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Australian Energy Market Commission

## FINAL REPORT

# NATIONAL ELECTRICITY AMENDMENT (FAST FREQUENCY RESPONSE MARKET ANCILLARY SERVICE) RULE 2021

Infigen Energy

15 JULY 2021

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# DETERMINATION

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## ABOUT THE AEMC

The AEMC reports to the Council of Australian Governments (COAG) through the COAG Energy Council. We have two functions. We make and amend the national electricity, gas and energy retail rules and conduct independent reviews for the COAG Energy Council.

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## SUMMARY

- 1 The Commission has made a final rule, which is a more preferable rule, to introduce two new market ancillary services in the NEM under the existing frequency control ancillary services (FCAS) arrangements, accompanied by additional reporting requirements. The introduction of these services will help keep the future power system secure and foster innovation in faster-responding technologies that will help lower costs for consumers. The new market ancillary services will allow for fast frequency response (FFR) to be procured by the Australian Energy Market Operator (AEMO) in the form of *very fast* services to help control power system frequency following sudden and unplanned generation or power system outages, known as contingency events. The use of these new services is expected to lower the cost of frequency control ancillary services relative to the expected future costs under a continuation of the current market ancillary service arrangements or other alternative arrangements.
- 2 The Commission has made this final rule with respect to a rule change request submitted by Infigen Energy. Infigen proposed that the National Electricity Rules (NER) be amended to introduce new market ancillary service arrangements for the procurement of FFR to help efficiently manage power system frequency following contingency events during low inertia operation. While Infigen's rule change request did not include proposed rule drafting, the final rule is consistent with the proposed solution in the rule change request. The differences between the final rule and Infigen's proposed solution are the naming of the new market ancillary services, the inclusion of implementation arrangements, and the amendment of reporting requirements.
- 3 At lower operating levels of inertia, increased volumes of fast acting frequency control services are required to arrest and stabilise the system frequency within the existing power system operating standards. Under the current market arrangements, AEMO expects that increased quantities of the current fastest service, which operates over a time frame of six seconds, will be required to arrest sudden changes in power system frequency following contingency events under low inertia operating conditions. This could lead to a significant increase in the costs for fast (6 second) FCAS, which could be partially mitigated by the procurement of faster responding services, such as FFR.
- 4 FFR generally refers to the delivery of a rapid active power increase or decrease by generation or load in a time frame of two seconds or less, to correct a supply-demand imbalance and assist in managing power system frequency. This is important as to maintain the power system in a secure operating state and avoid unplanned system or plant outages, power system frequency must be controlled within a narrow range around 50Hz. This is achieved by dynamically balancing electricity generation and consumption under both normal system conditions and in response to sudden larger changes in frequency caused by contingency events.
- 5 FFR services are expected to play a growing role in managing contingency events (an event that affects the power system which would likely involve the failure or sudden and unexpected removal from operational service of a generating unit or transmission element), particularly during periods when there is a lower level of inertia in the power system. Inertia

is an inherent characteristic of large spinning synchronous machines such as coal-fired steam turbines. The level of synchronous inertia in the power system is projected to decline over coming years as the power system transforms. AEMO's integrated system plan projects that the levels of large scale coal- and gas-fired thermal generation will gradually reduce over the coming years and be replaced by inverter connected generation including large scale solar PV, wind power, batteries and behind-the-meter distributed resources like rooftop solar.

- 6 The introduction of FFR services, which operate over much shorter time frames, will provide an alternative source of frequency control thereby reducing the overall costs of managing the frequency of the power system relative to the status quo or other alternative arrangements. These markets will also incentivise technology development and innovation, given that the types of resources that are most likely to provide such services are those inverter-based technologies, such as wind, solar PV, batteries and demand-side resources. The introduction of these new markets will further encourage entry of these types of resources into the market, and so the proposed change will also have flow on effects to reliability and security, beyond that associated with management of frequency control.
- 7 The Commission considers that it is appropriate for FFR to be procured through spot market arrangements. Spot market based provision of essential system services is preferred, where practicable, given it allows for full co-optimisation between services and energy, resulting in more efficient dispatch and pricing of services, driving innovation in the provision of various combinations of essential system services from different technologies. FCAS markets are currently procured through co-optimised spot markets, and so it follows that a very fast FCAS service is procured through this process as well.
- 8 The final rule is broadly the same as the draft rule. The final rule introduces two new market ancillary services into the NER for: the *very fast* raise and the *very fast* lower services, which are to operate more rapidly than the existing *fast* raise and *fast* lower services in response to the locally sensed frequency of the power system in order to arrest a rise and fall in frequency respectively.
- 9 The market arrangements for these new market ancillary services will be the same as those for the existing *fast* raise and *fast* lower services. This includes the arrangements for registration, scheduling, dispatch, pricing, settlement and cost allocation.
- 10 However, the implementation time for the new market ancillary services was brought forward in response to stakeholder submissions which considered that the implementation timeframes outlined in the draft determination were too long. While AEMO has advised that these services are not urgent for system security reasons, the majority of stakeholders reflected that the proposed implementation timeframe was too long. Stakeholders noted the potential reduction in costs and improved investment signals provide impetus to bring timeframes forward. The final rule implementation arrangements include:
- That AEMO revise the market ancillary services specification (MASS) within 18 months of the date that the rule is made (by 19 December 2022), to specify the detailed description and performance parameters for the *very fast* raise service and the *very fast* lower service.

- That the FFR market ancillary service arrangements commence two years and three months from the date that the rule is made (9 October 2023).

- 11 An additional change from the draft rule determination is the amendment of AEMO's quarterly frequency obligations to require information to be provided on the basis on which AEMO procures relative values of different FCAS services, including, where relevant, interactions with the level of inertia in the system. This change was introduced to address stakeholder submissions which raised challenges in understanding how AEMO implements the FCAS arrangements to determine the actions it takes. This additional information should help consumers better understand the benefits of these services which they ultimately pay for, as well as aiding investors in better understanding AEMO's requirements.
- 12 The final rule is consistent with the long-term direction for essential system services as set out in the Energy Security Board's (ESB's) p2025 work. The ESB's p2025 work is to advise on a long-term, fit for purpose market framework to support reliability, modifying the NEM as necessary to meet the needs of future diverse sources of non-dispatchable generation and flexible resources, including demand side response, storage and distributed energy resource participation.
- 13 The essential system services, alongside the scheduling and ahead mechanisms work, is a key part of the ESB's p2025 work. Frequency control is one of the four key services that the ESB is considering through this work and the development of market ancillary service arrangements for faster frequency response are an immediate priority area for reform. This rule change delivers a key part of the ESB's system services work program. Procuring these services through spot markets is consistent with the ESB's spectrum for how essential system services should be procured.
- 14 This rule change has been progressed in parallel to another element of the Commission's frequency control work, AEMO's *Primary frequency response incentive arrangements rule change*. In contrast to the rapid active power response provided by FFR, continuous primary frequency control helps to control power system frequency during normal operation by responding to small frequency variations. The Commission's final rule with respect to Infigen's rule change request does not include any specific provisions or revisions in relation to potential interactions between the provision of FFR and the existing requirement for mandatory PFR.
- 15 AEMO's advice is that affected plant can manage the interaction between provision of FFR and the mandatory PFR obligation through application of variable droop settings, which act to reduce plant sensitivity to small frequency changes while still complying with the mandatory PFR obligation. The Commission will further consider the interaction between the mandatory PFR requirement and the provision of contingency FCAS through its assessment of AEMO's Primary frequency response incentive arrangements rule change request and the related draft determination scheduled for publication by 16 September 2021.

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# 1 INFIGEN ENERGY'S RULE CHANGE REQUEST

## 1.1 The rule change request

On 19 March 2020, Infigen Energy (proponent) made a request to the Australian Energy Market Commission (AEMC or Commission) to make a rule regarding market ancillary services for fast frequency response (rule change request). The rule change request sought to amend the NER to introduce new market ancillary service arrangements for the procurement of fast frequency response (FFR).<sup>1</sup>

Infigen's rule change request identified that the projected decline in system inertia would negatively impact on AEMO's ability to control power system frequency and could result in an increased need for fast frequency control ancillary services (FCAS) that typically respond to frequency variations within a period of six seconds after a contingency event.

Infigen proposed the introduction of new contingency FCAS products that would respond more quickly to changes in power system frequency and better manage frequency variations during reduced inertia operation. Infigen's proposed FFR services would operate in a similar way to existing contingency FCAS, with service provision being based on enablement through the NEM dispatch on a five-minute basis. Infigen proposed an FFR service specification where full active power response is delivered within two seconds, as opposed to the six seconds specification for the existing "fast raise" and "fast lower" services.

The rule change request did not include proposed rule drafting.

## 1.2 Current arrangements

NER clause 3.11 outlines the framework for ancillary services, including AEMO's role and responsibilities. Clause 3.15.6A outlines the rules regarding ancillary service transactions.

The existing FCAS procured by AEMO through the spot market are known as 'market ancillary services'. Market ancillary services are defined under clause 3.11.2(a) as:

- the fast raise service;
- the fast lower service;
- the slow raise service;
- the slow lower service
- the regulating raise service;
- the regulating lower service;
- the delayed raise service; and
- the delayed lower service.

Raise services procure an increase in generation or load shedding to raise frequency in the system back to the normal operating frequency band (NOFB) of 49.85 to 50.15 Hz as defined

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<sup>1</sup> Infigen Energy, Fast frequency response market ancillary service — Electricity rule change proposal, 19 March 2020. Available at <https://www.aemc.gov.au/rule-changes/fast-frequency-response-marketancillary-service>

in the Frequency operating standard.<sup>2</sup> These services are divided into regulation and contingency services. Regulation services are used to correct for frequency deviations in response to minor changes in the balance between generation and load. Contingency services are used to correct for larger frequency deviations in response to a contingency event, such as the loss of a generator or a transmission element. Contingency services are split by the speed of the service with fast (6 second service currently) helping to arrest or contain a deviation in frequency, slow (60 second service) helping to stabilise frequency in the system, and delayed (5 min service) helping the system to recover and return to the NOFB.

### 1.3 Rationale for the rule change request

Infigen considers that inverter-based generating technologies are displacing synchronous thermal generators at certain times of the day and, in some cases, contributing to early retirement of thermal generators.<sup>3</sup> It considers that the cumulative impact of these effects is leading to a steady decline in the amount of inertia that is present on the power system.

This expected reduction in inertia presents operational challenges associated with maintaining a secure power system and controlling system frequency following contingency events. At lower levels of operating inertia, faster and/or more frequency control services are required to stabilise the system frequency following power system disturbances.

Stable frequency is a measure of the instantaneous balance of power supply and demand. To avoid damage to, or failure of, the power system, the frequency may only deviate within a narrow range below or above 50 hertz (Hz). If frequency goes outside the allowed range, additional generating units or load may trip, further exacerbating the supply/demand mismatch and moving frequency further away. The rate of change of frequency (RoCoF) is the speed at which the frequency deviates from 50 Hz following a contingency (an event on the power system). When RoCoF is too high, frequency can move outside of the allowed range before mitigating measures have time to respond.<sup>4</sup>

Broadly, Infigen considers that the reduction in system inertia is impacting the ability of AEMO to control power system frequency and the operation of the NEM in two ways:

- **an increase in the instantaneous rate of change of frequency (RoCoF).** As synchronous inertia in the power system decreases, the RoCoF following contingency events increases.
- **an increased requirement for six second contingency FCAS in the absence of faster responding reserves.** Higher RoCoF increases the need for more and faster

<sup>2</sup> The current version is available at: <https://www.aemc.gov.au/sites/default/files/2020-01/Frequency%20operating%20standard%20-%20effective%201%20January%202020%20-%20TYPO%20corrected%2019DEC2019.PDF>

<sup>3</sup> Infigen Energy Limited, *Fast frequency response market ancillary service — Electricity rule change proposal*, 18 March 2020, p.1-2.

<sup>4</sup> An overview of the principles of frequency control in the power system was included in Appendix A of the fast frequency response market ancillary service draft rule determination. Available at: <https://www.aemc.gov.au/rule-changes/fast-frequency-response-market-ancillary-service>



acting frequency response to meet the requirements of the power system frequency operating standard.

Infigen notes that these changes are occurring in the context of an increase in the variability and unpredictability associated with power system operation. Variability in the operation of wind and solar generators as well as more frequent and intense weather events are leading to new and different modes of network failure, with contingency events more likely and their impacts harder to predict. Therefore, Infigen considers that there is an increasing need to develop arrangements to preemptively address power system risks, and that any arrangements for new system services designed to address these issues should occur via transparent market-based frameworks

## 1.4 Solution proposed in the rule change request

Infigen seeks to resolve the issues discussed above by proposing a rule (proposed rule) to introduce new market ancillary service arrangements for the procurement of FFR raise and FFR lower services. Infigen considers that the introduction of these new FFR services would provide AEMO with more appropriate tools to manage system frequency following contingency events during low inertia operation.<sup>5</sup>

Under Infigen's proposal, FFR providers would respond automatically to any local frequency deviations that occur, and would need to provide their full response within two seconds.

The proposed new FFR service would operate in the same fashion as the existing contingency services. Participants would submit bids to provide the service. AEMO would determine the specifications for the FFR service in the Market Ancillary Services Specification (MASS).<sup>6</sup> The market for provision of FFR services would be open to generation and loads. AEMO would operate the markets similarly to how it operates existing contingency FCAS markets. FFR providers could participate in all FCAS contingency markets (6s, 60s, 5min) and would need to sustain their response for at least six seconds (in time to pass it on to the next 6s contingency FCAS market).<sup>7</sup>

## 1.5 Energy Security Board post-2025 market design interactions

The Energy Security Board (ESB) p2025 work is to advise on a long-term, fit for purpose market framework to support reliability, modifying the NEM as necessary to meet the needs of future diverse sources of non-dispatchable generation and flexible resources, including demand side response, storage and distributed energy resources. System security is a priority for this work as lower marginal cost variable inverter connected generation is displacing dispatchable thermal generation at great speed, making maintaining power system security more difficult. This is being advanced through the work stream on essential system services and scheduling and ahead mechanisms. The ESB's final advice is due in mid 2021.

<sup>5</sup> A contingency event is an event that affects the power system in a way which would likely involve the failure or sudden and unexpected removal from operational service of a generating unit or transmission element.

