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# Frequency Control Work Plan

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**September 2020**

A work plan of frequency control activities for the  
National Electricity Market

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# Important notice

## PURPOSE

This publication is to summarise and communicate the power system frequency control related work that is being planned and progressed by AEMO.

This publication has been prepared by AEMO using information available at the time of publication. Information made available after this date may have been included in this publication where practical.

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## VERSION CONTROL

Version	Release date	Changes
1.0	25/09/2020	Initial publication

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# 1. Introduction

The frequency control work plan forms a key component of AEMO's ongoing work to prepare and support the changing NEM power system. The development of AEMO's frequency control work plan aims to facilitate effective communication of technical issues, prioritising the most urgent issues, and allowing them to be addressed in a cohesive way across industry.

There has been a substantial amount of work undertaken across industry in relation to frequency control<sup>1</sup> over recent years, not least within AEMO.

As the pace of change within the energy industry increases, there is a greater need for technical engineering advice to inform our understanding of what changes should be pursued and how urgently they are needed.

While AEMO publishes a range of information on frequency control, as shown in Figure 1, there is a need to provide better visibility of AEMO's ongoing program of technical work and priorities as the system and market operator.

The frequency control work plan is needed to provide:

- **Visibility** – Improved communication of AEMO's work packages and priorities for frequency control is needed. This includes a greater understanding of linkages, dependencies and sequencing of engineering activities.
- **Coordination** – There are a number of complimentary initiatives across industry related to frequency control, including the Australian Energy Market Commission (**AEMC**) system services rule changes and the Energy Security Board (**ESB**) post-2025 market design work. AEMO's work plan, which dovetails with the AEMC's frequency work plan<sup>2</sup>, actively supports coordination in order to address issues in a more cohesive way.
- **Prioritisation** – Due to the volume of potential frequency control-related work and reforms there is a need for prioritisation. Some work items are needed to address immediate challenges and may need to take preference over others to allow AEMO, regulatory bodies and the wider industry to address them in the time required. Other work items and changes are dependent on foundational work being carried out as a precursor.

In order to promote active visibility, coordination and prioritisation, tracking and updates of existing and new activities is planned to assist in identifying technical challenges and navigating regulatory reforms.

The release of this plan in September 2020 is to provide immediate visibility on AEMO's current frequency control work to inform current AEMC and ESB processes. The frequency control work plan was a recommendation from the Renewable Integration Study (**RIS**) Stage 1<sup>3</sup>. It forms a core part of AEMO's ongoing work to prepare and support the changing NEM power system.

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<sup>1</sup> For a background on frequency control as a technical power system attribute, see AEMO's power system requirements paper at [https://www.aemo.com.au/-/media/Files/Electricity/NEM/Security\\_and\\_Reliability/Power-system-requirements.pdf](https://www.aemo.com.au/-/media/Files/Electricity/NEM/Security_and_Reliability/Power-system-requirements.pdf).

<sup>2</sup> AEMC, Mandatory primary frequency response, Rule determination, March 2020, available at [https://www.aemc.gov.au/sites/default/files/2020-03/ERC0274%20-%20Mandatory%20PFR%20-%20Final%20Determination\\_PUBLISHED%2026MAR2020.pdf](https://www.aemc.gov.au/sites/default/files/2020-03/ERC0274%20-%20Mandatory%20PFR%20-%20Final%20Determination_PUBLISHED%2026MAR2020.pdf)

<sup>3</sup> AEMO, Renewable Integration Study Stage 1, April 2020, available at <https://www.aemo.com.au/-/media/files/major-publications/ris/2020/renewable-integration-study-stage-1.pdf>

