia over the short to medium term. While these assets are procured for system strength, many are expected to contribute inertia as a co-benefit. This reduces the likelihood of inertia shortfalls and diminishes the potential benefit of a separate operational procurement mechanism in the near term.

Given that TNSPs are currently in the process of procuring assets and contracting with system security providers, and AEMO is developing its enablement tool, the Commission considers it important to promote regulatory certainty by not amending the existing long-term framework. The Commission considers that significant changes to the inertia procurement framework or to AEMO enablement in this rule change process would not promote the NEO. Any changes to either would likely increase system security contracting costs, may result in consumers incurring costs for tools that may not be used, and would leave industry with an unclear direction as to how to procure and provide inertia throughout the transition, risking system security.

3.5 We intend to require the Reliability Panel to monitor system conditions which would indicate whether operational procurement becomes beneficial in the future

Although the Commission considers that there are no material net benefits from introducing operational procurement of inertia now, we also consider that there are various factors that may improve the benefits in the future. These factors include:

- Minimum inertia requirements: if regional inertia requirements significantly increase in the future, then the existing TNSP procurement framework may not be adequate in efficiently procuring such large amounts of inertia.[93]
- Cost of long-term inertia procurement: currently, there are no active RIT-Ts being conducted to meet TNSP inertia obligations, as all inertia requirements are likely to be met as a consequence of the TNSPs meeting their system strength obligations (see section 3.1.3 and section 3.2.2). If it appears that significant additional TNSP procurement needs to occur to meet future inertia requirements, then using a combination of long-term and operational procurement may reduce costs for consumers.
- Contingency FCAS prices: if the 1-second FCAS price increases over the next decade, then the benefits of operationally procuring inertia significantly grow.
- Prominence of RoCoF-related constraints: Currently, there are only two RoCoF-related constraints that bind with significant frequency.[94] If AEMO determines that the technical

93 While the Commission notes that the magnitude of non-credible contingencies may increase in the future (for example, due to large Renewable Energy Zones (REZs) - see AEMO, 2025 Draft GPSRR, Chapter 4), AEMO's submission notes that the size of credible contingencies is not likely to increase because this would impose many significant adverse effects on system security, where inertia would be a relatively minor concern: see AEMO, submission to directions paper, p 3.

94 V_S_NIL_ROCOF and T_ROCOF_3.

envelope of the power system requires that more RoCoF constraints need to be formulated, then the value of relieving those constraints through operational procurement of additional inertia could be high.

To closely monitor the evolution of these factors, the Commission intends to task the Reliability Panel to monitor these matters through its RASR by including the factors discussed above in its terms of reference for future RASRs.[95] The Reliability Panel must then publicly report on these factors and whether they have changed in a way that warrants the reconsideration of operational procurement of inertia. If so, the Commission would consider the case for reform through a request from the Reliability Panel. We note that sufficient time would need to be given to allow for any implementation of a new framework or market to be in place before any urgent needs arise.

We remain open to different implementation pathways and would consult further on any future reform proposal.

Several stakeholders also highlighted the importance of coordination across system security procurement frameworks, to ensure that technologies contributing to multiple services are appropriately recognised. While the Commission considers that the ISF reforms have significantly improved TNSPs' abilities to coordinate solutions that meet multiple system needs simultaneously, without incurring costs twice, the Commission supports this view, and will continue to consider how procurement approaches for inertia, system strength, and frequency control can be improved as part of any future reforms.

95 For example, see the Commission's Terms of Reference to the Reliability Panel for its Annual Market Performance Review for FY 2024.

4 We suggest ways to improve how the existing inertia frameworks are being applied in practice

Box 3: Key points in this chapter

The Commission is not proposing changes to the rules at this time

- Stakeholders raised concerns about the transparency and implementation of current inertia procurement frameworks, including participation by non-synchronous technologies and clarity of investment justifications.
- The Commission considers that targeted improvements to how current frameworks are applied can effectively address these concerns without the need for rule changes.
- These improvements are already underway through existing AEMO and TNSP processes, including the use of Type 2 contracts and increased visibility of procurement decisions.
- Introducing new regulatory obligations would risk duplicating existing efforts and may reduce flexibility to respond to evolving technical understanding.

The Commission encourages AEMO to increase visibility of its technical work

- The Commission considers that AEMO is progressing key initiatives across four areas identified by stakeholders: real-time inertia measurement, locational analysis, improved dispatch integration, and performance standards for emerging technologies.
- Rather than recommending new obligations, the Commission encourages AEMO to consolidate reporting on this work through a dedicated section of the Transition Plan for System Security (TPSS).
- This would support transparency, coordination across workstreams, and stakeholder understanding of how AEMO's work supports both current frameworks and potential future procurement reform.
- The Commission considers this a proportionate and flexible response that preserves AEMO's operational independence while improving confidence in system readiness.

The Commission encourages TNSPs and the AER to strengthen transparency and technology-neutrality

- Submissions raised concerns about how procurement needs are defined, justified, and communicated by TNSPs and the AER.
- The Commission supports improvements to the clarity and accessibility of project justifications, including the role of synthetic and grid-forming technologies.
- TNSPs are encouraged to improve how emerging technologies are incorporated into planning and procurement processes under the existing system strength and inertia frameworks.
- The AER's guidance materials and assessment practices can also help support confidence in procurement outcomes and enable a more contestable, technology-neutral approach within the existing regulatory framework.

4.1 We considered stakeholder feedback on various opportunities to improve the current inertia framework

In response to the Directions Paper, stakeholders raised a number of concerns about how the current inertia procurement framework is being applied. These included the transparency of procurement decisions, the clarity of investment justifications, and whether the framework adequately supports participation by non-synchronous and emerging technologies. Stakeholders also emphasised the importance of progressing technical capabilities, such as real-time inertia measurement and improved dispatch integration, to support more flexible procurement over time.

The Commission considered whether the improvements required rule changes, but concluded that these were unlikely to provide proportional or effective improvements at this time. The Commission considers that meaningful outcomes can be achieved by supporting progress in AEMO's technical work, improving the visibility and application of existing obligations, and clarifying how tools such as Type 2 contracts can be used to build future readiness.

The following sections outline the Commission's consideration of specific opportunities to strengthen how current frameworks are applied, promote innovation, and support future procurement reform. These include improving transparency, enhancing system capabilities, and enabling a more flexible and technology-neutral approach under existing arrangements.

4.2 There are opportunities to improve information on technical priorities and forward planning without rule changes

4.2.1 Stakeholder submissions to the directions paper have identified priority areas for AEMO's technical work

Stakeholders broadly acknowledged the importance of AEMO's ongoing technical work in supporting secure system operation as levels of synchronous inertia decline. Submissions to the directions paper identified several areas where further progress and improved transparency could strengthen the operation of the existing inertia framework and help enable future operational procurement. These included:

- development of technical standards and roadmaps for emerging technologies,
- enhancements to real-time inertia measurement,
- improved clarity on the locational distribution of inertia needs, and
- improved representation of inertia in NEMDE.