<sup>6</sup> The market ancillary service specification (MASS) is prepared by AEMO in accordance with clause 3.11.2(b) of the NER. It includes a detailed description of each of the market ancillary services together with relevant performance parameters and requirements.

<sup>7</sup> Infigen Energy Limited, *Fast frequency response market ancillary service — Electricity rule change proposal*, 18 March 2020, p.5.

Frequency control is one of the four key services that the ESB is considering through this work stream. The ESB has identified new markets for fast frequency response as an immediate area of reform to help manage system frequency following contingency events with reducing system inertia. This final rule implements arrangements to address this and complements the thinking and assessment done in the ESB work program, as well as technical input from AEMO through its Renewable Integration Study and subsequent Engineering Framework.

The ESB also identifies the development of enduring primary frequency response (PFR) arrangements as another immediate reform needed to support frequency control during normal operation. The Commission's draft determination on AEMO's *Primary frequency response incentive arrangements* rule change request, which is due to be published in September 2021, will address this reform.

The ESB also acknowledges the close interaction between the development of market arrangements for FFR services and the valuation of inertia provided above the minimum security-critical levels. The NER currently includes an inertia framework that supports the provision of security-critical inertia for each of the NEM regions - where if an inertia shortfall is declared then a TNSP must provide inertia to fill that gap. This can come through installing network equipment or contracting with generators, including for fast frequency response. However, the NER does not currently support the full valuation of inertia above these minimum levels.

The ESB set out in its April 2021 options paper that its long-term direction is to work on a spot market approach for valuing and procuring inertia.<sup>8</sup> In the meantime, the Commission is considering the provision of inertia and related services through the *Synchronous services markets* and *Capacity commitment mechanism* rule change requests.<sup>9</sup>

## 1.6 The rule making process

This section provides an overview of the rule making process for the final rule - *Fast frequency response market ancillary service*.<sup>10</sup>

### **Consultation paper**

On 2 July 2020, the Commission published a consultation paper to commence the rule making process and consultation in respect of this rule change request *Fast frequency response market ancillary service*.<sup>11</sup> This consultation paper also covered six other rule change requests that relate to the provision of system security services in the NEM.<sup>12</sup> The

8 ESB, *Post 2025 market design options - a paper for consultation Part A*, 30 April 2021, p.9. Available at: <https://esb-post2025-market-design.aemc.gov.au/options-paper>

9 A joint policy directions paper for both of these rule change requests will be published in September 2021.

10 *The documents and submissions referenced below are available on the project web page:* <https://www.aemc.gov.au/rule-changes/fast-frequency-response-market-ancillary-service>

11 This notice was published under s.95 of the National Electricity Law (NEL).

12 AEMC, *System services rule changes - consultation paper*, 2 July 2020. Available at: <https://www.aemc.gov.au/rule-changes/fast-frequency-response-market-ancillary-service>

Commission received 43 submissions which were considered in the subsequent Directions Paper and draft rule determination.

### ***Directions paper***

On 17 December 2020, the Commission published a directions paper for both rule change requests that relate to the arrangements for frequency control in the NEM, *Fast frequency response market ancillary service* and *Primary frequency response incentive arrangements*.<sup>13</sup> The directions paper set out the Commission's initial views and high-level policy directions on key issues in relation to the arrangements for fast frequency response and primary frequency response in the NEM. The Commission received 29 submissions which were considered in the draft rule determination.

### ***Draft rule determination***

On 22 April, the Commission published a draft determination and rule. The Commission's draft determination was to make a rule consistent with the solution proposed by Infigen (which did not include rule drafting). The Commission invited submissions from stakeholders on the draft rule determination by 3 June 2021. 35 submissions were received from stakeholders in response to the draft determination. The Commission has made its final determination and rule following consideration of the issues raised in stakeholder submissions. The Commission's consideration of these issues is set out in detail in Chapters 2 and 3.

### ***Technical working group***

The Commission has continued to engage with experts from industry, and consumer groups through the frequency control technical working group, which was formed in October 2019 to discuss issues related to the frequency response rule change requests. In the lead up to the draft determination, technical working group meetings were convened on 8 October 2020 and 4 March 2021. A further technical working group meeting was convened on 21 May 2021 to inform the final determination.

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<sup>13</sup> AEMC, Frequency control rule changes — Directions paper, 17 December 2020. Available at: <https://www.aemc.gov.au/rule-changes/fast-frequency-response-market-ancillary-service>

## 2 FINAL RULE DETERMINATION

### 2.1 The Commission's final rule determination

The Commission's final rule determination is to make a final rule that is a more preferable rule. The final rule is consistent with the solution proposed by Infigen Energy in its rule change request (which did not include a proposed rule), and also contains additional reporting requirements. These reporting requirements provide greater transparency and accountability by helping consumers to better understand the costs they will ultimately bear and providing greater transparency for investors.

The final rule is attached to and published with this final rule determination. The final rule:

- introduces two new market ancillary services into the NER for:
  - the *very fast* raise service
  - the *very fast* lower servicewhich are to operate more rapidly than the existing *fast* raise and *fast* lower services in response to the locally sensed frequency of the power system in order to arrest a rise and fall in frequency respectively;
- provides for recovery of the costs of procuring the *very fast* raise service and *very fast* lower service in a manner consistent with the existing contingency raise and lower services, as set out in clause 3.15.6A(f) and 3.15.6A(g) of the NER respectively
- requires AEMO to revise the Market Ancillary Services Specification (MASS) within 18 months of the date that the rule is made, to specify the detailed description and performance parameters for the *very fast* raise and *very fast* lower services
- requires AEMO to communicate in its quarterly report on power system frequency the basis on which it determined the quantity and type of any market ancillary service or combination of market ancillary services it procured, including, to the extent that is relevant, the relationship between the volume of the market ancillary services procured and the levels of inertia in the power system.

All other market arrangements for registration, scheduling, dispatch, pricing, and settlement for the new market ancillary services are similar to those for the existing fast raise and fast lower services.

The final rule sets out that the FFR market will commence two years and three months from the date that the rule is made in order to allow AEMO to develop a product specification as well as undertake the necessary IT and market design changes in order to meet the product specification.

The Commission's reasons for making this final rule determination are set out in section 2.4.

This chapter outlines:

- the rule making test for changes to the NER
- the assessment framework for considering the rule change request
- a summary of the Commission's reasons for making the final rule.

Further information on the legal requirements for making this final rule determination is set out in appendix C.

## 2.2 Rule making test

### 2.2.1 Achieving the NEO

Under the NEL, the Commission may only make a rule if it is satisfied that the rule will, or is likely to, contribute to the achievement of the national electricity objective (NEO).<sup>14</sup> This is the decision-making framework that the Commission must apply.

The NEO is:<sup>15</sup>

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.

### 2.2.2 Making a more preferable rule

Under section 91A of the NEL, 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 will or is likely to better contribute to the achievement of the NEO. In this instance, the Commission has made a more preferable rule. The Commission considers that the changes made to the rule will better contribute to the achievement of the NEO. The reasons are summarised in section 2.4 and detailed further in section 3.4.

### 2.2.3 Rule making in relation to the Northern Territory

The NER, as amended from time to time, apply in the Northern Territory, subject to derogations set out in regulations made under the Northern Territory legislation adopting the NEL.<sup>16</sup> Under those regulations, only certain parts of the NER have been adopted in the Northern Territory.<sup>17</sup>

As the final rule either relates to parts of the NER that currently do not apply in the Northern Territory, or have no practical application in the Northern Territory, the Commission has not assessed the rule against the additional elements required by the Northern Territory legislation.<sup>18</sup>

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14 Section 88 of the NEL.

15 Section 7 of the NEL.

16 The regulations under the NT Act are the National Electricity (Northern Territory) (National Uniform Legislation) (Modifications) Regulations.

17 The version of the NER that applies in the Northern Territory is available on the AEMC website.

18 From 1 July 2016, the NER, as amended from time to time, apply in the NT, subject to derogations set out in regulations made under the NT legislation adopting the NEL. Under those regulations, only certain parts of the NER have been adopted in the NT. (See the AEMC website for the NER that applies in the NT.) National Electricity (Northern Territory) (National Uniform Legislation) Act 2015.

## 2.3 Assessment framework

In making a final determination with respect to Infigen's rule change request, the Commission has considered the system services objective. This objective was developed and set out in the System services rule changes consultation paper<sup>19</sup> and adapted to incorporate stakeholder feedback. It provides a means to assess the system services rule change requests against the NEO and reflects the trade-offs related to the provision of system services.

### 2.3.1 System services objective

The system services objective seeks to:

Establish arrangements to optimise the reliable, secure and safe provision of energy in the NEM, such that it is provided at efficient cost to consumers over the long-term, where 'efficient cost' implies the arrangements must promote:

- efficient short-run operation of,
  - efficient short-run use of,
  - efficient longer-term investment in,
- generation facilities, load, storage, networks (i.e. the power system) and other system service capability.

In providing further context for the system services objective:

- **Promoting efficient operation** refers to factors associated with the ability of the service design option to achieve an optimal combination of inputs to produce the demanded level of the service, at least cost i.e. for a given level of output, the value of those resources (inputs) for this output are minimised.
- **Promoting efficient use** refers to factors associated with the ability of a service design option to allocate limited resources to deliver a service, or the right combination of services, according to consumer preferences (or system need). This may include allocating resources between the provision of multiple services, to achieve an efficient mix of overall service provision. It may also require consideration of meeting multiple system needs, including security, reliability, and resilience.
- **Promoting efficient investment** refers to factors associated with the ability of the service design option to continue to achieve allocative and productive efficiencies, over time. This means developing flexible market and regulatory frameworks, that can adapt to future changes. This involves the following considerations:
  - a. It is likely that the technologies that *provide* system services, as well as the technologies that drive the *need* for these services, will change significantly over time.
  - b. Technical understanding of these services will also change over time.

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<sup>19</sup> Consultation paper available on the project web page: <https://www.aemc.gov.au/rule-changes/fast-frequency-response-market-ancillary-service>

- c. The robustness of service design options to climate change mitigation and adaptation risks will also contribute to dynamic efficiency over time.

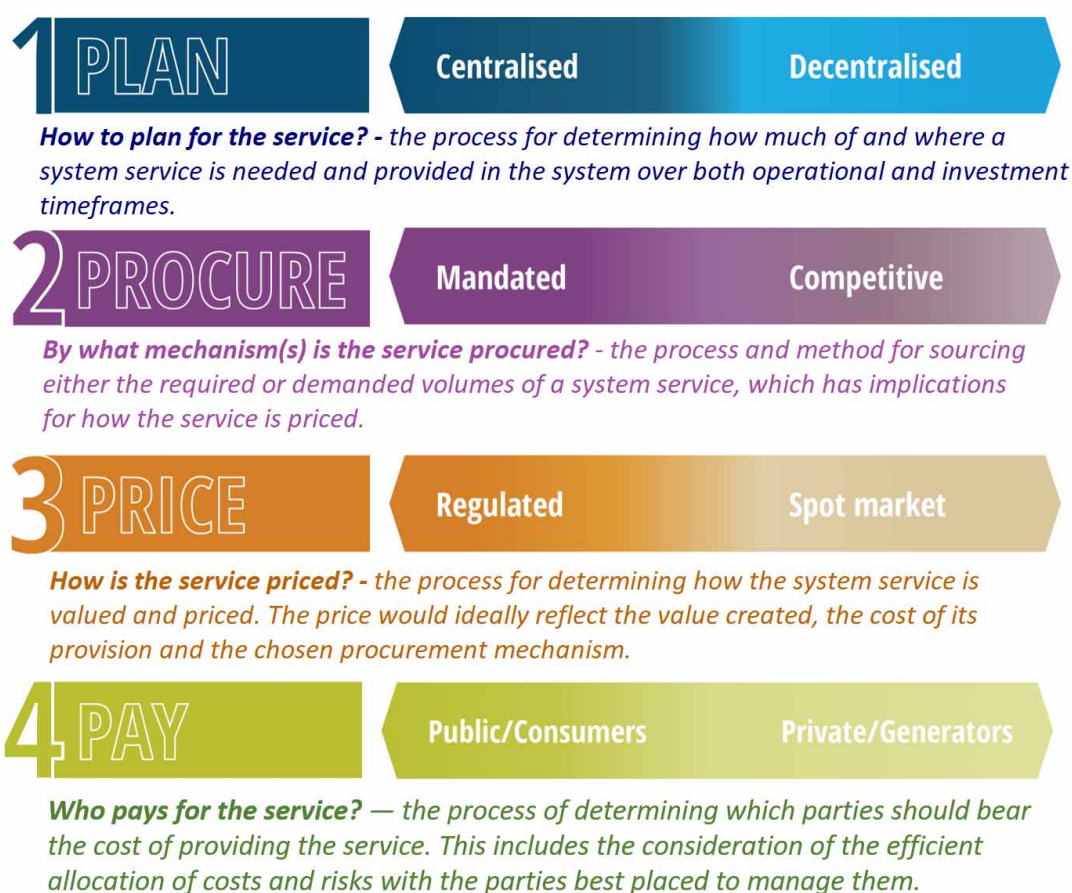
Achieving dynamically efficient outcomes requires flexible regulatory frameworks. The design of these frameworks should show explicit regard for how best to facilitate investment in the operation and use of system services over time, and how allocative and productive efficient outcomes in the short run can be maintained into the future.

### 2.3.2 System service design – Planning procuring, pricing and payment

The system services objective is used to assess service design options developed through the '4Ps' service design framework.

The Commission considers the development of new market and regulatory frameworks based on thinking about how system services can be planned for, procured, priced and paid for. Within these categories, there exist a range of options, which are explored in the Figure 2.1 below:

**Figure 2.1: Planning, Procuring, Pricing and Paying for system services**



Source: AEMC



### 2.3.3

#### Principles for assessment

In assessing the rule change request, the Commission has considered whether the proposal set out in the rule change request is likely to support and improve the security of the power system along with impacts on the effectiveness and efficiency of frequency control frameworks.