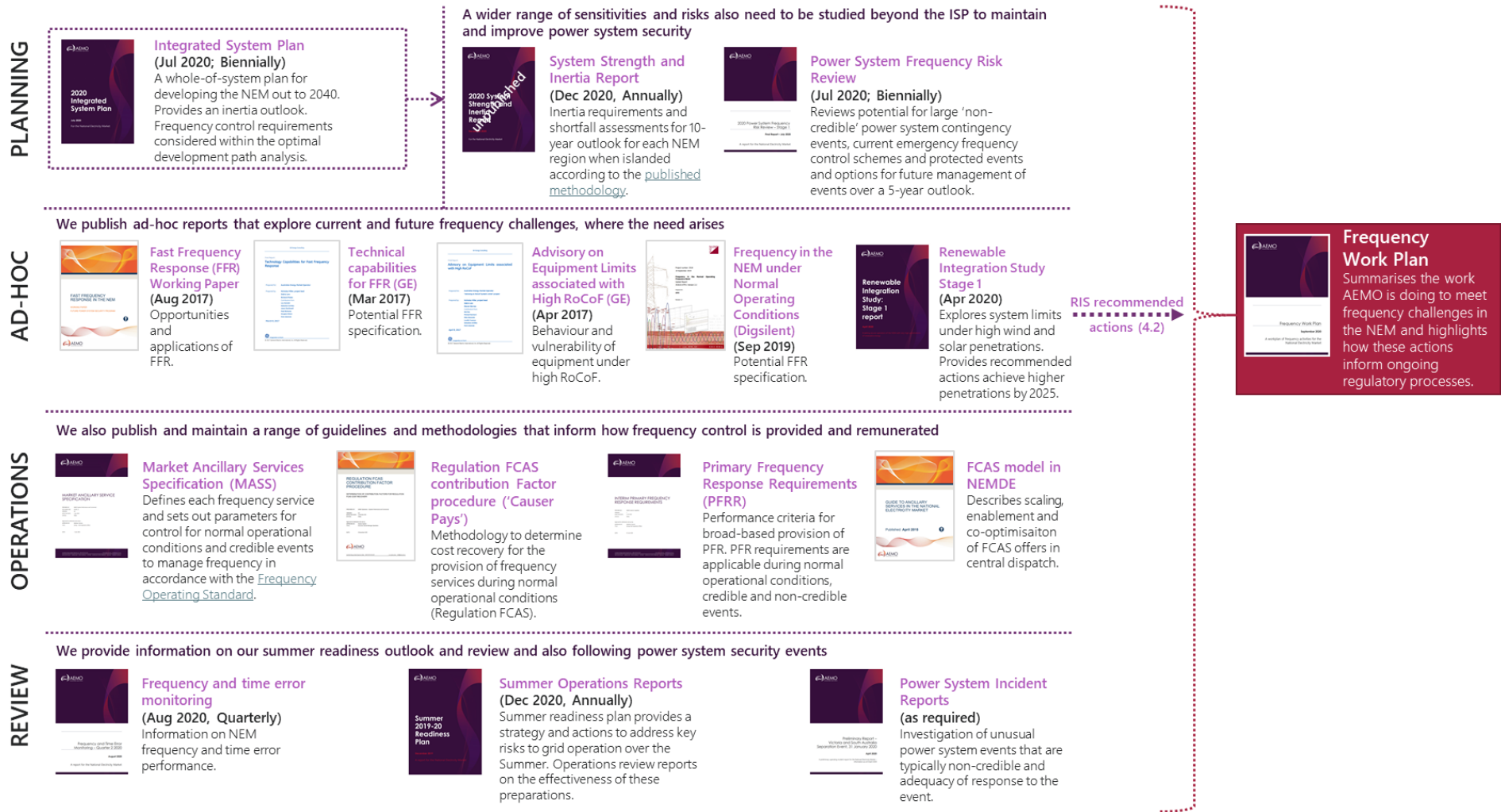
## 1.1 Relation to other AEMO publications

AEMO releases many publications related to frequency control in the NEM, as shown in Figure 1. These publications span planning, operational and review timeframes, as well as a number of ad-hoc publications to address specific areas of investigation.

This frequency control work plan follows recommended action 4.2 in the RIS, which included a commitment to produce a detailed frequency control work plan to provide transparency to stakeholders. It is intended to contextualise and communicate the body of work related to frequency control within AEMO, including how it relates to existing programs and publications.

The findings and recommendations from several of AEMO's publications, below, also provide valuable input to the AEMC's consideration and assessment of the system services rule change requests and the essential system services workstream under the ESB's Post 2025 Electricity Market Design project. Additional detail on how AEMO's frequency control work plan will coordinate with existing market and regulatory processes is outlined in Section 1.2.

Figure 1 AEMO publications related to frequency control



## 1.2 AEMC and ESB linkages

This AEMO frequency control work plan provides further detail on the actions and deliverables that AEMO intends to complete over the coming years. This work plan complements the existing frequency control work plan that was initially released by the AEMC in the Frequency Control Frameworks Review (**FCFR**)<sup>4</sup> and subsequently updated in the AEMC's final determination for the Mandatory Primary Frequency Response (**PFR**) rule change<sup>5</sup>. The immediate term actions from AEMC's frequency control work plan are presented in Appendix 1, along with an update on AEMO's actions. AEMO's work plan aims to provide technical input into the AEMC and ESB processes (in line with Figure 2, below).