Several stakeholders supported the development of a consolidated roadmap or structured technical work plan for grid-forming inverters and synthetic inertia.[96] Akaysha proposed that AEMO establish a forward technical program to guide the deployment of grid-forming BESS, including clearer certification requirements and performance standards. Iberdrola recommended progressing synthetic inertia standards through formalised technical work programs or rule amendments to reduce uncertainty. CS Energy supported expanded demonstration trials and the development of a governance framework for emerging technologies. SMA also supported the development of a roadmap to identify implementation steps and low-regret opportunities for enhancing system security.

Submissions from the AEC, CS Energy, Snowy Hydro and Tesla highlighted the need to improve real-time measurement of inertia.[97] The AEC encouraged further development of system inertia

96 Submissions to the directions paper, Akaysha, p 4; Iberdrola, p 3; CS Energy, p 2; SMA, p 2.

97 Submissions to the directions paper: AEC, p 1; CS Energy, p 5; SnowyHydro, p 5; Tesla, p 5.

measurement techniques, referring to work by the University of Melbourne on the concept of residual inertia.[98] CS Energy noted that better quantification of inertia in real time would support more informed operational decision-making and provide greater clarity around when and where services are needed. Snowy Hydro submitted that improved understanding of inertia levels would help AEMO assess long-term system requirements. Tesla emphasised the importance of aligning measurement tools with dispatch modelling, to support more accurate integration of inertia into operational processes.

Tesla also submitted that inertia, while a system-wide property, is affected by network topology and real-time transmission constraints, and that procurement approaches should reflect these locational dynamics.[99] Tesla argued that better clarity on how AEMO considers regional or sub-network requirements would help ensure that future procurement frameworks can deliver inertia where it is most effective.

In relation to dispatch integration, AEMO, CS Energy, and Tesla supported improvements to the way inertia is represented in NEMDE.[100] AEMO noted that current dispatch systems do not yet support co-optimisation of inertia or fully reflect the non-linear relationships between inertia, frequency control, and system constraints. CS Energy referred to recent modelling improvements in Tasmania as a precedent for more sophisticated representation of inertia behaviour. Tesla submitted that current simplifications in dispatch tools may result in inefficient outcomes and limit the participation of technologies capable of providing inertia dynamically.

While submissions varied in emphasis and level of prescription, stakeholders consistently emphasised the value of improved coordination and transparency in AEMO's technical work. Greater visibility of technical priorities, progress, and interdependencies was seen as important for supporting the effective operation of existing frameworks and building confidence in the system's readiness to support future reform. These suggestions inform the Commission's consideration of how existing workstreams can be used to respond to the priorities raised.

4.2.2 The Commission has considered AEMO's current technical work in response to stakeholder feedback

In response to stakeholder submissions to the Directions Paper, the Commission has considered AEMO's current technical work programs and their alignment with the areas of technical focus identified by stakeholders as essential to supporting both the operation of the current inertia framework and the system's readiness for potential future procurement.

In relation to technical standards and performance requirements, AEMO is progressing a range of work relevant to grid-forming inverters and synthetic inertia. This includes the Engineering Roadmap FY2025[101], continued refinement of generator access standards[102], and support for a forthcoming rule change on generator performance standards.[103] These workstreams collectively aim to clarify expectations for emerging technologies and address technical enablement needs identified by stakeholders.

On real-time inertia measurement, the Commission has considered that AEMO has completed several trial projects and is continuing to refine the underlying methodology developed to estimate

98 The University of Melbourne, Evaluation of Reactive Technologies Inertia Measurement and Techno-economic Modelling - *Knowledge Sharing Report*, August 2024.

99 Ibid., page 6.

100 Submissions to the directions paper: AEMO, p 6; CS Energy, p 2; Tesla, p 6.

101 AEMO, NEM Engineering Roadmap FY2025 Priority Actions, 15 August 2024.

102 AEMC, Improving the NEM access standards – Package 2

103 NEM Engineering Roadmap FY2025 Priority Actions, 15 August 2024.

inertia in real time. This methodology was outlined in The University of Melbourne's Evaluation of Reactive Technologies Inertia Measurement and Techno-economic Modelling - *Knowledge Sharing Report*, which assessed the feasibility of deriving inertia estimates from phasor measurement units (PMUs) and system response data following contingency events.[104] AEMO is currently evaluating the accuracy of this approach, exploring potential operational applications, and considering how it could inform future procurement design. This capability remains under development, and further work may be required before its wider application.

For locational inertia requirements, the Commission has considered that AEMO has conducted regional inertia assessments and commissioned external modelling, such as the Vysus study, to examine sub-network characteristics and emerging risks.[105] Vysus has noted that this modelling did not use a full NEM-wide system model and was not intended to inform operational decisions directly. Instead, it provides a foundation for building locational understanding over time and may help inform future planning and operational decisions, particularly in areas experiencing declining synchronous generation. AEMO has indicated that it is continuing to refine this locational understanding and engage with stakeholders on the evolving needs.[106]

With respect to operational integration, AEMO's submission to the Directions Paper acknowledged current limitations in the way inertia is represented in NEMDE.[107] AEMO has confirmed it is progressing internal improvements to better reflect inertia in dispatch decisions to support more effective co-optimisation with other system services. Since its submission, as part of its consultation on the new Security Enablement Procedures, AEMO has proposed that it would adapt the inertia and system strength requirements in its annual reports to create new operational constraints that will be monitored in dispatch and pre-dispatch.[108] It will also consider TNSP limits advice when developing these system security constraints, like other power system limits.[109] From 2 December 2025, these constraints will be publicly available to view in AEMO's Market Management System (MMS), but will not be applied in NEMDE or Projected Assessment of System Adequacy (PASA); instead, they will only be applied in the system security service scheduler.[110] We consider that the development of these system security constraints to reflect dynamic minimum security requirements will allow for the efficient enablement of system security contracts, and provide a better technical and operational foundation for any potential future procurement reform.

The Commission considers that AEMO is progressing a substantial body of work that addresses several of the concerns raised by stakeholders, including improvements to inertia measurement, operational integration, and locational understanding. Rather than introducing new regulatory obligations through changes to the rules at this stage, the Commission considers that increasing visibility of this work would support the transparency and coordination outcomes that stakeholders are seeking. This approach retains flexibility, avoids duplication, and can be delivered within the current framework. The Commission's recommended approach to supporting this visibility is set out in the following section.

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104 The University of Melbourne, Evaluation of Reactive Technologies InertiaMeasurement and Techno-economic Modelling: Technical Knowledge Sharing Report, August 2024

105 Vysus, The Role and Need for Inertia in a NEM-Like System, 22 April 2024.

106 AEMO, submission to the directions paper, p 6.

107 Ibid.

108 AEMO, Security Enablement Procedures consultation, Consultation Paper, pp 2, 15-16; Draft Security Enablement Procedures, p 8; ISF and IPRR Consultation of Constraint Formulation Guidelines, Constraint Formulation Guidelines, section 6.4.

109 Ibid.

110 AEMO, ISF and IPRR Consultation of Constraint Formulation Guidelines, Constraint Formulation Guidelines, section 6.4. See also section 3.4.1 for more information on system security enablement.