The Commission has applied the following principles in its assessment of Infigen's rule change request against the NEO:

- **Promoting power system security and reliability:** The operational security of the power system relates to the maintenance of the system within predefined limits for technical parameters such as voltage and frequency. System security, including frequency, underpins the operation of the energy market and the supply of electricity to consumers. Reliability refers to having sufficient capacity to meet consumer needs. It is therefore necessary to have regard to the potential benefits associated with improvements to system security and reliability brought about by the proposed rule change, weighed against the likely costs.
- **Appropriate risk allocation:** The allocation of risks and the accountability for investment and operational decisions should rest with those parties best placed to manage them. The arrangements that relate to frequency should recognise the technical and economic characteristics and capabilities of different types of market participants to engage with the system services planning, procurement, pricing and payment. Where practical, operational and investment risks should be borne by market participants, such as businesses, who are better able to manage them.
- **Technology neutral:** Regulatory arrangements should be designed to take into account the full range of potential market and network solutions. They should not be targeted at a particular technology, or be designed with a particular set of technologies in mind. Technologies are changing rapidly, and, to the extent possible, a change in technology should not require a change in regulatory arrangements.
- **Flexibility:** Regulatory arrangements must be flexible to changing market and external conditions. They must be able to remain effective in achieving security outcomes over the long-term in a changing market environment. Where practical, regulatory or policy changes should not be implemented to address issues that arise at a specific point in time. Further, NEM-wide solutions should not be put in place to address issues that have arisen and are only likely to arise in a specific jurisdiction. Solutions should be flexible enough to accommodate different circumstances in different jurisdictions. They should be effective in facilitating security outcomes where required, while not imposing undue market or compliance costs.
- **Transparent, predictable and simple:** The market and regulatory arrangements for frequency control should promote transparency and be predictable, so that market participants can make informed and efficient investment and operational decisions. Simple frameworks tend to result in more predictable outcomes and are lower cost to implement, administer and participate in.



## 2.4 Summary of reasons

In assessing whether the proposed rule is likely to meet the NEO, the Commission has balanced the power system needs and related benefits associated with improving system security, resilience and power system frequency control against the cost of delivering those outcomes.

In making its determination, the Commission has taken into account the proponent's views and stakeholder views as well as technical advice provided by AEMO, through its *Renewable integration study* and *subsequent Engineering Framework* and its more recent *FFR implementation options* advice. AEMO's analysis and advice helps to describe the emerging problems related to operating the NEM in the absence of arrangements to provide for FFR. Based on the continuation of current market and regulatory arrangements, the Commission understands that the following impacts will occur to the power system's operation:

- system inertia is expected to continue to decline over the period 2020 through 2035 in accordance with projections from AEMO's 2020 *Integrated system plan* (ISP)
- under reduced inertia operation, the frequency nadir following a contingency event that results in a loss of generation is expected to become increasingly deep, increasing the likelihood of under frequency load shedding
- increased quantities of fast (R6) contingency services will be required to maintain the frequency within the containment bands specified in the frequency operating standard

The Commission notes AEMO's advice that the provision of faster responding frequency reserves can mitigate the requirement for increased fast (R6) reserves. As noted by AEMO in its advice:<sup>20</sup>

Under low inertia conditions, larger volumes of Fast Raise (R6), as well as Fast Lower (L6) will be needed to manage frequency containment for credible events under system intact conditions, recognising that provision of response faster than the R6/L6 requirements will reduce the volumes of R6/L6 required and is likely to provide a more efficient mix of frequency control ancillary services (FCAS)-type products under projected levels of inertia.

The Commission considers that FFR provided through an explicit FFR mechanism would be effective at mitigating the need for increased fast FCAS to manage frequency during low inertia operation, and so in a lower cost way than do nothing and increasing the provision of fast (R6) reserves or other alternative options.

### **More preferable final rule**

The Commission has made a more preferable rule which includes additional reporting requirements on AEMO in its quarterly report on frequency performance. AEMO is required to report on the basis on which it determined the quantity and type of any market ancillary service or combination of market ancillary services procured over the quarter, including, to

<sup>20</sup> AEMO, Fast frequency response implementation options - Technical advice on the development of FFR arrangements in the NEM, April 2021, p.10.

the extent that is relevant, the relationship between the volume of the market ancillary services procured and the level of inertia in the power system. The Commission considers that this change better contributes to the achievement of the NEO than Infigen's proposed solution in its rule change request because it helps provide clearer price signals to promote efficient investment in, operation and use of these market ancillary services to support secure operation of the power system.

It does this by addressing information asymmetry by supporting access to, and understanding of, information for consumers, market participants and stakeholders. As discussed in section 3.4, a number of stakeholder submissions requested greater transparency around how AEMO implements and uses these new markets. Consumers wanted to better understand the costs they will ultimately bear from the use of these services while investors and developers wanted to be able to establish clearer expectations of potential revenues from provision of these services. The Commission considers this reporting requirement to be a proportionate response to stakeholders' concerns.

#### 2.4.1 Economic benefits of FFR provision

As noted above, technical analysis by AEMO indicates that the availability of faster acting frequency control services will help manage system frequency more efficiently in the future during periods of low power system inertia. In order to inform the Commission's considerations, analysis was undertaken to determine the scale of the potential increases in the requirement for fast (R6) raise services in the NEM, based on the projected decline in system inertia and the relationship between inertia and the need for fast raise services. The AEMC analysis indicated the scale of the potential increases in requirement for fast raise services in the NEM under a future where the level of inertia in the power system is decreasing but where there are no new arrangements for provision of FFR.

In the absence of changes to the existing market arrangements, the requirement for R6 services is projected to increase as system inertia declines.<sup>21</sup> AEMO projected that, following implementation of dynamic inertia constraints, the R6 requirement would be expected to rise from the current static level of 655.7MW for a 750MW contingency under low load conditions, to around 1200MW in 2029-30 under the ISP central scenario or by 2024-25 under the ISP step change scenario.<sup>22</sup>

The Commission's analysis showed that in the absence of FFR services the decline in system inertia and doubling of the requirement for fast (R6) services could translate into increased costs for R6 services in the order of \$60 million per annum under the ISP central scenario, based on historical revenues for R6 services.<sup>23</sup> This indicative analysis was based on the relationship between inertia and the dynamic R6 requirement reported in AEMO's Renewable Integration Study - Stage 1. More targeted, granular procurement of FFR services would

<sup>21</sup> AEMO intends to implement a process to establish dynamic inertia dependent contingency FCAS volumes for system intact conditions from Q3/Q4 2021. Refer to AEMO's Frequency control work plan update, March 2021, p.7.

<sup>22</sup> AEMO, *Renewable Integration Study – Stage 1 report - Appendix B: Frequency control*, March 2020, p.21-22.

<sup>23</sup> Further detail can be found in Appendix C of the draft rule determination. It is worth noting the dynamic market impacts such as increased FCAS prices associated with any increased R6 requirement were not accounted for.

result in lower costs compared to the current status quo arrangements of increasing procurement of R6 over time, or other alternative arrangements.

The Commission acknowledges that AEMO currently has the capability to manage system security issues that may arise under low inertia operating conditions through the procurement of greater volumes of fast contingency reserves. Therefore, in the medium term, the provision of FFR is not required as an additional system security measure in order to maintain the security of the system. However, the Commission's analysis suggests that the use of R6 as per the existing MASS, is an inefficient tool to manage frequency during lower inertia operation, resulting in higher costs for consumers in terms of managing the system securely. As a result, the analysis suggests that the cost increase related to the increased requirement for R6 services could be reduced through the optimal dispatch of FFR services, and in future through the co-optimisation of inertia, FFR and R6 services.

The Commission understands that there is significant uncertainty in relation to the projected system inertia levels and the potential impact on requirements for fast raise services. This uncertainty relates to the dynamic nature of the technological transition underway in the power system and the potential impact that changes to the regulatory and market arrangements may have on the projected system characteristics. For example, the implementation of new system services for FFR and inertia is likely to shift the projected increased requirements for R6 services.

This analysis provides a good indication that the implementation of arrangements to integrate FFR into the NEM can help to mitigate projected increased requirements for R6 services over the coming five to ten years in a lower cost way for consumers. In particular, the Commission notes that the ISP step change scenario indicates that the potential benefit offered by FFR services will become increasingly material over the next five years, starting from the commencement of the constraints for dynamic FCAS requirements as flagged by AEMO for action in Q3/Q4 2021.<sup>24</sup>

## 2.4.2

### Spot markets for FFR

The Commission considers that it is appropriate for FFR to be procured through spot market arrangements, consistent with the ESB's spectrum for how essential system services should be procured. Spot market based provision of essential system services is preferred, where practicable, given it allows for full co-optimisation between services and energy, resulting in more efficient dispatch and pricing of services, driving innovation in the provision of various combinations of essential system services from different technologies. FCAS markets are currently procured through co-optimised spot markets, and so it follows that a very fast FCAS service is procured through this process as well.

The ESB noted in its April 2021 paper that spot markets should be used for frequency control services given that:<sup>25</sup>

<sup>24</sup> AEMO, *Frequency control work plan*, 25 September 2020, p.11.

<sup>25</sup> ESB, *Post 2025 market design options - a paper for consultation Part A*, 30 April 2021, p.43. Available at <https://esb-post2025-market-design.aemc.gov.au/options-paper>

- The volume of frequency control services can be readily defined in MW
- There is good scope for competitive provision of frequency control services, with locational issues limited to regional considerations and generally limited market power concerns
- There is significant international experience for spot market procurement of frequency control services
- Frequency control services can be readily co-optimised with energy and other system services, such as operating reserves.

This approach of using spot markets to procure FFR is supported by the majority of stakeholder submissions to the consultation paper, directions paper and draft rule determination.

The market design principles in the NER underpin the existing market and regulatory arrangements in the NEM and also provide a guide to the consideration of changes to the market frameworks, including the development of arrangements for new market ancillary services, such as FFR. The market design principles state that:<sup>26</sup>

...market ancillary services should, to the extent that it is efficient, be acquired through competitive market arrangements and as far as practicable determined on a dynamic basis.

Where arrangements can function competitively through a market, they are more likely to support the economic dispatch of power system resources and help to reduce the long-term costs of power system operation in the long term interests of electricity consumers. Therefore, these arrangements are preferred where the capability is able to be provided through a market — as it is in this case.

The Commission notes the concerns of large energy users, and consumers more generally, in relation to electricity costs, including the concern that the introduction of new market arrangements for FFR may lead to increases in the price for electricity or the uncertainty associated with electricity bills.<sup>27</sup> However, the Commission's analysis, outlined above and as set out further in Appendix C of the draft determination,<sup>28</sup> indicates that the introduction of an FFR service is likely to help mitigate future increases in the costs of frequency control services compared to the status quo or other alternative options, resulting in a secure system provided at lower costs for consumers. This analysis suggests up to \$60 million a year could be saved through reducing use of the fast six second services, compared to AEMO's estimated costs of implementing these markets which were estimated at being up to \$6.5 million (see section 3.1.2 for more information).

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26 NER Clause 3.1.4(6).

27 Submissions to the Consultation paper – System services rule changes: EUAA, pp.2-3.; Brickworks, pp.4-5.; South Australian Chamber of Mines and Energy, p.1-3., as well as the South Australian Chamber of Mines and Energy's submission to the draft rule determination

28 Available at: <https://www.aemc.gov.au/rule-changes/fast-frequency-response-market-ancillary-service>

## 3 ELEMENTS OF THE FINAL RULE

The final rule includes the following key elements:

- the introduction of two **new market ancillary services** for a:
  - very fast raise service
  - very fast lower service
- **market arrangements** for registration, scheduling, dispatch, pricing, settlement and cost allocation for the new market ancillary services that are similar and consistent with those for the existing fast raise and fast lower services.
- **implementation arrangements** for the new market ancillary services including:
  - that AEMO revise the MASS within 18 months of the date that the rule is made, to specify the detailed description and performance parameters for the very fast raise and very fast lower services
  - that the FFR market ancillary service arrangements will commence on a date that is two years and three months from the date that the rule is made
- **reporting arrangements** to require AEMO in its quarterly report on power system frequency, to communicate the basis on which it determined the quantity and type of any market ancillary service or combination of market ancillary services it procured, including, to the extent that is relevant, the relationship between the volume of the market ancillary services procured and the levels of inertia in the power system.

The following sections set out the Commission's considerations in relation to each of these elements of the final rule. These sections focus on how stakeholder submissions to the draft rule determination, as well as additional information and analysis, shaped the final rule determination. Information on how stakeholder submissions were considered earlier in the process is outlined in the Frequency control rule changes directions paper and draft rule determination.<sup>29</sup>

### 3.1 New market ancillary services for FFR

The final rule creates two new categories of market ancillary services in the NEM. These new categories support the establishment of market ancillary service arrangements for procurement of contingency FFR, enabling lower cost outcomes in order to manage system security in the NEM. As is the case for the existing market ancillary services, AEMO will be responsible for determining the detailed service descriptions and specifying the relevant performance parameters in its market ancillary service specification. In the draft rule determination the Commission sought stakeholders' views on potentially renaming the contingency services to reflect the role they play in the frequency control framework.<sup>30</sup>

<sup>29</sup> Both of these documents are available on the project webpage: <https://www.aemc.gov.au/rule-changes/fast-frequency-response-market-ancillary-service>

<sup>30</sup> See page 39 of the draft rule determination for more information.

The new market ancillary services for FFR will operate in a similar way to the existing contingency services, to help AEMO maintain the power system in a secure operating state and manage risks associated with credible contingency events. This is consistent with the problem statement in the rule change request. The Commission recognises that there are other use cases for FFR, including fast regulation and synthetic inertia. Although the specification for these services may differ, including whether their intended use is for normal operating or islanded conditions.

The Commission considers this change to the NER will support the efficient dispatch of energy and market ancillary services in the NEM during low inertia operation. AEMO's *Renewable integration study* demonstrated that, in the absence of faster acting contingency reserves, the requirement for the existing fast raise and fast lower services would need to increase to help manage lower levels of system inertia.<sup>31</sup> The Commission's analysis shows that, in the absence of new arrangements for fast frequency response, the requirement for the existing fast raise service could double by 2025 under the ISP step change scenario or by 2030 under the ISP central scenario. This could lead to a significant increase in the costs for fast FCAS under a do nothing approach. The procurement of very fast market ancillary services would help mitigate this impact and deliver lower overall costs for market ancillary services under the projected future operating conditions, promoting the long-term interests of consumers.

### 3.1.1 Proponent's view

In its rule change request, Infigen proposes the introduction of two new faster responding contingency FCAS markets, FFR raise and FFR lower. Infigen considers that the introduction of these new FFR services would provide AEMO with more appropriate tools to manage system frequency following contingency events during low inertia operation.

Under Infigen's proposal, FFR providers would respond automatically to any local frequency deviations that occur, and would need to provide their full response within two seconds. As is currently the case for the existing market ancillary services, AEMO would determine the detailed service specifications for the FFR services in the MASS.