The AEMC is currently progressing seven rule change requests that relate to provision of essential system services in the National Electricity Rules (**NER**)<sup>6</sup>.

Current rule changes directly related to frequency:

- AEMO — Primary frequency response incentive arrangements rule change request (ERC0263). In the rule determination the AEMC will resolve the sunset clause on the Mandatory PFR rule.
- Infigen — Fast frequency response rule change (ERC0296)

Rule changes indirectly related to frequency:

- Delta — Capacity commitment mechanism for system security and reliability services (ERC0306)
- Hydro Tasmania — Synchronous services rule change (ERC0290)

On 7 September 2020, the ESB published the post 2025 Market Design consultation paper<sup>7</sup>. This included discussion of key challenges for system security services, such as the fact that the frequency of the power system is now at risk of not meeting the standard and, more importantly, is now showing inadequate response to disturbances that would normally be expected. These discussions leverage the work completed by AEMO in its recent engineering reports such as the RIS. Key elements of the ESB 2025 market design for essential system services related to frequency control are options for procurement of inertia and FFR services. In addition, consideration is given to how the essential system services integrate with the other workstreams such as Resource Adequacy Mechanisms and Scheduling and Ahead Markets.

The AEMC's system services rule changes consultation paper<sup>8</sup> provides a view of how the AEMC, ESB and AEMO work programs fit together, as shown in Figure 2.

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<sup>4</sup> AEMC, Frequency control frameworks review, Final report, 26 July 2018, available at <https://www.aemc.gov.au/sites/default/files/2018-07/Final%20report.pdf>

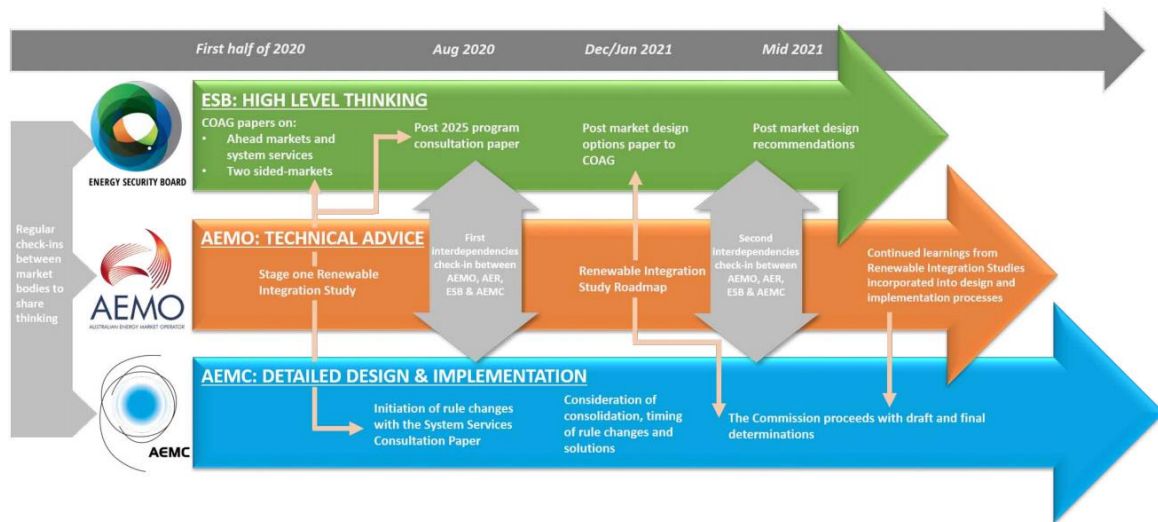
<sup>5</sup> AEMC, Mandatory primary frequency response, Rule determination, 26 March 2020, available at [https://www.aemc.gov.au/sites/default/files/2020-03/ERC0274%20-%20Mandatory%20PFR%20-%20Final%20Determination\\_PUBLISHED%2026MAR2020.pdf](https://www.aemc.gov.au/sites/default/files/2020-03/ERC0274%20-%20Mandatory%20PFR%20-%20Final%20Determination_PUBLISHED%2026MAR2020.pdf)

<sup>6</sup> AEMC, System services rule changes, Consultation paper, 2 July 2020, available at <https://www.aemc.gov.au/sites/default/files/2020-07/System%20services%20rule%20changes%20-%20Consultation%20paper%20%E2%80%93%202020%20July%202020.pdf>