4.2.3 There are opportunities to enhance visibility of AEMO's technical work through the Transition Plan for System Security (TPSS)

The Commission considers that increasing the visibility of AEMO's existing technical work programs is the most appropriate and proportionate way to address the concerns raised in response to the Directions Paper. As outlined in Section 4.2.2, AEMO is already progressing work across the key technical areas identified by stakeholders, including real-time inertia measurement, locational assessments, improved inertia representation in NEMDE, and integration of emerging technologies. Rather than introducing new regulatory obligations at this stage, the Commission considers that greater visibility of this work, through structured reporting and stakeholder engagement, would support transparency, help coordinate system development, and maintain flexibility as technical capability evolves.

However, the Commission acknowledges some stakeholder feedback that this work is not always clearly communicated or easy to track, particularly where activities span multiple reports or relate to internal processes. The Commission has considered whether it would be appropriate to introduce new obligations or rules to require AEMO to prioritise or enhance reporting on its existing technical work programs. Given the depth and scope of work already underway, the Commission does not consider that such obligations are necessary at this stage. The Commission suggests that AEMO could enhance transparency and visibility by including a dedicated section in future editions of its TPSS to report on progress, key developments, and next steps across these areas.

Improved visibility through the TPSS would provide stakeholders with a more consolidated view of how AEMO's technical work supports both near-term needs under the existing inertia frameworks and improve the system readiness to transition to operational procurement - if the benefits justify this in future. This approach would also help clarify how different initiatives (such as the Engineering Roadmap,[111] generator performance standard reforms, and internal modelling improvements) interact and contribute to broader system planning and procurement decisions. This is particularly important for supporting investor confidence, enabling emerging technologies to align with future performance expectations, and ensuring a more coordinated understanding of how operational procurement could evolve over time.

This approach also allows AEMO to retain flexibility over the sequencing and delivery of its technical work, while providing a clearer framework for communicating progress. It avoids the potential duplication, rigidity, or unintended consequences that could result from codifying technical work priorities in the rules. The Commission considers that enhancing transparency through the TPSS provides a practical and low-cost mechanism to build stakeholder confidence, support coordination across workstreams, and reduce barriers to participation for new providers of system security services.

The Commission considers that this approach best aligns with the assessment framework by promoting transparency, proportionality, and efficient implementation, while respecting AEMO's operational independence. It also offers a practical means of coordinating related workstreams and providing stakeholders with clearer visibility of how technical priorities are being progressed.

111 AEMO, Engineering Roadmap: FY2025 Priority Actions Report

4.3 We also considered what would be needed to support future operational procurement of inertia

The Commission has also considered what would be required to support the reconsideration and potential implementation of operational procurement of inertia in the future, if and when it is assessed as beneficial. While the Commission is not recommending implementation at this stage, it recognises that system conditions continue to evolve. Maintaining the ability to implement operational procurement quickly, should the benefits justify it, will be important to ensuring the power system remains secure and efficient under a wider range of future scenarios.

The Commission acknowledges that many of the building blocks that would be required to support future operational procurement are already in place. These include various reforms introduced through the ISF rule change including the NEM-wide inertia floor,[112] as well as AEMO's ongoing development of real-time inertia measurement tools, and the maturing capability of emerging technologies such as grid-forming inverters and synthetic inertia. These foundational elements provide a strong starting point for more dynamic procurement models, even if they are not currently being used for operational procurement of inertia.

Progressing work in these areas not only supports the effectiveness of the existing framework but also builds optionality for the future. As outlined in Section 4.2, stakeholders have identified several technical priorities that could form critical inputs to the design and implementation of operational procurement of inertia in the future. The Commission considers that advancing these areas of work now can help reduce lead times, implementation costs, and integration risks if a decision is made to pursue operational procurement at a later stage.

The Commission sees value in continuing to rely on AEMO's current and work program to address these priority areas, particularly where progress would deliver 'no regrets' outcomes. These could include improvements that benefit system security, planning, or operational coordination, regardless of whether operational procurement is ultimately implemented. This approach also helps maintain stakeholder and investor confidence by demonstrating that the system is preparing for a range of future conditions.

The Commission notes that a 'no regrets' approach means that this work would focus on improvements to system understanding and procurement frameworks already underway, such as AEMO's various work programs under its Engineering Roadmap and the use of Type 2 contracts. It would not encompass the specific work to implement operational procurement itself, including dispatch design, cost recovery, and pricing, which we do not propose should be progressed at this time.

The Commission considers that improving the preparedness for the design and implementation of the operational procurement of inertia in the long term aligns with the assessment framework by supporting efficient implementation pathways, preserving flexibility, and enabling a more adaptive response to future system needs. We do not consider that we would be missing out on benefits or value to consumers by not implementing operational procurement of inertia at this time, because technical work is required to support the implementation of operational procurement, and components of this work are already progressing.

The Commission encourages AEMO to continue reporting on its progress in these technical work areas through its annual TPSS. Visibility of AEMO's work program will support both industry confidence and enable effective monitoring of system readiness for any future transition to operational procurement of inertia.

112 AEMC Improving Security Frameworks - Final Determination, 28 Mar 2024, p 41.

The Commission also notes that the Reliability Panel is able to comment on AEMO's annual TPSS, and its future commentary could consider AEMO's progress on the technical development areas identified in this draft determination, including real-time inertia measurement and operational coordination capabilities. This can provide a transparent mechanism for ongoing oversight of technical readiness to support any future reconsideration of operational procurement of inertia.

4.4 We see value in AEMO continuing to use Type 2 contracts to support innovation and future procurement readiness

The Commission considers that the existing Type 2 contract framework remains appropriate and fit for purpose. The Commission encourages AEMO to use Type 2 contracts to support confidence-building and technical exploration related to synthetic inertia, real-time inertia measurement, and other capabilities that may support future service delivery. AEMO is also required to report on findings from its use of Type 2 contracts through the ISF reporting framework, which provides a structured and transparent channel for sharing lessons learned. This existing reporting obligation ensures that the operational insights gained through Type 2 contracts are publicly available and can inform both ongoing system planning and any future design work for operational procurement of inertia.

While Type 2 contracts are not a substitute for operational procurement, they can support system readiness by providing early operational insights, such as how new technologies perform under different system conditions or interact with other services. These insights help reduce future implementation risks by identifying integration challenges, data needs, or system impacts ahead of formal market design. The operational experience gained through these trials will also provide practical input to any future development of operational procurement design, by allowing technical integration issues to be identified and addressed prior to formal implementation.

Retaining the current framework allows AEMO to prioritise emerging technical issues without introducing unnecessary prescription or administrative burden, while ensuring that lessons from Type 2 activity can inform the design of any future procurement mechanism for inertia.

The Commission considers that this approach aligns with the assessment framework by supporting flexibility, proportionality, and preparedness, and by enabling innovation in a way that builds system confidence without imposing premature obligations.

4.4.1 Some stakeholders proposed requiring AEMO to use Type 2 contracts to meet specific targets

In response to the Directions Paper, Iberdrola submitted that AEMO should be subject to a minimum target or volume-based obligation for the use of Type 2 contracts.[113] This suggestion was intended to support the integration of emerging technologies and help build operational experience with services such as synthetic inertia. Iberdrola proposed that setting an explicit target could create a stronger framework for progressing innovation and reducing uncertainty for industry.

The Commission acknowledges this perspective and recognises the value stakeholders place on structured pathways for emerging technologies to demonstrate capability and contribute to future procurement reforms. The Commission has carefully considered this stakeholder feedback in assessing whether there is a need to introduce a volume-based obligation for the use of Type 2 contracts.