### 3.1.2 AEMO advice

AEMO provided technical advice and input to the Commission for the draft rule determination. AEMO's *FFR implementation options* advice included an analysis and assessment of a range of market implementation options for FFR, based on the high level policy options outlined by the AEMC in its directions paper. AEMO assessed each of the policy options with respect to system security, operability, implementation, transparency and efficiency criteria. AEMO's advice provided an assessment of the following policy options:<sup>32</sup>

- Baseline: no change to the NER or MASS. Contingency risk during low inertia operation managed through the inertia dependent constraints to determine R6/L6 volumes.

<sup>31</sup> AEMO, *Renewable integration study: Stage 1 report*, March 2020, p.45.

<sup>32</sup> AEMO, *Fast frequency response implementation options - Technical advice on the development of FFR arrangements in the NEM*, April 2021, p.41.

- Option 1: Introducing new market ancillary services to procure FFR FCAS
- Option 2: Reconfiguration of the existing FCAS arrangements to procure FFR
- Option 3: The use of differential pricing enabled through the application of scaling factors that reflect varying levels of performance from individual providers.

AEMO's assessment is that each of the options would be able to support the secure operation of the power system, although it does note that the baseline option may expose the power system to risk of capacity shortfalls for R6 services under very low inertia conditions.<sup>33</sup> AEMO concludes that:<sup>34</sup>

**FFR services should be developed for managing frequency containment under system intact conditions** - In the longer term, inertia dependent R6/L6 will be an indirect and inefficient way to ensure the required speed of frequency response under lower inertia conditions. Introduction of an FCAS-like FFR service would allow the existing speed capability within current FCAS providers to be recognised, and allow new providers to assist in reducing R6/L6 volume requirements.

AEMO notes that the introduction of speed factor parameterisation, or differential pricing (option 3), is not recommended at this time. This approach to implementation of FFR would require significant development for application in the NEM resulting in an increase in the complexity of the market ancillary service arrangements and a longer time frame for implementation. This approach is also expected to provide less transparency around market outcomes compared with the other options.<sup>35</sup>

AEMO's advice is that the baseline option (no change) and option 3 (differential pricing) are not recommended approaches for the future frequency control frameworks in the NEM. AEMO considers that both option 1 and option 2 are viable frequency control reforms. A summary of AEMO's assessment of the FFR implementation options is included in Figure 3.1 and its advice in relation to these options is discussed further below.

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33 Ibid., p.44.

34 Ibid., p.41.

35 Ibid., p.42, 59.



**Figure 3.1: Summary table – AEMO assessment of FFR implementation options**

	System security and operability	Efficiency	Simplicity and transparency	Implementation
<b>Baseline:</b> Inertia dependent R6 FCAS (without an FFR service)	<ul style="list-style-type: none"> <li>✓ Maintain system security of the short and medium term.</li> <li>✗ Very low inertia levels could result in R6 shortfalls.</li> </ul>	<ul style="list-style-type: none"> <li>✗ Inefficient reserve volume: expected to require much greater amounts of R6.</li> <li>✗ Scheduling efficiency should risk size co-optimisation be introduced.</li> </ul>	<ul style="list-style-type: none"> <li>✓ Maintains the existing contingency FCAS markets.</li> </ul>	<ul style="list-style-type: none"> <li>✓ Inertia dependant FCAS for islanding already implimented.</li> <li>✓ Could extend practice for to usual system condition.</li> </ul>
<b>Option 1:</b> New market ancillary services to procure FFR FCAS	<ul style="list-style-type: none"> <li>✓ Can maintain system security, provided the technical requirements for the provision of FFR are managed.</li> <li>✓ Can be scheduled by FCAS constraints.</li> </ul>	<ul style="list-style-type: none"> <li>✓ Recognises the speed of response.</li> <li>✓ Recognises and rewards existing FFR capacity within FCAS market.</li> </ul>	<ul style="list-style-type: none"> <li>✓ Extension to the existing FCAS markets, better understood.</li> </ul>	<ul style="list-style-type: none"> <li>✗ Requires new FCAS markets.</li> <li>✗ New constraints required.</li> <li>✗ Possible changes to MASS for existing services.</li> <li>✗ Cost more than baseline option.</li> </ul>
<b>Option 2:</b> Reconfiguration of the existing FCAS arrangements to procure FFR	<ul style="list-style-type: none"> <li>✓ Can maintain system security, provided the technical requirements for the provision of FFR are managed.</li> <li>✓ Can be scheduled by FCAS constraints.</li> </ul>	<ul style="list-style-type: none"> <li>✓ Recognises the speed of response.</li> <li>✓ Recognises FFR capacity within existing services.</li> <li>✗ Some provision from 6 and 60 sec providers will be affected.</li> </ul>	<ul style="list-style-type: none"> <li>✓ Minimises the number of existing services.</li> </ul>	<ul style="list-style-type: none"> <li>✓ Minimises changes to FCAS market systems.</li> <li>✗ Changes to registration of 6 and 60 sec service required.</li> </ul>
<b>Option 3:</b> Differential FCAS pricing based on scaling factors for faster response	<ul style="list-style-type: none"> <li>✓ Able to maintain system security.</li> <li>✗ <i>Security</i>: may need additional limits or requirement on FFR providers.</li> <li>✗ <i>Operability</i>: scheduling is more complex. May result in less flexibility in the future.</li> </ul>	<ul style="list-style-type: none"> <li>✓ More granular differentiation in response speed.</li> </ul>	<ul style="list-style-type: none"> <li>✓ Allows for fewer contingency services.</li> <li>✗ Market outcomes less transparent.</li> <li>✗ Signals for the required speed may be less clear.</li> </ul>	<ul style="list-style-type: none"> <li>✗ Complex implementation requiring development of new systems.</li> <li>✗ More costly than Option 1 and 2.</li> </ul>

Source: AEMC summary based on AEMO's advice: *Fast frequency response implementation options* — Technical advice on the development of FFR arrangements in the NEM, April 2021, pp.41-60.



### Comparison between option 1 and option 2

AEMO's advice includes a range of illustrative sketches that indicate the potential approaches to the incorporation of FFR services as part of the suite of market ancillary services under option 1 and option 2.<sup>36</sup> These include:<sup>37</sup>

- Option 1 — new FFR services in addition to the existing contingency services. Figure 3.2 provides an illustration of this conceptual suite of contingency raise services.
- Option 2 — introduce FFR by re-specifying the existing contingency services, including:
  - a. Consolidating FFR within the Fast (R6/L6) services, slow and delayed services remain unchanged.
  - b. Re-specify the fast services to be FFR, combining the R6/L6 with the R60/L60 under the slow service categories and delayed service remains unchanged.
  - c. Re-specify the fast services to be FFR, slow service remains unchanged and R60/L60 is combined with R5/L5 as the delayed service

AEMO advises that the consolidation of FFR and R6/L6 (option 2a) and the consolidation of R60/L60 and R5/L5 (option 2c) are not recommended as in each case the service characteristics are not compatible. AEMO notes that:<sup>38</sup>

- Option 2a would exclude or restrict the utilisation of plant that can provide a 6-second type response but are not capable of providing a 1-second, FFR type response. Such response is expected to be valuable when there is a higher level of system inertia.
- Option 2c is not advised as the R5/L5 services play a different role by acting to restore system frequency to 50Hz within 5 minutes of a frequency disturbance. This function is typically provided by different plant such as manual load reduction and fast start hydro and gas turbines. AEMO also notes that the dispatch of the delayed service is currently co-optimised with the regulating service, while there are operational similarities between the delayed service and the regulating service, this is not the case for the slow (R60/L60) service which provides an automatic active power response to stabilise system frequency following a disturbance.

Option 1 and option 2b are the preferred examples for how FFR could be incorporated through the development of new market ancillary services or through re-specification of the existing services. Figure 3.2 shows AEMO's conceptual illustration of the contingency raise services including the addition of a new FFR raise service with full service delivery at one second. Figure 3.3 shows AEMO's conceptual illustration of the preferred approach to the reconfiguration of the existing market ancillary services to include FFR as a discrete service and consolidate the R6/L6 with the R60/L60 services under the "slow" service category.

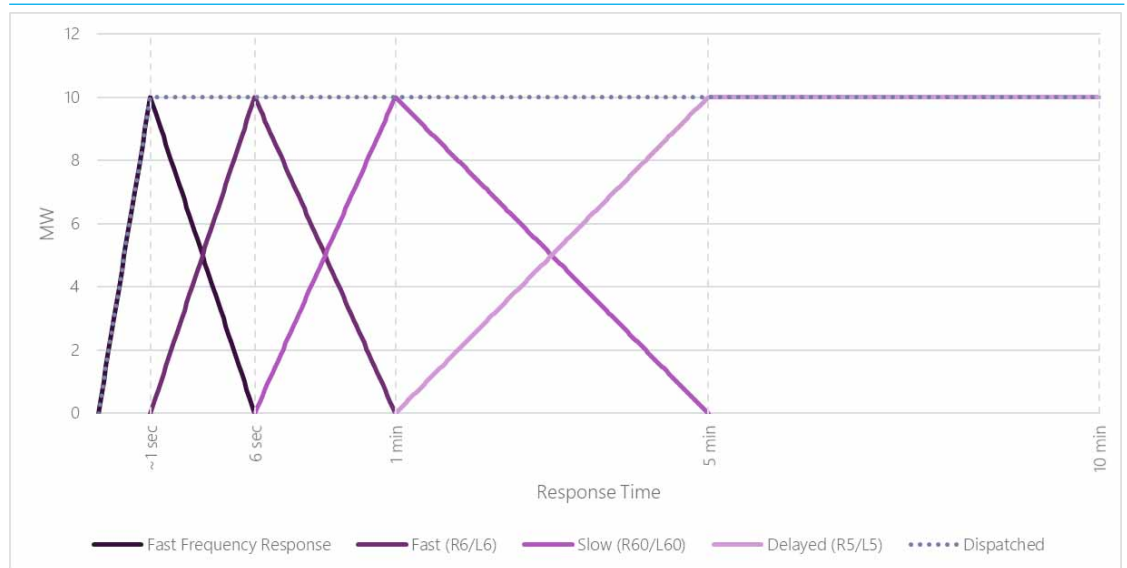
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<sup>36</sup> These specifications are included as concepts for illustrative purposes only, they do not relate to the final rule. Under the NER and the final rule, AEMO is responsible for determining the detailed service descriptions and specifying the relevant performance parameters in its Market ancillary service specification.

<sup>37</sup> AEMO, *Fast frequency response implementation options* - Technical advice on the development of FFR arrangements in the NEM, April 2021, p.45, 47.

<sup>38</sup> Ibid.

**Figure 3.2: Option 1: Contingency raise services with new FFR raise service**



Source: AEMO, Fast frequency response implementation options — Technical advice on the development of FFR arrangements in the NEM, April 2021, p.45.

Note: The service specifications are intended to be illustrative of the policy concept. The detailed service specifications for the market ancillary services are determined by AEMO through consultation on the *Market ancillary service specification*.

**Figure 3.3: Option 2b: Reconfiguration of the contingency raise services to include FFR – consolidation of R6/L6 and R60/L60**



Source: AEMO, Fast frequency response implementation options — Technical advice on the development of FFR arrangements in the NEM, April 2021, p.49.

Note: The service specifications are intended to be illustrative of the policy concept. The detailed service specifications for the market ancillary services are determined by AEMO through consultation on the *Market ancillary service specification*.

### **AEMO's analysis**

In relation to the comparison between Option 1 (new services) and Option 2b (reconfiguration of existing services), AEMO considers that Option 2b is preferable from a market implementation perspective. AEMO identifies the following benefits associated with this option:<sup>39</sup>

- it would minimise changes to AEMO market and settlement systems
- it provides a simpler set of market ancillary services which would reduce administrative costs for AEMO and market participants

At the same time, AEMO noted that there would be material impacts on the registration of FCAS providers under Option 2b. This impact is driven by the need for revision of the service specifications for the fast and slow contingency services which would require service providers to re-register their plant capacity under the revised specifications. AEMO notes that there are also likely to be registration impacts under Option 1 (Figure 3.2), although to a lesser degree and with a lower impact.<sup>40</sup>

AEMO's advice includes further analysis in relation to the potential impacts on the registration outcomes for providers of the fast raise (R6) and slow raise (R60) services that may be combined as shown under Option 2b (Figure 3.3). AEMO's analysis of FCAS registration and enablement indicates that there is not a high level of use of the R6 service to value responses that are not sustained. The use of R60 from providers that are not registered in R6, and the use of R6 from providers that are not registered in R60, is also small.<sup>41</sup>

AEMO also made a submission to the draft rule determination noting that it expects the costs of implementing additional FFR services rather than combining the existing 6 and 60 second services is likely to be higher.<sup>42</sup> AEMO then provided an additional letter stating that it estimates that indicative establishment costs of FFR through implementing additional services to be between \$4 million to \$6.5 million. AEMO went on to note that there may be ongoing operating costs, which will be determined once detailed planning has been undertaken. On the basis of these cost estimates, noting that this is a planning-level estimate and detailed planning is still required, the Commission considers that the cost to implement these services is not excessive.<sup>43</sup>

### **3.1.3**

#### **Stakeholder submissions to the draft rule determination**

Stakeholders, in submissions to the draft rule determination, generally supported the development of market arrangements (AEMO Option 1) to support the provision of FFR in the NEM. The SA Department for Energy and Mining noted that this option may result in longer implementation time frames than "desirable" compared to the alternative option of

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39 Ibid., p.60.

40 Ibid.

41 Further information on AEMO's analysis in relation to the registration impacts associated with consolidation of the R6 and R60 services is available in section 6.8.8 and Appendix A.2 of AEMO's advice, *Fast frequency response implementation options*.