113 Iberdrola, submission to the directions paper.

4.4.2 The Commission does not propose to introduce volume-based obligations for Type 2 contracts

Having considered stakeholder feedback, the Commission does not propose to introduce a volume-based obligation for AEMO's use of Type 2 contracts. The Commission considers that such obligations would not align with the original purpose of the Type 2 framework, which is designed to support early-stage technical exploration in areas not yet covered by formal procurement arrangements.

Type 2 contracts are intended to provide AEMO with a flexible and low-cost mechanism to trial new technologies and system services, gather operational insights, and build confidence in emerging capabilities. These contracts are not intended to function as a delivery or compliance mechanism, and prescribing their use through targets or fixed obligations could reduce AEMO's discretion and constrain its ability to focus trials on areas of greatest technical uncertainty or system needs.

The Commission considers that maintaining a flexible and proportionate approach to Type 2 contracts better supports their intended function as a research and innovation tool. This approach also aligns with the assessment framework by preserving optionality, avoiding unnecessary regulatory complexity, and enabling low-regrets system learning that can inform future procurement reforms if and when they are pursued.

4.4.3 The Commission considers it is sufficiently clear that synthetic inertia trials are eligible under Type 2 contracts

The Commission has considered whether the current provisions in the NER remain fit for purpose in supporting the advancement of technical understanding of synthetic inertia through the use of Type 2 contracts. In light of stakeholder feedback emphasising the importance of enabling innovation in this area, the Commission has reviewed the eligibility criteria under clause 3.11.11(b) to ensure there is no barrier to using Type 2 contracts for synthetic inertia technologies. This includes circumstances where the technology has been previously demonstrated prior to the cut-off date of 31 March 2024, which may otherwise create ambiguity about whether it qualifies as a "new source" or "new application."

Clause 3.11.11(b)(2) of the NER provides that:

> (b) AEMO must only acquire transitional services where:
>
> (2) the services are acquired for the purpose of trialling new technologies, or a new application of existing technologies, for the management of power system security in a low-or zero-emissions power system where the particular application of the technology employed through the transitional services has not been used to provide services to manage power system security prior to 28 March 2024.

Reflecting on the original policy intent of the Type 2 contract framework, the Commission considers that synthetic inertia technologies remain eligible where the contract is used to trial a new application of the technology. This may include, for example, exploring new operational roles for synthetic inertia within the NEM. On this basis, the Commission does not consider that any amendment to the NER is necessary at this stage to clarify eligibility under clause 3.11.11(b).

4.5 There are opportunities to improve how procurement decisions are applied, assessed, and communicated within the existing framework

4.5.1 Stakeholders supported the current inertia procurement framework but identified opportunities to improve its effectiveness

In response to the Directions Paper, stakeholders acknowledged the role of the current long-term procurement framework in securing minimum levels of inertia but raised concerns about how it is being applied in practice. Several submissions identified risks related to technology lock-in, limited contestability, and a lack of transparency in how TNSPs assess and justify procurement decisions.

ENGIE, Snowy Hydro, and the Justice and Equity Centre submitted that the commercial terms of existing inertia contracts are typically not disclosed, and that contracts are tendered infrequently.[114] They noted that this lack of visibility may reduce competitive pressure and limit opportunities for emerging providers, even where their services could deliver inertia at lower cost or with greater flexibility.

Submissions from CS Energy, Akaysha Energy, and Tesla raised concerns about the application of the existing long-term procurement framework.[115] These stakeholders submitted that current processes may not adequately account for the multiservice value of grid-forming batteries and other emerging technologies. They also noted that technical feasibility assessments are not always applied consistently, which may disadvantage technologies that have not yet been widely deployed.

Some stakeholders also proposed specific changes to improve the transparency and contestability of procurement under the current framework. Iberdrola[116] suggested that TNSPs be required to procure an increasing share of inertia from emerging technologies over time, with the aim of reaching 100 per cent by 2050. Their submission suggested this would promote innovation, reduce reliance on legacy synchronous infrastructure, and better align procurement with system transition objectives. Iberdola[117] and ENGIE[118] also proposed shortening contract durations to better reflect the pace of technology development and increasing disclosure of contract parameters to support investment and promote competition.

Across these submissions, stakeholders emphasised the importance of maintaining procurement frameworks that are open, forward-looking, and capable of integrating new technologies. While the specific proposals varied, many stakeholders considered that improvements in how current frameworks are applied, particularly in relation to transparency, accountability, and the treatment of emerging technologies, would support more efficient outcomes over time.

4.5.2 The Commission considers that improvements can be delivered effectively through existing frameworks without rule changes

The Commission has considered stakeholder proposals to introduce new obligations into the NER. These included technology-specific targets for emerging resources, limits on contract durations, and more structured reporting of procurement assessments. While the Commission acknowledges the intent behind these proposals, it considers that the concerns raised can be more effectively addressed through an improved application of the existing regulatory framework, rather than through new prescriptive obligations at this time.

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114 Submissions to the directions paper: Engie, p 2; Justice and Equity Centre, p 5; SnowyHydro, p 3.
115 Submissions to the directions paper: Akaysha, p 3; CS Energy, p 3; Tesla, p 5.
116 Iberdrola submission to Directions Paper: p 2.
117 Ibid., p 3.
118 Ibid., p 3.

The current framework already includes mechanisms designed to support transparent, contestable and efficient procurement. These include the Regulatory Investment Test for Transmission (RIT-T),[119] cost pass-through provisions,[120] and oversight by the AER. These processes require TNSPs to consult with stakeholders, assess credible options on a consistent basis, and publish their decision-making in Project Assessment Draft Reports[121] (PADRs) and Project Assessment Conclusions Reports (PACRs).[122] Where stakeholders consider that these processes have not been followed appropriately, clause 5.16B of the NER provides a formal dispute pathway.

The Commission recognises, however, that the effectiveness of these frameworks depends on how they are applied in practice. In particular, the Commission considers that greater clarity in how TNSPs evaluate and justify procurement decisions could help address the transparency, efficiency and contestability concerns raised in submissions. A refined application would include clearer articulation of:

- how different options, including non-network technologies, are assessed on a like-for-like basis;
- the technical assumptions used to determine feasibility or capability; and
- the rationale for selecting the preferred option based on system security and cost considerations.

The Commission encourages TNSPs to consider how their existing reporting obligations, particularly through PADRs and PACRs, could be used more effectively to explain these judgements.The Commission considers that improvements in the application of existing frameworks can be delivered through clearer documentation and explanation of procurement decisions within TNSPs' existing RIT-T reporting processes. In addition, the AER may consider whether further guidance or clarification of good practice could assist in supporting consistency across TNSP assessments. These steps provide practical pathways for implementing the transparency and contestability improvements identified by stakeholders, without requiring changes to the NER.

The Commission does not propose new obligations for the AER but encourages consideration of how existing oversight functions and guidance can support consistency in assessing TNSP decision-making. Improving the clarity and consistency of how procurement decisions are justified and reported will help build confidence in the efficiency of investment choices and strengthen the link between planning decisions and long-term outcomes for consumers.

This approach allows for meaningful improvements to procurement transparency and stakeholder confidence, without the need for additional regulatory complexity. The Commission considers that better leveraging the tools already available provides a more proportionate and flexible response to stakeholder feedback, particularly given the relatively early stage of inertia procurement and the existence of related reforms to system strength and broader transmission investment processes.

4.5.3 The Commission's approach supports proportionate reform and future readiness

The Commission considers that delivering improvements through existing frameworks is the most proportionate and effective response to stakeholder feedback. This approach aligns with the

119 Clause 5.16 of the NER.
120 Clause 6.6.1 of the NER.
121 Clause 5.16.4 of the NER.
122 Ibid.

assessment framework by promoting transparency, maintaining flexibility, and enabling low-regrets innovation without introducing unnecessary regulatory complexity.

As outlined in Section 4.5.2, clearer application of current procurement process, particularly around documentation, technical assessments, and option evaluation, can address the concerns raised by stakeholders in a practical and low-cost manner. Enhancing how these frameworks are applied also supports regulatory accountability and reinforces the credibility of procurement outcomes.

Importantly, these improvements contribute to longer-term preparedness. By strengthening transparency and consistency now, the sector will be better positioned to implement operational procurement of inertia if and when it becomes justified. The Commission considers this approach to be consistent with efficient reform sequencing: it addresses current challenges while preserving optionality for future system needs. Given that these opportunities for improvements can be progressed now, we do not consider that we would be missing out on benefits or value to consumers by not implementing operational procurement of inertia at this time. The reforms from the recent Improving security frameworks (ISF) rule change will deliver benefits, and should have time to play out before initiating further change.

A Rule making process

A standard rule change request includes the following stages:

- A rule change request is submitted to the Commission by a proponent.
- The Commission initiates the rule change process by publishing a consultation paper and inviting submissions from stakeholders.
- Stakeholders provide feedback through submissions and other engagement with the AEMC project team.
- The Commission considers the issues raised and publishes a draft rule determination and draft rule (if applicable).
- Stakeholders have the opportunity to comment on the draft through a second round of consultation.
- The Commission publishes a final determination and final rule (if applicable), informed by stakeholder input and further analysis.

You can find more information on the rule change process on our website.[123]

A.1 The AEC proposed a rule to establish operational procurement of inertia

The Australian Energy Council (AEC) submitted a rule change request proposing the introduction of an ancillary service spot market for inertia in the NEM. The proposed rule aimed to establish inertia as a standalone market-based service, procured and dispatched in real time, to better support system security and efficiency as the generation mix transitions.

Under the AEC's proposal, a dedicated spot market would be created in which inertia could be offered, priced, and dispatched separately from other services. This market would operate with a common clearing price and a price floor of zero, and would enable AEMO to procure inertia from synchronous generators, including those operating at zero megawatt output, as well as grid-forming inverter-based resources assessed by AEMO as capable of providing inertia-like performance.

The proposed framework would provide real-time price signals to reflect system-wide inertia needs, supporting transparent valuation and enabling more efficient procurement. Inertia would also be co-optimised with existing FCAS markets in the NEM Dispatch Engine (NEMDE), allowing total system costs to be minimised across essential system services.

The AEC argued that the existing framework, which relies on long-term TNSP contracting and uncompensated provision from synchronous generators, may not remain sufficient under evolving system conditions. The proposal was intended to address concerns around inflexibility, lack of transparency, and over-contracted solutions by enabling more dynamic, technology-neutral, and cost-reflective procurement arrangements.

A.2 The process to date

On 2 March 2023, the Commission initiated the rule change request submitted by the Australian Energy Council (AEC) proposing a spot market for inertia. A consultation paper was published to

123 See our website for more information on the rule change process: https://www.aemc.gov.au/our-work/changing-energy-rules

seek stakeholder feedback on the proposal and related issues. Submissions closed on 31 March 2023, with 25 submissions received.

Following this consultation, the Commission prioritised finalising the *Improving System Security Frameworks* (ISF) rule change before progressing further on the operational procurement of inertia. The ISF final determination was published on 28 March 2024. These reforms introduced a NEM-wide minimum inertia requirement, enhanced procurement frameworks, and a framework for Type 2 system security contracts.

Building on the ISF reforms, the Commission published the ERC0339 Directions Paper on 12 December 2024. This paper set out preliminary views on the operational procurement of inertia and sought stakeholder feedback on whether a new mechanism should be implemented now or deferred in favour of improvements to existing frameworks.

The Commission received 20 submissions in response to the Directions Paper. All stakeholder feedback has been considered in developing this draft determination. A summary of key issues raised and the Commission's responses is included in Chapters 3 and 4.

B Regulatory impact analysis

The Commission has undertaken regulatory impact analysis to make its draft determination.

B.1 Our regulatory impact analysis methodology

The Commission has undertaken a comprehensive regulatory impact analysis to inform its draft determination.

Regulatory impact analysis methodology

The Commission considered a range of policy options, including the AEC's proposed rule, a business-as-usual scenario where no rule is made, and a more preferable rule featuring targeted improvements to existing frameworks. These options are detailed in Chapter 2.

The analysis identified affected stakeholders and assessed the costs and benefits associated with each option. The scope of analysis was proportionate to the potential impacts. Quantitative modelling underpinned much of the assessment, drawing primarily on work by HoustonKemp for the Directions Paper, supplemented by the Commission's own scenario analyses on inertia spot market benefits under various plausible future conditions. A summary of the regulatory impact analysis is provided in Table B.1.

Key findings from the analysis

A central factor in the Commission's decision not to implement operational procurement at this time was a revision of key assumptions in HoustonKemp's modelling. The originally conceived base case projected significant benefits from an inertia spot market, based on rising FCAS costs, frequent AEMO directions due to inertia shortfalls, and material benefits from RoCoF constraint relief and contingency size reductions.

The Commission's updated base case, applying more conservative assumptions, found that these benefits were substantially lower. When balanced against the fixed costs of market implementation, the net benefit was negative.

Further, slower-than-expected installation of synchronous condensers—primarily contracted for system strength—would reduce potential spot market benefits, since these condensers are expected to deliver inertia as a by-product of their system strength role.

While recognising the potential long-term value of an inertia spot market, the Commission concludes that there are not material net benefits under current assumptions.

At present, the Commission considers that maintaining existing arrangements, coupled with continuous monitoring and targeted improvements, offers the most prudent path forward for consumers.