42 AEMO, Submission to the draft determination, 3 June 2021.

43 Letter from AEMO to AEMC, 1 July 2021. This can be found on our website.

reconfiguring existing services.<sup>44</sup> However, most stakeholders shared the Commission's concerns regarding the potential reduction in available capacity for FCAS should the 6 and 60 second services be combined, as well as potentially confusing the different roles these services play.<sup>45</sup> AEC stated that when FCAS markets were introduced in 2001 there was a perception that services could be adjusted or added to, especially to reflect new technology capabilities, and adding new services would be consistent with this.<sup>46</sup> The South Australian Chamber of Mines & Energy accepted the importance of FFR services but suggested that the need be met through placing an obligation to provide these services on generators.<sup>47</sup>

Stakeholders were relatively neutral about the naming of these services. Some stakeholders acknowledged there may be some value in renaming services.<sup>48</sup> CS Energy suggested the naming in the FOS should be used.<sup>49</sup> One stakeholder - Flow Power - suggested other alternative namings to differentiate FFR from the 6 second fast frequency response, such as "fast and furious".<sup>50</sup>

Stakeholders accepted that FFR should be considered separately to inertia, noting that while inertia may inform the level of FFR required, these services should be valued through separate mechanisms, as set out in the ESB post 2025 work.<sup>51</sup> A few stakeholders felt the introduction of these services would contribute to the NEO but noted it shouldn't detract from work to value inertia, and may be better considered in parallel with this work.<sup>52</sup> Conversely, some stakeholders suggested that implementing and understanding the new FFR markets will then help inform the development of inertia services markets.<sup>53</sup>

### 3.1.4 The Commission's conclusions

The Commission has proceeded with the position in the draft rule determination to implement FFR as two new services - very fast raise and very fast lower. The intention of introducing new markets for FFR is to increase AEMO's access to market ancillary services to support secure and efficient operation of the system. Stakeholder submissions to the draft determination reinforced analysis from AEMO and the Commission's own analysis that reconfiguring existing services risks reducing overall capacity available for the provision of FCAS. While the implementation of this option may involve higher costs, it is expected to provide greater capacity to manage the system, including across varying levels of inertia. The Commission also notes that AEMO's cost estimate suggests that the increase in cost is likely

44 SA Department for Energy and Mining, Submission to the draft rule determination, 27 May 2021, p.1

45 For example, Submissions to the draft rule determination: Sonnen p.2, Shell Energy p.2, Energy Australia p.3, AEC p.2, EUAA p.1, Tilt Renewables p.2, HydroTasmania p.1, MEU p.2, Snowy Hydro p.1, AGL p.1, Clean Energy Council p.2, and VIOTAS p.4

46 Submission to the draft rule determination p.1

47 Submission to the draft rule determination p.2.

48 Submissions to the draft rule determination: SA Department for Energy and mining p.3, Iberdrola p.1, and Enel X p.2

49 Page 7 of their submission to the draft rule determination.

50 Submission to the draft rule determination p. 3.

51 Submissions to the draft rule determination: Viotas, p.4, AEC p.2, AGL p.1, Alinta Energy p.1, CS Energy p.3, Delta Electricity p.1, Energy Australia p.3, Snowy Hydro p.2, Tesla p.2, and VIOTAS p.4

52 Submissions to the draft rule determination: AEC p.1, Clean Energy Council p.2, CS Energy p.2, Energy Australia p.2, HydroTasmania p. 3, and Snowy Hydro p.2

53 Submissions to the draft rule determination: MEU p.3 and Fluence p.7

to be incremental (relative to reconfiguring existing services) and therefore should not act as a barrier to introducing FFR as additional services.

In line with AEMO's advice, and consistent with the draft determination, the final rule does not require that inertial response be valued as part of the new market ancillary services for FFR. The Commission recognises that there is a close interaction between the development of market arrangements for FFR services and the valuation of inertia. However, FFR and inertia are different services. Although FFR has the potential to assist with frequency management at lower levels of system inertia, FFR and inertia are delivered via different physical mechanisms, and play roles that are not directly interchangeable. A discussion of the relationship between FFR and inertia is set out more fully in section 5.1 of the draft rule determination.<sup>54</sup>

The Commission notes the feedback from stakeholders that inertia remains a key priority area of reform for them. However, the Commission also notes that there are numerous reforms underway considering inertia. The ESB set out in its April options paper that it has identified a spot market approach for valuing and procuring inertia as a long-term priority, in the first instance relying on the current arrangements for TNSPs to procure minimum levels of inertia along with the potential to use an SSM to procure additional inertia when required.<sup>55</sup> The ESB's final advice is due in mid 2021.

In the meantime, the AEMC is continuing to consult with stakeholders on arrangements for the valuation of essential system services through the assessment of active rule changes requests, including the *Synchronous services markets*<sup>56</sup> and *Capacity commitment mechanism for system security and reliability services*<sup>57</sup> which are considering procurement of system services, such as inertia.

Additionally, AEMO's work into inertia dependent procurement of FCAS due to commence Q3 2021, investigation into a potential system inertia safety net also due to commence Q3 2021, the reform program in the Wholesale Electricity Market (WEM) in Western Australia to value inertia from October 2022, and RoCoF Limits in the future will help improve understanding of the interaction between frequency control and inertia.<sup>58</sup>

## 3.2 Market ancillary service arrangements

This section describes the Commission's consideration of the market ancillary service arrangements for the very fast raise and very fast lower services, including the processes for:

- **registration** of FFR capable plant to participant in the new FFR ancillary service markets

54 AEMC, Fast frequency response ancillary service market - draft determination, 22 April 2021, p. 64.

55 See: <https://esb-post2025-market-design.aemc.gov.au/32572/1619564199-part-a-p2025-march-paper-esb-final-for-publication-30-april-2021.pdf>

56 <https://www.aemc.gov.au/rule-changes/synchronous-services-markets>

57 <https://www.aemc.gov.au/rule-changes/capacity-commitment-mechanism-system-security-and-reliability-services>

58 AEMO's frequency work plan update available at: <https://aemo.com.au/en/energy-systems/electricity/national-electricity-market-nem/system-operations/ancillary-services/frequency-control-work-plan>

- **scheduling & dispatch** which involves the determination of the required quantity of FFR ancillary services to meet system needs and the enablement of individual service providers through the competitive dispatch process
- **pricing & settlement** to determine the market price paid for FFR market ancillary services
- **allocation of costs** associated with the provision of FFR market ancillary services

The Commission notes that some aspects of the market ancillary services framework are the subject of another rule change that is currently underway. The *Integrating energy storage system into the NEM* rule change is investigating potential changes to the NER related to the participation framework and the arrangements for recovery of non-energy costs. This includes aspects of the NER that relate to the registration of plant to provide market ancillary services and the arrangements for the allocation of non-energy costs, including costs associated with the provision of market ancillary services. The Commission plans to publish a draft determination for the *Integrating energy storage system into the NEM* rule change on 15 July 2021.<sup>59</sup>

Implementing FFR services under the existing market ancillary service arrangements provides consistency for stakeholders and should effectively represent an incremental change to processes. Although the Commission acknowledges that in practice this may not be a simple copy and paste of the market design and dispatch arrangements for existing FCAS as there are a number of decisions to be made regarding specifications and interactions with the existing services to be considered. Given the strong stakeholder support, the final rule maintains the use of existing market ancillary service arrangements to introduce FFR services.

### **Stakeholder submissions**

Infigen's proposal is based on the understanding that the market arrangements for the new services would be based on the arrangements for the existing market ancillary services (i.e. FCAS), with the key difference being the specification for the new FFR services to provide faster response.<sup>60</sup>

Most stakeholders, in their submissions to the draft determination, supported using the existing market arrangements for FCAS to introduce the new very fast raise and very fast lower services. This is because these arrangements are already well understood, and therefore provide transparency and consistency for investors and avoid creating barriers to entry.<sup>61</sup> Stakeholders also noted that many of the participants who will provide these services are already providing other FCAS and that this will minimise the impact on them, ensure FCAS are valued and treated equally, and remain consistent with the ESB post 2025 work.<sup>62</sup>

59 More information is available on the project webpage: <https://www.aemc.gov.au/rule-changes/integrating-energy-storage-systems-nem>

60 Infigen Energy, Fast frequency response market ancillary service - electricity rule change proposal, 19 March 2020, p. 4. This view is clarified in its submission to the directions paper: Infigen Energy, submission to the directions paper - frequency control rule changes, 7 February 2021, p.3.

61 Submissions to the draft determination, including: AGL p.2, Alinta Energy p.1, Delta Electricity p.1, Iberdrola p.1, VIOTAS p.4, Tesla p.2, SA Department p.2, Firm Power p.3

62 Submissions to the draft determination, including CS Energy p.6, MEA p.1, Rheem p.2

Stakeholders suggested the clarity and simplicity of this approach should ensure FFR is provided at the lowest cost and that unintended outcomes are avoided<sup>63</sup>

### 3.2.1

#### Registration

Consistent with the draft rule, the final rule maintains that the arrangements for the registration of plant to provide the new very fast raise service and very fast lower service are the same as the existing arrangements for registration of plant capable of providing the existing market ancillary services.

##### **Registration process**

As noted in the draft rule determination, market participants who wish to participate in the FCAS markets must apply to AEMO to have their plant registered as ancillary services generating units or ancillary services loads (ancillary services facilities).<sup>64</sup>

AEMO must approve such an application if it is reasonably satisfied that:

- the generating unit or load is able to be used to provide the market ancillary services referred to in the application in accordance with the market ancillary service specification;<sup>65</sup>
- the market generator, market ancillary service provider or the market customer (as the case may be) has adequate communication and/or telemetry to support the issuing of dispatch instructions and the audit of responses;<sup>66</sup>
- for registration of ancillary service loads only, the market ancillary service provider or the market customer (as the case may be) has an arrangement with the retail customer at the relevant connection point for the supply of market ancillary services.<sup>67</sup>

##### **Measurement and verification of plant capacity**

The Commission considers that AEMO is best placed to determine the detailed service specifications for the market ancillary services, including FFR. As noted in its advice, AEMO recognised the limitations of the standard 4-second frequency ramp and indicated that this aspect of the service specification would be subject to review as part of the development of the specification for any new FFR services. The Commission notes that AEMO is required to consult on changes to the MASS, including the changes required to develop the detailed service specifications for the very fast raise and very fast lower services.

##### **Stakeholder submissions**

A number of stakeholders also explicitly supported the Commission's decision to maintain the existing registration process. They noted that additional changes risk creating significant barriers to entry.<sup>68</sup> Some stakeholders noted that the MASS already provides AEMO with the

63 Submissions to the draft determination, including EnergyAustralia p.3, AEC p.1, EUAA p.1, Reposit P.1, Shell Energy p.2

64 NER clause 2.2.6, clause 2.3.5.

65 NER clause 2.2.6., clause 2.3.5

66 NER clause 2.2.6., clause 2.3.5

67 NER clause 2.3.5.

68 Submissions to the draft determination, including Enel X p.2, EEC p.1 Fluence p.7, VIOTAS p.6, SA Department p.2



opportunity to clearly articulate technical parameters that market participants are responsible for delivering.<sup>69</sup> Flow Power noted that connection agreements also specify technical requirements.<sup>70</sup>

### ***The Commission's analysis and conclusions***

The Commission notes AEMO's concerns in relation the benefits of it undertaking technical studies to inform the registration process for ancillary services facilities, in a similar manner to the Generator registration process.

In order to register generating plant as a generator to participate in the NEM, the NER require that AEMO be satisfied that the generating system complies with the relevant performance standards established through the generator connection process set out in Clause 5.3.4A of the NER.<sup>71</sup> The generator connection process is run by the local network service provider.<sup>72</sup> As part of this process, AEMO may request that an application for connection of a Generator be revised or rejected in relation to an 'AEMO advisory matter' or where the connection is expected to adversely affect power system security.<sup>73</sup>

AEMO's proposed changes to the registration process for FFR capable plant would be expected to lengthen the time taken to assess an application for registration of ancillary services facilities. While a more conservative registration process would provide increased certainty in relation to the dispatchability of registered plant, this would come at the cost of reduced flexibility in relation to integration of available plant capacity in the event that network constraints are relaxed over time, due to network upgrades and operational changes.

The Commission considers that the existing generator connection process provides adequate provisions to manage and mitigate system security risks related to new connections. In addition, AEMO can also manage system security impacts related to the dispatch of plant for provision of energy or market ancillary services through the dispatch process. This includes through the application of network constraints on the dispatch of ancillary service facilities for the provision of FFR.<sup>74</sup>

The Commission does not consider it necessary for the NER to include additional requirements as part of the process for registration of ancillary service facilities in order to introduce a market for FFR. AEMO already has the ability under the NER to set out in the MASS the performance parameters and requirements which must be satisfied in order for a service to qualify as a market ancillary service.<sup>75</sup> This could include a requirement to undertake technical studies.

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69 Submissions to the draft determination, including CS Energy P7, Reposit p.2

70 Submission to the draft determination p..2

71 NER Clause 2.2.1(c)(3)

72 NER clause 5.3.2

73 NER clauses: 4.14(q), 5.3.4A(a) and 5.3.4A(f).

74 NER clause 3.8.10

75 NER clause 3.11.2(b)



In addition, the existing arrangements allow AEMO to undertake technical studies as required to support the security constrained dispatch of the NEM in accordance with AEMO's general power system security responsibilities and the application of network constraints.<sup>76</sup> AEMO may also impose constraints on central dispatch due to the quantity and nature of ancillary services provided or procured by AEMO under the Rules that are required to be managed in conjunction with central dispatch.<sup>77</sup> In addition, for each dispatch interval AEMO must impose constraints upon the dispatch algorithm to determine the quantity of each global market ancillary service requirement and any local market ancillary service requirements.<sup>78</sup>

Transparency around the application of constraints is provided by AEMO through the following process:

- its consultation on, and publication of the network constraint formulation guidelines under clause 3.8.10(c); and
- the requirement on AEMO under cl 3.8.13 to publish the parameters used in the dispatch algorithm for the modelling of certain types of constraints, including ancillary services constraints.<sup>79</sup>

AEMO proposed that the registration process for FFR capable plant include additional steps such that AEMO may reject an application for registration of FFR capable plant if the plant has the potential to have an adverse impact on system security. The final rule does not include any changes to the existing arrangements for the registration of FCAS capable plant as the Commission considers that the existing arrangements allow AEMO to manage system security risks through constrained dispatch and the application of constraints on generator capacity is consistent with the current arrangements for dispatch in the NEM.

Under the final rule, the existing registration process for FCAS capable plant will be extended to include registration of plant for provision of the very fast raise service and the very fast lower service.

As is the current practice, AEMO is responsible for determining the detailed specification for the market ancillary services through its determination of the MASS. In amending the MASS, AEMO must consult with stakeholders in accordance with the Rules consultation procedures.<sup>80</sup> In its advice, AEMO indicated the detailed specification for contingency FFR services would include consideration of the appropriate standard frequency response time for measurement and verification purposes.