Table B.1: Regulatory impact analysis methodology

Assessment criteria	Primary costs Low, medium or high –	Primary benefits Low, medium or high –	Stakeholders affected	Methodology QT = quantitative, QL = qualitative
System security, resilience and reliability	Low	Maintaining a secure and stable system through the transition to higher levels of inverter-based resources (IBR). Monitoring system signals to inform timely reassessment of inertia needs.	TNSPs, AEMO, market participants, all consumers	Quantitative: HoustonKemp analysis for Directions Paper; internal AEMC economic modelling incorporating FCAS cost scenarios and inertia supply timelines. Qualitative: Stakeholder feedback from consultation and Directions Paper submissions.
Emissions reduction from greater integration of grid-forming machines (GFM)	Medium (costs associated with establishing new procurement mechanisms and technology integration)	Lower emissions by supporting replacement of synchronous generation with grid-forming inverter-based resources as primary inertia providers.	All consumers	Qualitative: Assessment of policy reform options and existing arrangements. Stakeholder feedback to Directions Paper.
Principles of market efficiency	Low to medium (monitoring and regulatory oversight costs)	Efficiency benefits from maintaining a framework that supports least-cost procurement decisions while avoiding premature reforms that may not deliver material benefits.	TNSPs, market participants, all consumers	Quantitative: AEMC modelling of spot market benefit scenarios. Qualitative: Stakeholder submissions to Directions Paper.
Innovation and	Low (costs related to	Supports innovation by	TNSPs, market	Qualitative: Review of current framework flexibility and

Assessment criteria	Primary costs Low, medium or high –	Primary benefits Low, medium or high –	Stakeholders affected	Methodology QT = quantitative, QL = qualitative
flexibility	developing and trialling new technologies under existing frameworks)	enabling trial and demonstration of new inertia provision technologies, maintaining flexibility for future reforms.	participants, AEMO, all consumers	stakeholder input.
Implementation considerations	Medium (costs related to establishing and operating inertia spot market and associated processes)	Balanced assessment of implementation complexity, regulatory interactions, and market readiness, ensuring reforms are timely and proportionate.	TNSPs, market participants, AEMO, all consumers	Quantitative and Qualitative: AEMO's response to HoustonKemp modelling and modelling by HoustonKemp itself; stakeholder feedback.

C Legal requirements to make a rule

This appendix sets out the relevant legal requirements under the NEL for the Commission to make a draft rule determination.

C.1 Draft determination

In accordance with section 99 of the NEL, the Commission has made this draft determination to make no rule in relation to the rule proposed by AEC.

The Commission's reasons for making this draft determination are set out in chapters 2-4.

C.2 Commission's considerations

In assessing the rule change request the Commission considered:

- its powers under the NEL to make no rule
- the rule change request
- submissions received during first round consultation and the directions paper process
- the Commission's analysis as to the ways in which the draft rule will or is likely to contribute to the achievement of the NEO
- the application of the draft determination to the Northern Territory

There is no relevant Ministerial Council on Energy (MCE) statement of policy principles for this rule change request.[124]

C.3 Making electricity rules in the Northern Territory

The NER, as amended from time to time, apply in the Northern Territory, subject to modifications set out in regulations made under the Northern Territory legislation adopting the NEL.[125] Under those regulations, only certain parts of the NER have been adopted in the Northern Territory.

The draft determination does not relate to parts of the NER that apply in the Northern Territory. As such, the Commission has not considered Northern Territory application issues.

124 Under s. 33 of the NEL and s. 73 of the NGL the AEMC must have regard to any relevant MCE statement of policy principles in making a rule. The MCE is referenced in the AEMC's governing legislation and is a legally enduring body comprising the Federal, State and Territory Ministers responsible for energy. On 1 July 2011, the MCE was amalgamated with the Ministerial Council on Mineral and Petroleum Resources. In December 2013, it became known as the Council of Australian Government (COAG) Energy Council. In May 2020, the Energy National Cabinet Reform Committee and the Energy Ministers' Meeting were established to replace the former COAG Energy Council.

125 These regulations under the NT Act are the National Electricity (Northern Territory) (National Uniform Legislation) (Modifications) Regulations 2016

D Inertia requirements and regional inertia supply and demand graphs

D.1 The 2024 Inertia Report sets out the binding inertia requirements for each region

AEMO's most recent 2024 Inertia Report applied the new Inertia Requirements Methodology, which now includes the determination of a system-wide inertia level, as well as an inertia sub-network allocation for each mainland NEM region.[126] AEMO has determined the following inertia requirements from 2 December 2024 to 1 December 2034 - see Table D.1 below.

Table D.1: Summary of mainland inertia requirements from 2 December 2024 to 1 December 2034

Region	Inertia sub-network allocation (MWs)	Secure inertia level (MWs)
New South Wales	**9,600**	12,500
Queensland	10,500	**13,700**[A]
Victoria	**11,800**	15,400
South Australia	**4,300**	5,600[B]

Source: Adapted from AEMO, 2024 Inertia Report, Table 1 on p 3.

Note: The amount of inertia that each TNSP must make available by 2 December 2027 is depicted in **bold**, and depends upon whether AEMO considers there is a credible risk of islanding for that region. See clause 5.20B.2 and 5.20B.4 of the NER.

Note: [A] AEMO considers Queensland is likely to island until both QNI Connect is commissioned and a control scheme exists to manage the non-credible loss of QNI and QNI Connect, which is only expected to be completed in 2033 or later. Therefore, Powerlink must ensure that the secure inertia level is available, pursuant to clause 5.20B.4(b) of the NER (in addition to its requirements under 5.20B.4(a1) and (a2) in respect of the inertia sub-network allocation).

Note: [B] AEMO does not consider that South Australia to be sufficiently likely to island following the expected commissioning of Project Energy Connect (PEC) Stage 2 and necessary protection schemes are in place to manage the non-credible loss of either PEC itself or the Heywood interconnector. As PEC Stage 2 is expected to be commissioned before 2 December 2027, ElectraNet must ensure that the inertia sub-network allocation level is available by that date, pursuant to clause 5.20B.4(a1) and (a2) of the NER.

For the purpose of determining an aggregate requirement for Figure 3.4, the sum of the 'binding' requirements (depicted in bold in Table D.1) was used, subject to the following assumptions:

- The aggregate requirement uses the secure inertia level for South Australia, but only until the beginning of 2028, when PEC Stage 2 is expected to be fully operational. Thereafter, the inertia sub-network allocation for South Australia is used.
- The aggregate requirement uses the secure inertia level for Queensland, but only until the beginning of 2036, by which point QNI Connect is expected to be commissioned. Although QNI Connect is expected to be commissioned by June 2033, we have assumed that the credible risk of islanding for Queensland does not change through the 10-year forecast in the 2024 Inertia Report (that is, until 1 December 2034).[127] This is a conservative estimate for when inertia requirements may decrease due to Queensland no longer having a credible risk of islanding, and provides leeway for delays to QNI Connect.

D.2 Regional inertia supply and demand graphs show that inertia shortfalls are not expected in the short- and medium-term

Figure 3.4 provides a summarised aggregate view of expected mainland NEM inertia requirements. However, it is important to recognise that there is no mainland-wide 'minimum inertia requirement' - instead, there are different regional inertia requirements that must be met by

126 See section 3.1.4 for more information on how the ISF rule has modified various aspects of the inertia framework.

127 Powerlink, Preparatory Activities - QNI Connect, p 16.

each applicable TNSP. Therefore, it is more useful to look at the expected inertia supply and demand at a regional level. These have been presented below at Figure D.1, Figure D.2, Figure D.3 and Figure D.4.

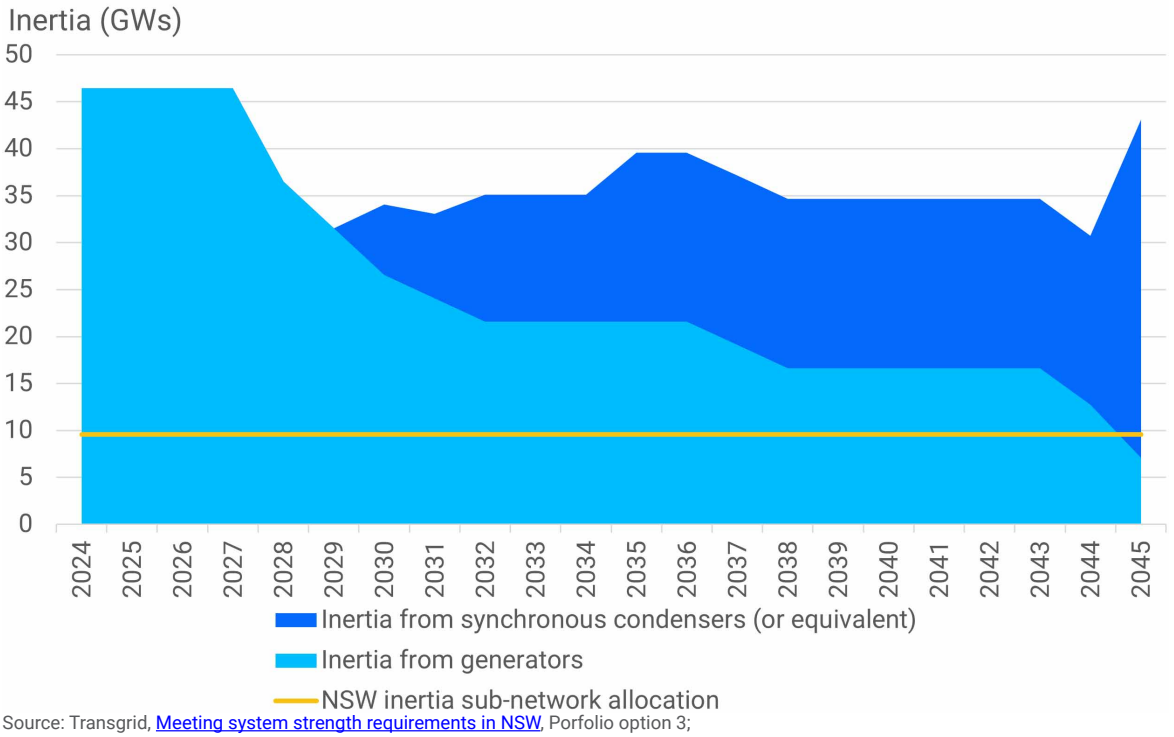
The following assumptions about inertia supply have been made:

- Future synchronous condensers are assumed to deliver about 1500 MWs (see Transgrid PADR, p 31), noting that it is expected that TNSPs will add flywheels to their synchronous condensers when meeting system strength obligations (see section 3.1.3).
- From each TNSP PADR, the portfolio with the least number of synchronous condensers (or synchronous condenser equivalents, such as new clutched gas turbines, which provide comparable amounts of inertia) was selected.
- Any inertia that may be provided from future GFM BESS that may be contracted to meet stable voltage waveform requirements was not included in order to present a more conservative view of future inertia supply.
- If an investment is listed to be commissioned for a particular financial year in each PADR (e.g. for 2027/28), then it was assumed that it would only be delivered in time for the next calendar year (e.g. 2029). That is, we have accounted for any delays that last between 6 and 18 months.
- In each graph, the 'inertia from generators' series was calculated by inspecting the relevant Generic Constraint Right Hand Side Equations used in pre-dispatch, and extracting the amount of inertia that is provided by each generating unit.[128] This means that it includes the inertia from already-installed synchronous condensers, such as the Davenport and Robertstown synchronous condensers in South Australia, or the synchronous condensers supporting the Murra Warra Wind Farm or the Kiamal Solar Farm in Victoria.
- The retirement dates for existing generators were taken from AEMO's 2024 ISP and its Generating Unit Expected Closure Year spreadsheet from April 2025.[129] Where retirement dates conflict, the earliest retirement date was chosen to reflect a 'worst-case' scenario for inertia supply. An exception to this is the closure date for the Osborne Power Station, which is now reasonably expected to close in 2027.

128 The Equation IDs that were referenced are: X-QLD_INERT_PD, X-NSW_INERT_PD, X-VIC_INERT_PD and X-SA_INERT_PD.

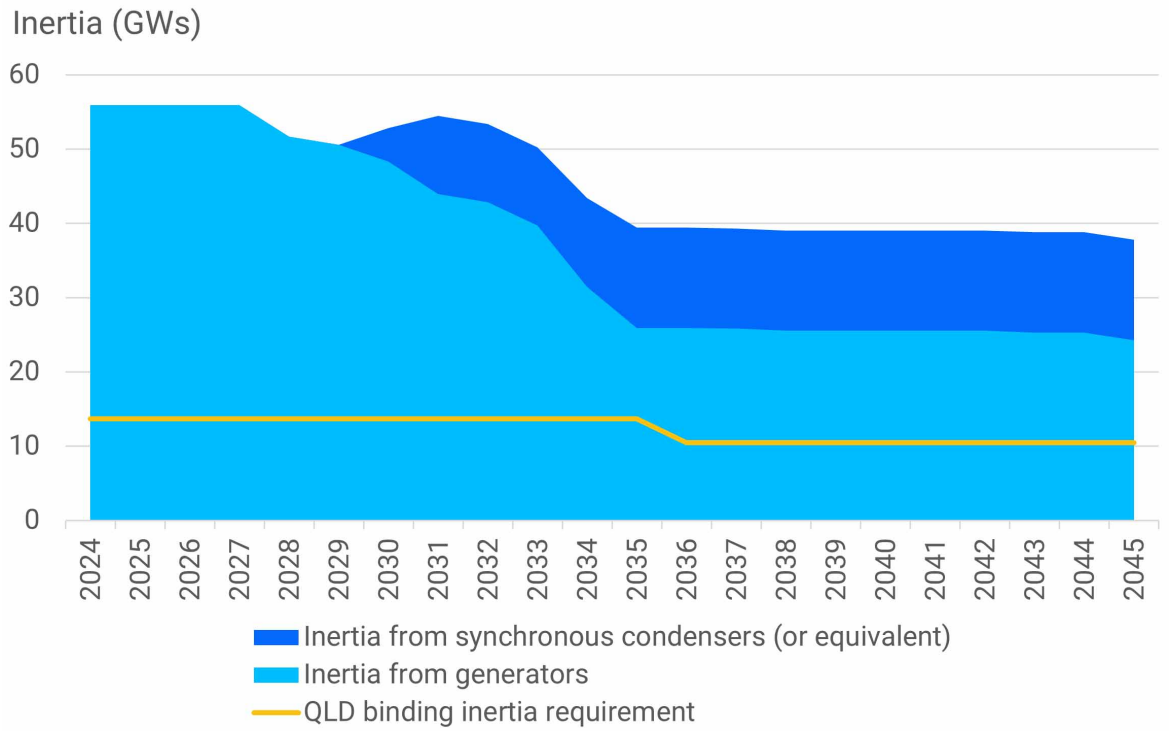
129 See AEMO's generation information page.