The Commission understands that AEMO will also explore a range of questions through its MASS consultations that will be required to introduce the new services, including but not limited to the appropriate response time (e.g. 0.5, 1, or 2 seconds), the frequency ramp to assess registered FFR capacity against, the treatment of Tasmania Vs Mainland NEM, and whether R6 should be revised at the same time or operate with some overlap initially.

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76 NER clause 3.8.10

77 NER clause 3.8.11

78 NER clause 3.8.11(a1)

79 AEMO issue market notices relating to market and operational matters via its website. Refer to <https://aemo.com.au/en/market-notices>

80 NER Clause 3.11.2 (d)

### 3.2.2 Scheduling & dispatch

The final rule also maintains that AEMO is responsible for determining the relevant factors to optimise dispatch. AEMO is responsible for operating central dispatch in order to maximise the value of dispatched load less the cost of energy, market ancillary services and network services. The final rule does not place any new requirements on AEMO in relation to the optimal dispatch of market ancillary services.

Although the Commission notes that AEMO intends to begin work considering inertia dependent procurement of FCAS from Q3 2021.<sup>81</sup>

#### ***Stakeholder submissions***

In its rule change request, Infigen also recognised that there is an interaction between the levels of FFR, primary frequency response and inertia to maintain the power system in a secure operating state. Infigen proposed that the volume of FFR service procured should be calculated based on contingency size with the consideration of system inertia.<sup>82</sup>

#### ***The Commission's analysis and conclusions***

AEMO is required to operate the central dispatch for the NEM to determine the optimal combination of resources based on market bids for provision of energy and market ancillary services, subject to physical constraints.<sup>83</sup> The NER set out a number of elements and variables that this dispatch optimisation should be subject to, including:

- dispatch offers, dispatch bids and market ancillary service offers
- generation and network constraints
- power system security requirements
- intra-regional losses and inter-regional losses;
- current levels of dispatched generation, load and market network services
- the management of any negative settlements residue

However, the NER do not require AEMO to consider the impact of the largest credible risk, nor any other specific interactions between individual market ancillary services, such as relationships between FFR and R6/L6.

The Commission accepts that the economic co-optimisation of different system services, such as energy and FCAS can be a complex process and accepts that the complexity of establishing processes that drive the co-optimisation must be weighed up against the potential benefits offered through improved dispatch efficiency.

However, the Commission notes that AEMO's advice includes modelling results that describe the relationship between inertia and FFR and dynamic R6 volumes. Such a relationship is one possible way that AEMO could determine the co-optimal dispatch of FFR and R6/L6 services

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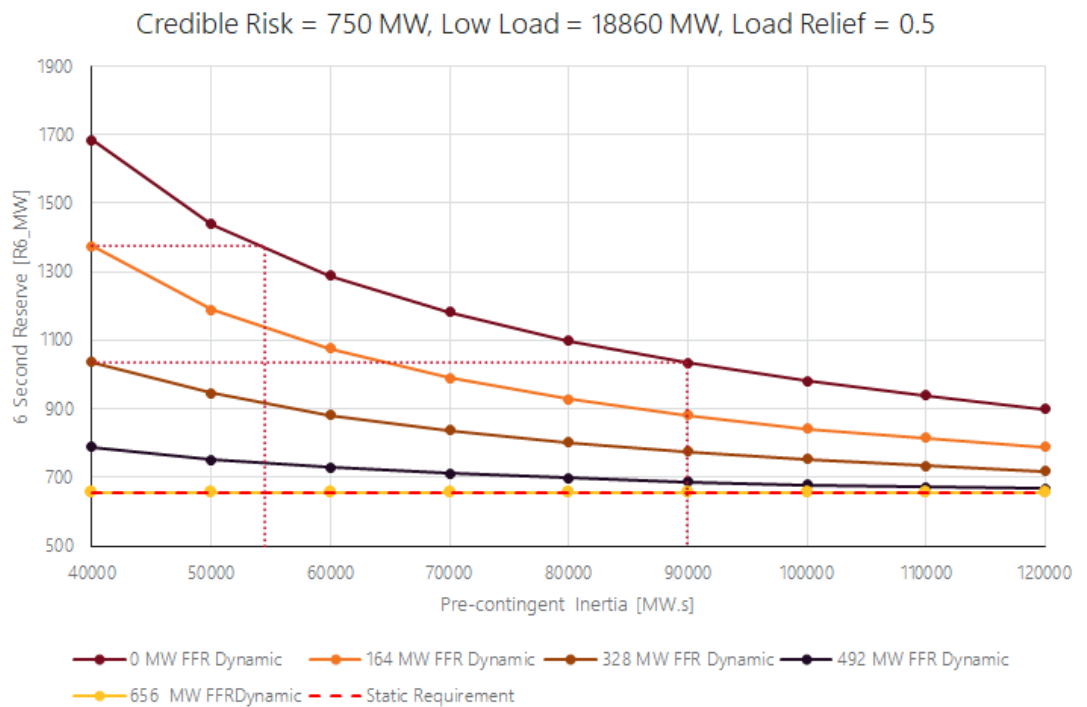
81 This was reinforced through the March 2021 update to the Frequency control work plan available at: <https://aemo.com.au/en/energy-systems/electricity/national-electricity-market-nem/system-operations/ancillary-services/frequency-control-work-plan>

82 Infigen Energy, Fast frequency response market ancillary service - electricity rule change proposal, 19 March 2020, p.5.

83 NER Clause 3.8.1.

but it remains at AEMO's discretion to determine dispatch optimisation. Figure 3.4 below illustrates the potential interactions between these variables.

**Figure 3.4:** Relative impact of inertia and FFR on R6 requirement



Source: AEMO, Fast frequency response implementation options - Technical advice on the development of FFR arrangements in the NEM, April 2021, p.28.

The Commission understands that in addition to MASS consultations to implement FFR, AEMO is also considering how to identify and publish rules for how FFR will be dispatched/procured, including interactions with the six second services. Implementing these dispatch arrangements in new FCAS constraints may require existing FCAS constraints to be re-worked.

### 3.2.3

#### Pricing & Settlement

Under the final rule, the arrangements for the pricing of the new very fast raise service or very fast lower service remain the same as the arrangements for the existing market ancillary services. The existing arrangements allow AEMO to adequately differentiate contingency response profiles to meet power system requirements and deliver efficient market outcomes. The inclusion of the new very fast services would provide AEMO with an additional FCAS segment in order to further refine the dispatch of market ancillary services to meet the power system requirements at an efficient cost.

#### Stakeholder submissions

Some submissions to the draft determination supported the introduction of scaling pricing by speed of response.<sup>84</sup> However, some noted that this is already implicitly occurring through the current FCAS market arrangements and the volumes registered in each service.<sup>85</sup> EnergyAustralia also noted this should be explored through a broader process for all FCAS, rather than just for FFR.<sup>86</sup>

Other broader areas for review proposed by stakeholders include the double-sided causer pays cost-allocation and runaway pricing for contingency FCAS,<sup>87</sup> as well as a review of how the system could be operated in a stable manner beyond specific reviews like the MASS and FOS.<sup>88</sup>

### ***The Commission's analysis and conclusions***

The Commission accepts the feedback provided by stakeholders and advice provided by AEMO that the development of differential pricing arrangements based on spot price multipliers is not a priority area of reform and is not likely to result in improved market outcomes in the NEM at the current time. Such an approach is likely to increase the complexity of the market ancillary service arrangements and reduce the transparency around market outcomes, relative to the current arrangements. Furthermore, the benefits offered by differential pricing arrangements are likely to be muted in the NEM due to the time based segmentation of contingency response across the fast, slow and delayed service categories.

#### **3.2.4**

#### **Allocation of costs**

The existing cost allocation arrangements for contingency raise and lower services provide a basis for the allocation of costs associated with FFR services.

Under the NER, the costs of contingency services are allocated based on a loosely applied causer pays principle. Costs for contingency raise services are recovered from registered generators and costs of lower services are recovered from market customers.<sup>89</sup>

This approach is consistent with the NEM market design principles that state that:<sup>90</sup>

where arrangements require participants to pay a proportion of AEMO costs for ancillary services, charges should where possible be allocated to provide incentives to lower overall costs of the NEM. Costs unable to be reasonably allocated this way should be apportioned as broadly as possible whilst minimising distortions to production, consumption and investment decisions.

The Commission considered that the existing approach provides an incentive for market participants to adjust their plant operation to reduce the overall cost of ancillary services. For example, during high wind periods, the availability of low cost wind generation may drive

84 Submissions to the draft determination, including firm Power p.2 and VIOTAS p.3

85 Submissions to the draft determination including VIOTAS p.3 AEC p.2

86 P.3

87 Flow Power, submission to the draft determination, p.3

88 UNSW submission to the draft determination, p.3

89 NER clause 3.1.4 (f) & clause 3.1.4 (g)

90 NER clause 3.1.4 (a) (8)

synchronous hydro and thermal generators to bid unavailable. This can also cause a reduction in the available capacity for frequency raise services, leading to increased market prices for these services. At these times, the increased cost of FCAS is borne by plant that is generating at that time, which are therefore incentivised to reduce output to reduce their exposure to high FCAS costs. This provides a feedback to improve the efficiency of market outcomes while at the same time avoiding distortions in the allocation of FCAS costs.

Therefore, the Commission considers that it is appropriate that the costs of the very fast raise and very fast lower services are recovered from market participants in this fashion, consistent with the causer pays principles as articulated above.

### ***The Commission's analysis and conclusions***

The Commission recognises that there are opportunities to improve the arrangements for the allocation of costs associated with contingency services, including more sophisticated application of the causer pays principles and potential inclusion of consideration for provision of related power system services, such as inertia. One such potential improvement is the application of the runway pricing approach proposed by Grids.<sup>91</sup> Under the runway pricing approach the costs of contingency services would be allocated based on the degree to which a market participant's plant contributes to the size of the largest credible risk and therefore the overall need for contingency services.

The Commission considers there are still benefits to be achieved through progressing with the introduction of new markets with existing cost recovery arrangements.

There may be benefits to introducing more sophisticated causer pays arrangements for contingency FCAS, but there are also a range of complexities that would need to be worked through. The Commission maintains its position that a reform of this nature that applies to all existing contingency services would be beyond the scope of introducing new markets for the provision of FFR services.

## **3.3 Implementation arrangements**

The draft rule included the following arrangements for the implementation of the new market ancillary services for FFR:

- That AEMO revise the MASS within 18 months of the date that the rule is made (19 December 2022), to specify the detailed description and performance parameters for the very fast raise and very fast lower services.
- That the FFR market ancillary service arrangements commence three years from the date that the rule is made.

The Commission acknowledges stakeholders' concerns in response to the draft rule that these timeframes are excessive. Based on AEMO's advice, the Commission has retained the timeline of 18 months to revise the MASS in the final rule. This is due to the complexity associated with specifying the new services. However, the overall timeframe for implementing the new markets for FFR has been shortened to two years and three months in the final rule.

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<sup>91</sup> Grids Energy, submission to the Directions paper – *Frequency control rule changes*, 4 February 2021, p.2.

The Commission and AEMO have worked together to bring the implementation of the market forward in response to stakeholder comments, balancing the need to engage with stakeholders on detailed matters properly to deliver FFR to the market that delivers outcomes as well as the current reform agenda that is committed over the next 6-12 months together with the emerging reform agenda through the ESB.

### 3.3.1 Proponent's view

Infigen's rule change request did not include specific discussion in relation to implementation or transitional arrangements for FFR market ancillary services. However, its submission to the directions paper clarified its view that:<sup>92</sup>

FFR should be implemented as soon as practical, to ensure that frameworks are in place for when they are needed.

Infigen noted that the procured quantity for FFR services may initially be low or zero depending on AEMO's assessment of power system needs, but that it would be preferable to have FFR market arrangements operational sooner rather than later. Infigen noted that further delays in defining and procuring FFR will place the system at risk of not having the service when it is needed in the future.<sup>93</sup>

### 3.3.2 AEMO advice

As noted in the draft rule determination, AEMO's advice included the following overview of the process for the implementation of new market ancillary service arrangements for FFR as an extension to the existing contingency FCAS framework.<sup>94</sup>

Implementing FFR as an extension to the existing contingency FCAS services may require:

- Development of FCAS constraints to schedule FFR.
- NEMDE changes related to energy/FCAS co-optimisation arrangements.
- Changes to the settlements systems and processes.
- Registration of FFR providers and associated testing and compliance measures.
- Amendment to MASS specification for R6/L6 and potentially changes to existing FCAS registered volumes.

The implementation process will be dependent on the final rule made. As a high-level

<sup>92</sup> Infigen energy, Submission to the directions paper - *Frequency control rule changes*, p.1.

<sup>93</sup> Ibid., p.7.

<sup>94</sup> AEMO, Fast frequency response implementation options — Technical advice on the development of FFR arrangements in the NEM, April 2021, p.46.

<sup>95</sup> Ibid. p.40

estimate, based on previous experience with market system changes, AEMO estimates that the implementation would be in the order of three years. This implementation would include:

- Engineering work on FFR service definition including telemetry and data recording requirements.
- Engineering work on the scheduling arrangements for FFR services, including FCAS constraint development.
- Market system and IT system changes, including NEMDE changes.
- Consultation with industry, including consultation on MASS changes.