Figure D.1: Expected inertia supply in New South Wales



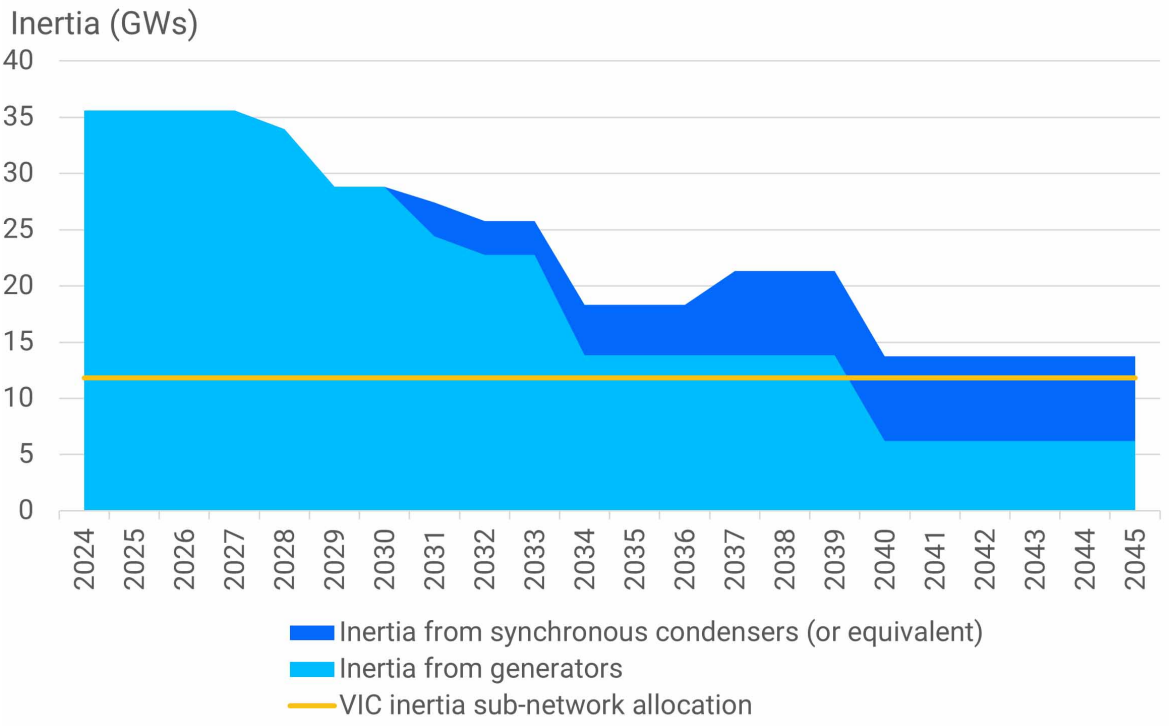
Source: Transgrid, Meeting system strength requirements in NSW, Porfolio option 3;

Figure D.2: Expected inertia supply in Queensland



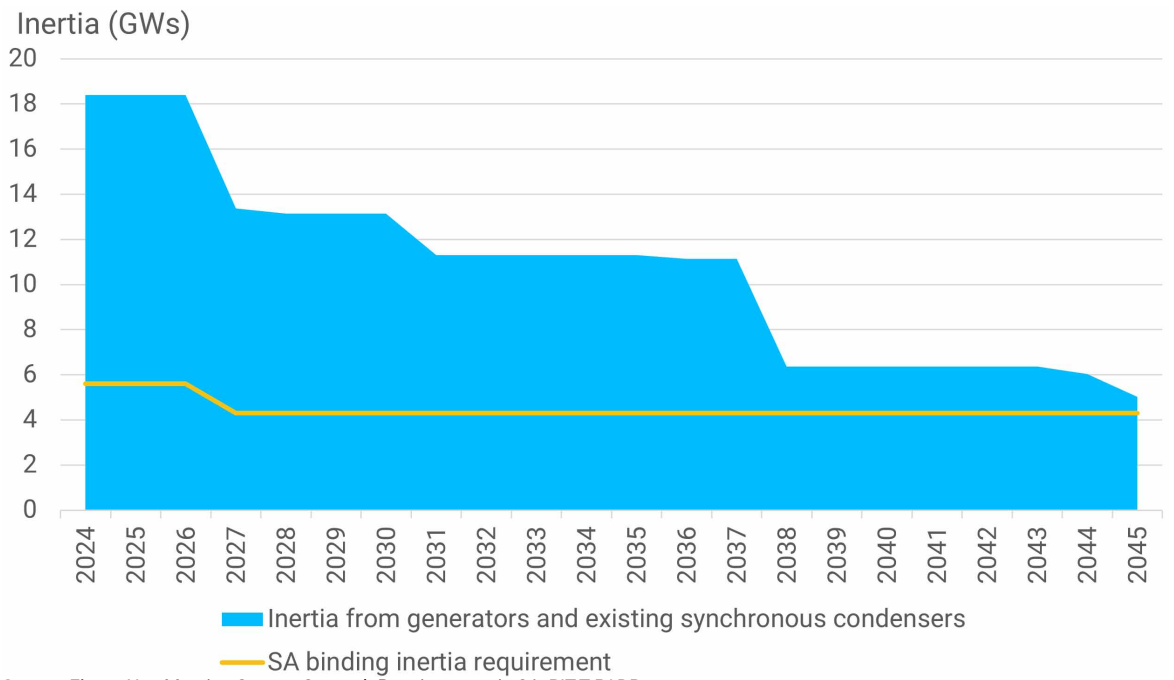
Source: Powerlink, Addressing system strength requirements from Dec 2025, Portfolio 2 and 3

Figure D.3: Expected inertia supply in Victoria



Source: AEMO Victorian Planning, Victorian System Strength Requirement RIT-T PADR, Portfolio 3

Figure D.4: Expected inertia supply in South Australia



Source: ElectraNet, Meeting System Strength Requirements in SA, RIT-T PADR.

Note: ElectraNet does not consider that it will meet its system strength obligations without any new investments. However, it noted that it may consider adding clutches to new synchronous generators in the future, as insurance against having insufficient system strength, if system conditions change. Therefore, the graph above does not show any future synchronous condenser investment or equivalent.

Abbreviations and defined terms

AC	Alternating current
AEC	Australian Energy Council
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
AMPR	Annual Market Performance Review
BESS	Battery Energy Storage System
Commission	See AEMC
DPV	Distributed photovoltaic
ENA	Energy Networks Australia
ENTSO-E	European Network of Transmission System Operators for Electricity
FCAS	Frequency control ancillary service
FFR	Fast frequency response
GFM	Grid-forming
GPSRR	General power system risk review
Hz	Hertz - cycles per second
IBR	Inverter based resource
ISF	Improving security frameworks for the energy transition Rule 2024
MMS	Market Management System
NEL	National Electricity Law
NEM	National Electricity Market
NEMDE	National Electricity Market Dispatch Engine
NEO	National Electricity Objective
NER	National Electricity Rules
NSCAS	Network Support and Control Ancillary Service
NSP	Network Service Provider
PACR	Project Assessment Conclusions Report (in relation to a RIT-T)
PADR	Project Assessment Draft Report (in relation to a RIT-T)
PASA	Projected Assessment of System Adequacy
Proponent	The individual / organisation who submitted the rule change request to the Commission
RASR	Reliability & Security Report
REZ	Renewable Energy Zone
RIT-T	Regulatory investment test for transmission
RoCoF	Rate of change of frequency
TNSP	Transmission Network Service Provider
TPSS	Transition Plan for System Security