AEMO also noted that an important aspect of the implementation process for new FFR services would be the gradual increase of FFR volumes in a similar manner to the recent changes to contingency FCAS requirements due to the revision of the assumed value for load relief. AEMO noted that this approach would allow it to progressively assess FFR introduction and respond if power system or market issues become evident.<sup>95</sup>

In this advice, AEMO also noted that the current impetus for FFR is to enable more efficient management of containment following contingency events, rather than for system stability. With instantaneous RoCoF remaining within 0.5 Hz/s for the NEM during system intact conditions, there is currently no need to manage instantaneous RoCoF to keep it above a minimum level.<sup>96</sup>

### 3.3.3

#### Stakeholder submissions to the draft rule determination

The majority of stakeholders did not support the timelines proposed in the draft rule for implementing the new market ancillary services for FFR. Some stakeholders made general comments on the appropriate length of different processes. This included commentary on the current MASS consultation only taking seven months, a perception that the original FCAS were introduced in six months, and that data on potential impacts and operation exists with some existing providers of six second data responding very fast already.<sup>97</sup> As well as requests that it be brought forward if possible as this should be readily achievable.<sup>98</sup>

Other stakeholders felt there was greater urgency to support market development and/or system security than the timelines indicated noting the inertia shortfalls in South Australia, the recent frequency dip to 48.55 Hz following the Callide event, and the perception that these are low-cost, high reward services.<sup>99</sup> Reposit noted that investors already operate with no very fast FCAS so the risk of AEMO starting with more conservative arrangements (e.g. minimal volumes) and refining these over time (e.g. by changing specifications) should not

<sup>96</sup> Ibid. p.13

<sup>97</sup> Submissions to the draft determination: Ausgrid p.2, Flow Power p.2, Iberdrola Australia p.2, MEU p.3

<sup>98</sup> Submissions to the draft determination: MEU p.3, Neoen p.1, EEC p.1

<sup>99</sup> Submissions to the draft determination: CEIG p.2, EUAA p.2, Iberdrola Australia p.2, Firm Power p.4, Rheem p.4, Sonnen p.2, PIAC p.2

be a barrier to implementation.<sup>100</sup> The SA Department for Energy and Mines proposed the Commission consider earlier introduction in jurisdictions where it is most required.<sup>101</sup>

Alongside the general requests for greater expediency were proposals to introduce very fast frequency response markets within either one, one and a half, or two years.

Those calling for the establishment of the new markets within 12 months of the final determination considered that clear signals to investors will be required to help them develop capacity before it is urgently needed given the speed of the energy transition.<sup>102</sup> Enel X stated it didn't feel AEMO's justification for the longer time period was clear and that with inertia declining quickly, there is a need to get technology prepared before it is critically needed. Enel X suggested that 12 months for implementation would be preferable given that AEMO is replicating existing FCAS market arrangements.<sup>103</sup> Tesla's rationale for 12 months noted that the industry has been talking about FFR since 2017, it's clearly needed as AEMO directed Electranet to procure FFR inertia support, there's already strong support from stakeholder's so it will be a low risk extension of existing FCAS structures, and there are benefits for investment signals in earlier adoption.<sup>104</sup>

The Clean Energy Council asserted concern over the proposed time frame with the cost of managing frequency expected to rise year on year without FFR services and suggested that an 18 month time frame could be possible if the MASS review was undertaken in 9-12 months.<sup>105</sup>

Stakeholders used similar arguments to suggest two years was a more appropriate timeline, such as the framework is well understood, there is a perception that inertia is falling faster and therefore FFR will be needed sooner, a desire to prevent inefficient volumes of 6 second services being procured, and that they don't consider the risk of starting with conservative arrangements to be material.<sup>106</sup>

Conversely, a few stakeholders noted that their understanding was there was no urgency for these FFR services and that there was a risk of poorer outcomes if AEMO did not have sufficient time to test dispatch constraints and service specification.<sup>107</sup> While AEC noted they did not perceive FFR as urgent at this stage, the timeline proposed by AEMO seems generous for "an incremental design".<sup>108</sup>

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100 Page 3 of their submission to the draft determination

101 Page 2 of their submission to the draft determination.

102 Submissions to the draft determination: Enel Green Power p.1, Fluence p.1

103 Pages 1,3, 4, and 5 of their submission to the draft determination

104 Page 3 of their submission to the draft determination

105 Pages 1 and 2 of their submission to the draft determination

106 Submissions to the draft determination: AGL p.2, VIOTAS p.2, TILT page 1 and Shell Energy page 4

107 Submissions to the draft determination, including CS Energy p.2, Energy Australia p.3, and UNSW p.4

108 Submission to the draft determination p.3



### 3.3.4 The Commission's conclusions

There are two components to implementing FFR markets - preparing the service specifications through MASS consultations and implementing these specifications in AEMO's processes and systems to commence the market.

The Commission understands that there are a number of factors driving the need for longer time frames for the MASS consultations. For example, the use of a 2 second maximum time in the Commission's determinations was intended to provide a reference point rather than a definitive specification. The Commission understands AEMO intends to explore the appropriate maximum time. AEMO also intends to consider whether the mainland frequency ramp should remain at 49.5Hz to 50.5Hz for FFR and whether inertia should be subtracted from FFR responses as it is for other FCAS. The Commission also understands that AEMO may explore whether FFR registration, trapeziums, and dispatch could manage MW overload capacity.

Additionally, some of the precedent cited by stakeholder submissions is not necessarily directly comparable. For example, the use of FFR as an inertia support service occurs during islanded conditions but FFR as an FCAS service will be developed for managing frequency containment under system intact conditions. The Commission understands that the speed of response and duration of the inertia support FFR service may vary substantially from the potential specifications for the MASS consultations.

However, while the Commission has maintained 18 months for the revision of the MASS as part of the final rule, it has worked with AEMO to revisit the time frame to implement FFR markets given the benefits identified through the Commission's analysis,<sup>109</sup> the efficiency benefits noted by AEMO in its advice, and stakeholders' desire for clear investment signals. The Commission understands that AEMO may require some time to identify and publish specific provisions in the MASS to determine how FFR will be dispatched and procured, as well as how it may interact with procurement of the fast (6 second) service. Given the expected economic benefits, through collaboration with AEMO staff, the Commission has changed the commencement date for the new FFR markets to 9 October 2023. This is two years and three months from the publication of the final rule.

This brings forward the implementation of the market by nine months. This balances the feedback from stakeholders on the timetable to deliver, with their preference to put this market in place earlier, the need to engage with stakeholders on detailed matters properly to deliver FFR to the market that delivers outcomes, and the current reform agenda that is committed over the next 6-12 months together with the emerging reform agenda through the ESB.

Finally, the Technical Working Group raised the question of whether the Commission could move from a set implementation date to allowing earlier implementation should AEMO be ready earlier. This idea was reiterated in some of the stakeholder submissions to the draft

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<sup>109</sup> As noted in section 2.4.1 the Commission estimates around \$60 million per annum could be prevented by reducing the volume of fast 6 second services through the use of faster frequency response

determination.<sup>110</sup> However, the Commission has determined to make a rule with a fixed commencement date of 9 October 2023 for reasons of clarity and certainty for stakeholders. This clarity and certainty relates not just to potential FFR providers and consumers who will ultimately face the costs, but also to interactions with the broader framework, including the consideration of this framework to inform future Rules.

### 3.4 Reporting arrangements

The draft rule determination did not propose any modifications to AEMO's frequency reporting obligations. However, the Commission decided to revisit this issue after receiving a number of stakeholder submissions requesting greater clarity on how AEMO's framework for procuring FCAS would be applied in practice. The Commission considers it appropriate that AEMO's quarterly reporting obligations are modified to help stakeholders better understand how AEMO decides to undertake the procurement (actions) it does, including both interactions between different market ancillary services and with levels of inertia. This should help alleviate investor and consumer concerns regarding uncertainty of revenues and costs.

In July 2019, the Commission made a final rule to establish ongoing reporting obligations for the AER and AEMO in relation to frequency and frequency control performance. This rule was made in response to rule change requests from AEMO and the AER to action the recommendations made in the AEMC's Frequency control frameworks review final report. These recommendations were made to address a lack of transparency and help inform market participants' investment and operational decisions that impact frequency control, as well as a lack of regular, readily available information for participants.<sup>111</sup> The rule requires AEMO to report statistical data on a weekly basis and accompany this with more qualitative reporting on a quarterly basis.<sup>112</sup>

Since then, AEMO has undertaken further work to better communicate with stakeholders. For example, by voluntarily developing additional reporting around primary frequency control, such as the monthly updates on PFR implementation<sup>113</sup> to complement the required interim primary frequency response requirements and additional commentary in the Quarterly Frequency and Time Error Monitoring report.<sup>114</sup> These enhancements have been received positively by stakeholders. AEMO has also published a frequency control work plan to help communicate plans to update and improve the operational arrangements related to frequency control, such as exploring inertia dependent procurement of FCAS, and how AEMO is prioritising these plans.<sup>115</sup>

Additional relevant reporting by AEMO is outlined in Appendix B.

<sup>110</sup> Submissions to the draft determination: Flow Power p.2, AEC p.3, Neoen p.1, and Shell Energy p.5

<sup>111</sup> Frequency control frameworks review final report Pages 10 - 11 Available at: <https://www.aemc.gov.au/sites/default/files/2018-07/Final%20report.pdf>

<sup>112</sup> NER clause 4.8.16 AEMO reporting on frequency performance

<sup>113</sup> Available on AEMO's dedicated PFR webpage: <https://aemo.com.au/en/initiatives/major-programs/primary-frequency-response>

<sup>114</sup> Available on AEMO's dedicated webpage: <https://aemo.com.au/en/energy-systems/electricity/national-electricity-market-nem/system-operations/ancillary-services/frequency-and-time-deviation-monitoring>

<sup>115</sup> Available at: <https://aemo.com.au/en/energy-systems/electricity/national-electricity-market-nem/system-operations/ancillary-services/frequency-control-work-plan>

### 3.4.1 Proponent's view

Infigen's rule change request did not include specific discussion in relation to reporting obligations for AEMO's operation of FFR market ancillary services. However, Infigen did recognise there will be interactions between different mechanisms available to AEMO, and that this is important for the development of clear price signals and efficient market outcomes.<sup>116</sup>

Understanding the marginal economic benefit of procuring additional FFR compared to imposing constraints on power system operation (reducing Contingency size) or procuring additional inertia (e.g., directing on units or procuring synchronous condensers) is required to provide clear price signals for trading-off each service.

### 3.4.2 Stakeholder submissions to the draft rule determination

A number of stakeholders considered there to be a need to monitor and transparently report on the effectiveness of how the new FFR services are to be used, both in terms of delivering savings for consumers and in terms of system stability.<sup>117</sup> UNSW suggested that there is a need to improve communication of how the efficacy of the services is assessed and how this informs AEMO's use of the services.<sup>118</sup> Iberdrola Australia stated that clarity on requirements will help investors deliver lower costs to consumers.<sup>119</sup>

Firm Power and the South Australian Chamber of Mines & Energy (SACOME) suggested the uncertainty was great enough to require the development of hedging markets. For Firm Power this related to the need to allay investor concerns over interactions with other market redesign initiatives, government intervention, and volatility.<sup>120</sup> For SACOME it was more about helping consumers avoid bill shock from uncertainty regarding how these services are used and the associated cost for consumers.<sup>121</sup>

### 3.4.3 The Commission's conclusions

AEMO's existing reporting (both mandatory and voluntary) provides stakeholders with information on the potential need for FFR, the frameworks under which it will be procured, and dispatched (including constraints). AEMO is also obliged to report the actions it undertakes to manage frequency in the NEM. However, the Commission acknowledges stakeholder uncertainty of how AEMO applies these frameworks to decide which actions, and combination of actions to undertake remains. For example, how the relative volumes of each FCAS service was established and, where relevant, how this was informed by the level of inertia in the system.

Therefore, the Commission considers it appropriate that AEMO's quarterly reporting obligations are modified to help stakeholders better understand how AEMO decides to

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<sup>116</sup> Page 6 of their rule change request

<sup>117</sup> Submissions to the draft determination: ARENA p.3, Delta Electricity P.1

<sup>118</sup> Page 3 of their submission to the draft determination

<sup>119</sup> Page 2 of their submission to the draft determination

<sup>120</sup> Page 3 of their submission to the draft determination

<sup>121</sup> Page 2 of their submission to the draft determination.

undertake the procurement (actions) it does, including both interactions between different market ancillary services and with levels of inertia. This should help alleviate investor and consumer concerns regarding uncertainty of revenues and costs.

## ABBREVIATIONS

ACCC	Australian Competition and Consumer Commission
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
AGC	Automatic Generation Control system
Commission	See AEMC
DER	Distributed Energy Resources
DSCP	Double-Sided Causer Pays
ESB	Energy Security Board
ESS	Essential System Services
FCAS	Frequency Control Ancillary Service(s)
FFR	Fast Frequency Response
FI	Frequency Indicator
FOS	Frequency Operating Standard
IBFFR	Inverter Based Fast Frequency Response
ISP	AEMO's Integrated System Plan
MASS	Market Ancillary Service Specification
MCE	Ministerial Council on Energy
NEL	National Electricity Law
NEM	National Energy Market
NEMDE	National Electricity Market Dispatch Engine
NEO	National Electricity Objective
NERL	National Energy Retail Law
NERO	National Energy Retail Objective
NGL	National Gas Law
NGO	National Gas Objective
NOFB	Normal Operating Frequency Band
PFCB	Primary Frequency Control Band
PFR	Primary Frequency Response
PFRR	Primary Frequency Response Requirements
QNI	Queensland - New South Wales Interconnector
SOLI	Secure Operating Level of Inertia
RoCoF	Rate of Change of Frequency
TNSP	Transmission Network Service Provider
VPP	Virtual Power Plant
VRE	Variable Renewable Energy (generation)
WEM	Wholesale Electricity Market (Western Australia)

## A SUMMARY OF OTHER ISSUES RAISED IN SUBMISSIONS

This appendix sets out the issues raised in submissions to the draft rule determination which are not covered by the final rule and the AEMC's response to each issue. Summaries of stakeholder submissions to the consultation paper and directions paper are covered in the draft rule determination.<sup>122</sup>

**Table A. 1: Summary of other issues raised in submissions**

STAKEHOLDER	ISSUE	AEMC RESPONSE
Alinta Energy	The MASS must be developed to recognise the value of inertial responses within this new service.	The intention of this service is to provide FFR. The level of inertia may inform the volume of FFR procured and FFR can be used to provide inertial support services in islanded conditions. But as noted in section 3.1, inertia and FFR are separate services and are being progressed separately.
ARENA	Draft determination does not link 'runway' pricing to other reform like 'schedule lite', invites the Commission to identify need for further work	Noted. These broader issues are being considered through other processes, such as the ESB Essential System Services work program.
ARENA	The Commission should consider additional reporting of the benefits of FFR which might include greater system hosting capacity for renewables, reduced wholesale prices and GHG emissions, and reduced procurement costs for other contingency services.	The Commission agrees there may be benefit in additional reporting, see section 3.4 for more detail. The AER is also required to report on the market outcomes of frequency control services, which includes wholesale prices and FCAS costs.

<sup>122</sup> Available at: <https://www.aemc.gov.au/rule-changes/fast-frequency-response-market-ancillary-service>

STAKEHOLDER	ISSUE	AEMC RESPONSE
Ausgrid	Regulatory arrangements, such as service classification and ring-fencing arrangements, should not unduly constrain the efficient use of existing network assets in providing FFR services.	This issue relates to the AER remit. The AER is currently reviewing the ring-fencing guideline: <a href="https://www.aer.gov.au/networks-pipelines/ring-fencing">https://www.aer.gov.au/networks-pipelines/ring-fencing</a>
CS Energy	Bring forward the FOS review to develop operational metrics to capture changing system dynamics and the baseline need for FFR, inertia and PFR. Clarifying expectations in the FOS would help transparency on how frequency should be managed within normal frequency operating band. Also it appears AEMO will be implicitly basing FFR procurement volumes on RoCoF, so why not make this explicit and abate concerns of over-procurement at times of higher system inertia.	The Commission agrees there may be benefit in additional reporting, see section 3.4 for more detail. However, it is up to AEMO to determine the specifications for the services it requires through consultation with stakeholders on the MASS. The Commission encourages all interested stakeholders to engage directly with AEMO in its technical needs and assessment of the requirements to ensure system security. AEMO has flagged its intention to pursue inertia dependent procurement of FCAS and will continue to report on this through its Frequency control work plan, which can be found on AEMO's website.
CS Energy	There has been no assessment of whether the existing contingency markets are appropriately defined in the context of FFR and separate services	The Commission has considered the interactions of new FFR services with the existing contingency services, including whether or not FFR could be integrated with the existing 'fast' services through its consideration of matters through this rule change request. Ultimately the specifications of the contingency services are defined by AEMO through the MASS.



STAKEHOLDER	ISSUE	AEMC RESPONSE
Delta electricity	Mandatory PFR is delivering far more frequency response than required by AEMO "acting reasonably" to ensure system security and is outweighing the purpose of procuring slow and delayed contingency FCAS. Most contingency events are now recovering in less than 20 seconds.	These concepts are being explored through the Primary frequency response incentive arrangements rule change process with a draft rule change expected 16 September 2021: <a href="https://www.aemc.gov.au/rule-changes/primary-frequency-response-incentive-arrangements">https://www.aemc.gov.au/rule-changes/primary-frequency-response-incentive-arrangements</a>
Enel Green Power	The draft rule determination seems to have settled on a 2 second response for the FFR markets but suggest 1 second or less be considered.	The rule does not specify the speed of response, merely introduces additional market ancillary services that are faster than the fast service (i.e. very fast). The appropriate speed of response will be determined through AEMO's MASS review on this issue, through which it will consult with stakeholders.
Flow Power	The Commission should explore additional complementary reforms, such as double sided causer pays arrangements for regulation FCAS and runaway pricing for contingency FCAS.	The Primary frequency response incentive arrangements rule change process is considering a range of options including double sided causer pays arrangements.  As discussed in the draft rule determination (p.53) the Commission recognise there may be benefits to more sophisticated arrangements for contingency FCAS but notes this is well beyond the scope of introducing new markets for the provision of FFR services
Hydro Tasmania	The MASS should recognise all FFR capable technologies	The Commission agrees with this, and has used this principle to assess Infigen's rule change

STAKEHOLDER	ISSUE	AEMC RESPONSE
		proposal (see section 2.3.3). The MASS process is focused on services requirements, not technologies, so should remain technology neutral too.
Neoen	PFR is increasing mileage on batteries so may deplete battery FFR capacity before a potential contingency event. PFR should be separately reserved, not have a narrow deadband which interferes with efficient operation and dispatch.	These concepts are being explored through the Primary frequency response incentive arrangements rule change process with a draft rule change expected 16 September 2021: <a href="https://www.aemc.gov.au/rule-changes/primary-frequency-response-incentive-arrangements">https://www.aemc.gov.au/rule-changes/primary-frequency-response-incentive-arrangements</a>
SA Department for Energy & Mining	The Commission should consider whether there is scope to introduce FFR markets in jurisdictions where it is most required from an earlier date.	AEMO already has the capacity to instruct networks to procure inertia support services and has done so in SA to address the identified need during islanded conditions. AEMO notes that the procurement of FFR through new markets will not be a system security requirement in the near term and that the principal outcome will be to reduce the procured volume of the 'fast' service resulting in lower costs for consumers.
South Australian Chamber of Mines & Energy (SACOME)	It would be better to place obligations on generators to provide/procure FFR and just get them to factor the costs into their bid price which will be smoothed evenly across all users in a more predictable manner.	As discussed in section 2.4.2, the Commission considers it is appropriate for FFR to be procured through spot market arrangements, consistent with the ESB's position on procurement of essential system services. This allows for full co-optimisation between services

STAKEHOLDER	ISSUE	AEMC RESPONSE
		and energy resulting in more efficient dispatch and pricing of services, as well as innovation in the provision of combinations of services from different technologies.
Tesla	It is important to ensure procurement arrangements for contingency and regulation FCAS are updates so all act in a complementary manner. Otherwise during coincident high prices and system stress, generators will be operating at capacity and PFR and FCAS will see an insufficient response.	These concepts are being explored through the Primary frequency response incentive arrangements rule change process with a draft rule change expected 16 September 2021: <a href="https://www.aemc.gov.au/rule-changes/primary-frequency-response-incentive-arrangements">https://www.aemc.gov.au/rule-changes/primary-frequency-response-incentive-arrangements</a>
UNSW	Need to think through how FCAS interacts with potential operating reserves, how system services should be prioritised, etc. through an iterative regulatory process driven by operational experience.	The Commission is conscious of these interactions between different essential system services and will have regard to these through its consideration of the system services rule changes, including: Operating reserve market, Synchronous services markets, and Capacity commitment mechanism system security and reliability services rule changes.
South Australian Chamber of Mines & Energy (SACOME)	Markets should be developed to enable consumers to hedge against bill shock from uncertainty around volumes and costs.	Developing financial hedging markets outside the NEM is not a function of the Commission. However, to address the perceived uncertainty regarding this revenue stream we are introducing additional reporting requirements, see section 3.4.
Firm Power	Support the introduction of a hedging and derivative market to provide the necessary price signals for investors. Will also increase the attractiveness of bi-lateral contracts between	

STAKEHOLDER	ISSUE	AEMC RESPONSE
	variable renewable energy and stand-alone battery energy projects.	
Shell Energy	The Commission should recommend that AEMO review delivery requirements for 6 second services, including if power system security could be maintained if it was extended to 8 or 10 seconds and allow more suppliers to participate	It is up to AEMO to determine the specifications for the services it requires through consultation with stakeholders on the MASS. The Commission encourages all interested stakeholders to engage directly with AEMO in its technical needs and assessment of the requirements to ensure system security.
EUAA	Support's Shell's proposal to change the 6 second service to 8 or 10 seconds to increase competition in the provision of the "fast" services which should reduce costs to consumers.	
MEU	AEMO should be required to consider changing the 6 second service to a 12 second service to allow the introduction of new providers.	
VIOTAS	It is important to recognise that different technologies are suited to providing different services and these services must be defined separately to enable the best possible utilisation of all providers. Complementary arrangements to incentivise and reward PFR are important.	These concepts are being explored through the Primary frequency response incentive arrangements rule change process with a draft rule change expected 16 September 2021: <a href="https://www.aemc.gov.au/rule-changes/primary-frequency-response-incentive-arrangements">https://www.aemc.gov.au/rule-changes/primary-frequency-response-incentive-arrangements</a>
VIOTAS	MASS is currently deficient as the time of the event which led to frequency leaving the normal operating frequency band is determined	It is up to AEMO to determine the specifications for the services it requires through consultation with stakeholders on the MASS. The Commission

STAKEHOLDER	ISSUE	AEMC RESPONSE
	retrospectively by AEMO. This should be changed to the time at which local frequency falls below a controller's assigned frequency trigger for Switched Controllers. This change should be required as part of the changes to the MASS to incorporate FFR.	encourages all interested stakeholders to engage directly with AEMO in its technical needs and assessment of the requirements to ensure system security.

## B OTHER RELEVANT AEMO REPORTING

AEMO has a number of resources available to help understand the potential need for and operation of frequency control arrangements. For example, the system strength and inertia reports assess conditions in the NEM over the next 10 years, as well as in each region, to help stakeholders understand the potential need for support services.<sup>123</sup> AEMO will publish regional notifications to advise when they take action to access these services during islanded conditions, e.g. by directing the transmission network system operator in South Australia to procure inertia support services such as FFR.<sup>124</sup> Stakeholders can understand the potential resources available to deal with these needs, as well as supply frequency control services, through AEMO's publication of the constraints informing their dispatch of energy and FCAS<sup>125</sup> and the register of market participant (particularly the Ancillary Services tab)<sup>126</sup>. Market notices<sup>127</sup> and ad-hoc updates on operational changes<sup>128</sup> also help to inform market participants.

More generally, AEMO publishes a range of documents outlining its expectations of how it expects the system to evolve and what that means for the volume and variety of services required to support efficient operation of the system. For example, AEMO reports the expected evolution of the generation mix in the integrated system planning (ISP) documents<sup>129</sup> and accompanied the 2020 ISP document with a renewable integration study (RIS), including a dedicated appendix on frequency control.<sup>130</sup> AEMO has also commenced the development of an Engineering Framework to build on the RIS and identify the future operational requirements of the power system, current work underway to meet these future needs, and areas where additional effort is required to the meet future operational requirements.<sup>131</sup>

As well as outlining its expectations, AEMO publishes the Electricity Statement of Opportunities (ESOO) which includes opportunities to improve frequency control to inform stakeholder's decisions. For example, the 2020 ESOO notes providers could consider the benefits of fast active power response (FAPR) which can help arrest changes in frequency

123 Available at: <https://aemo.com.au/en/energy-systems/electricity/national-electricity-market-nem/nem-forecasting-and-planning/planning-for-operability>

124 For example, AEMO's August 2020 Notice of South Australia inertia requirements shortfall available at: [https://aemo.com.au/-/media/files/electricity/nem/security\\_and\\_reliability/system-security-market-frameworks-review/2020/2020-notice-of-south-australia-inertia-requirements-and-shortfall.pdf?la=en](https://aemo.com.au/-/media/files/electricity/nem/security_and_reliability/system-security-market-frameworks-review/2020/2020-notice-of-south-australia-inertia-requirements-and-shortfall.pdf?la=en)

125 Available at: <https://aemo.com.au/en/energy-systems/electricity/national-electricity-market-nem/system-operations/congestion-information-resource/statistical-reporting-streams>

126 Available at: <https://aemo.com.au/en/energy-systems/electricity/national-electricity-market-nem/participate-in-the-market/registration>

127 For example a factsheet on changes to regulation FCAS quantities. Available at: [https://aemo.com.au/-/media/files/electricity/nem/security\\_and\\_reliability/ancillary\\_services/frequency-and-time-error-reports/regulation-fcas-changes\\_line-update.pdf?la=en](https://aemo.com.au/-/media/files/electricity/nem/security_and_reliability/ancillary_services/frequency-and-time-error-reports/regulation-fcas-changes_line-update.pdf?la=en)

128 For example a factsheet on changes to the assumed level of load relief that informs the procurement volumes of contingency FCAS. Available at: <https://aemo.com.au/en/energy-systems/electricity/national-electricity-market-nem/system-operations/ancillary-services/load-relief>

129 Information on the 2018, 2020 and 2022 ISP plans are available here: <https://aemo.com.au/en/energy-systems/major-publications/integrated-system-plan-isp>

130 Available at: <https://aemo.com.au/en/energy-systems/major-publications/renewable-integration-study-ris>

131 Available at: <https://aemo.com.au/en/initiatives/major-programs/engineering-framework>

following severe disturbances during their design stage and notes this rule change may help this service be procured and rewarded.<sup>132</sup>

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<sup>132</sup> Page 73 available at: <https://aemo.com.au/en/energy-systems/electricity/national-electricity-market-nem/nem-forecasting-and-planning/forecasting-and-reliability/nem-electricity-statement-of-opportunities-esoo>



## C LEGAL REQUIREMENTS UNDER THE NEL

This appendix sets out the relevant legal requirements under the NEL for the AEMC to make this final rule determination.

### C.1 Final rule determination

In accordance with s. 102 and 103 of the NEL the Commission has made this final rule determination in relation to the rule proposed by Infigen Energy Ltd.

The Commission's reasons for making this final rule determination are set out in section 2.4. A copy of the final rule, which is a more preferable rule, is attached to and published with this final rule determination. Its key features are described in chapter 3 and in more detail in chapter 3.

### C.2 Power to make the rule

The Commission is satisfied that the final rule falls within the subject matter about which the Commission may make rules. The final rule falls within s. 34 of the NEL as it relates to the operation of the national electricity market and the operation of the national electricity system for the purposes of the safety, security and reliability of that system.

### C.3 Commission's considerations

In assessing the rule change request the Commission considered:

- its powers under the NEL to make the rule
- the rule change request
- submissions received during first, second and third rounds of consultation
- stakeholder feedback provided through technical working group meetings
- the Commission's analysis as to the ways in which the proposed rule will or is likely to, contribute to the NEO.

There is no relevant Ministerial Council on Energy (MCE) statement of policy principles for this rule change request.<sup>133]</sup>

The Commission may only make a rule that has effect with respect to an adoptive jurisdiction if satisfied that the proposed rule is compatible with the proper performance of Australian Energy Market Operator (AEMO)'s declared network functions.<sup>134</sup> The final rule is compatible with AEMO's declared network functions because it leaves those functions unchanged.

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<sup>133</sup> Under s. 33 of the NEL 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. The amalgamated council is now referred to as the Energy ministers meeting.

<sup>134</sup> Section 91(8) of the NEL.

## C.4 Civil penalties

The Commission cannot create new civil penalty provisions. However, it may recommend to the Energy ministers meeting that new or existing provisions of the NER be classified as civil penalty provisions.

The final rule does not amend any clauses that are currently classified as civil penalty provisions under the NEL or National Electricity (South Australia) Regulations. The Commission does not propose to recommend to the Energy ministers meeting that any of the proposed amendments made by the final rule be classified as civil penalty provisions.

## C.5 Conduct provisions

The Commission cannot create new conduct provisions. However, it may recommend to the Energy ministers meeting that new or existing provisions of the NER be classified as conduct provisions.

The final rule does not amend any rules that are currently classified as conduct provisions under the NEL or National Electricity (South Australia) Regulations. The Commission does not propose to recommend to the Energy ministers meeting that any of the proposed amendments made by the final rule be classified as conduct provisions.