<sup>7</sup> ESB, Post 2025 Market Design Consultation Paper, September 2020, available at <http://www.coagenergycouncil.gov.au/sites/prod.energycouncil/files/publications/documents/P2025%20Market%20Design%20Consultation%20paper.Final.pdf>

<sup>8</sup> AEMC, System services rule changes, Consultation paper, 2 July 2020, available at <https://www.aemc.gov.au/sites/default/files/2020-07/System%20services%20rule%20changes%20-%20Consultation%20paper%20%E2%80%93%202020%20July%202020.pdf>

**Figure 2 Coordination between market bodies on essential system services**



Source: AEMC, System services rule changes, Consultation paper, July 2020, p.5.

As AEMO progresses its tasks under this frequency control work plan, learnings will be incorporated into both the ESB's post 2025 market design project and AEMC's assessment of the rule change requests and incorporated into the development of future work plans.

## 2. Activities and Work Plan

The purpose of the frequency control work plan is to promote a coordinated approach to frequency control in AEMO and across industry.

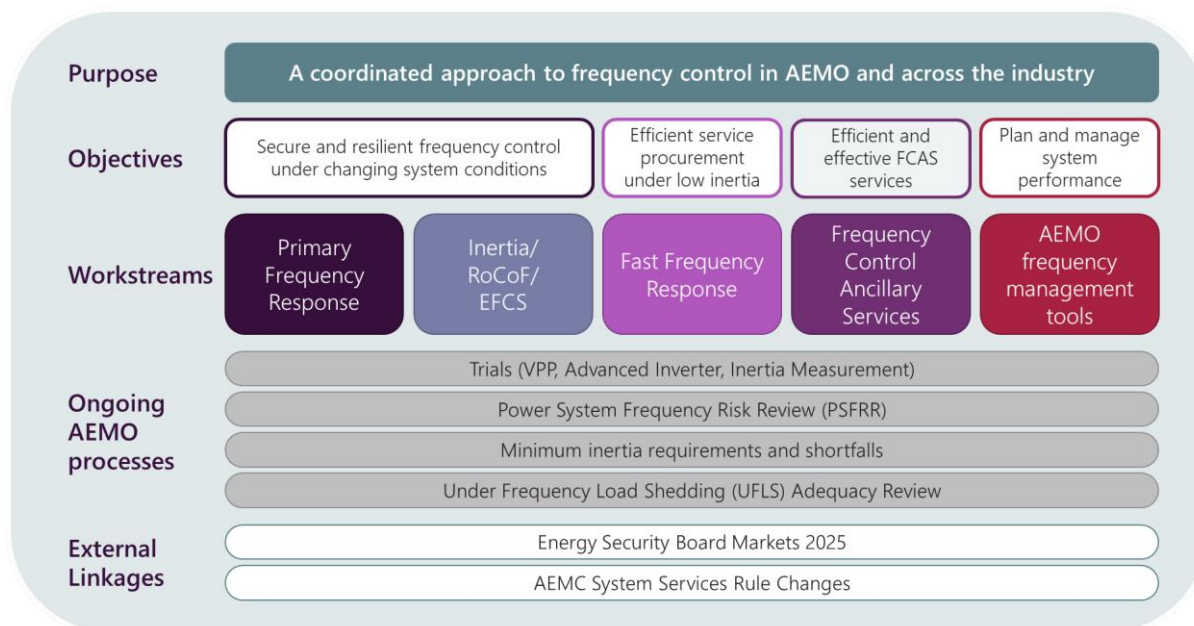
### 2.1 Summary

Figure 3 provides a summary of the structure of the frequency control work plan. There are:

- **Five key workstreams** that are broadly aligned to **four key objectives** for frequency control. The five workstreams form the core structure of the frequency control work plan activity list (Section 2.2) and schedule (Section 2.3).
- Additional **ongoing processes** that are related to frequency control. These processes have defined publication cycles or governance frameworks and so are not explored in the context of the frequency control work plan workstreams. These are noted in Section 2.2 on the activity list.
- Linkages with **external market and regulatory processes**. These linkages are described in Section 1.2 and further explored in Section 2.3 on the activity schedule and Section 3 on key dependencies.



**Figure 3 Frequency control work plan summary**



As shown in Figure 3, each workstream broadly aligns to contribute to one of the four objectives. Table 1, below, links the objectives of the frequency control work plan to the outcomes of each workstream.

**Table 1 Workstream objectives and outcomes**

Objective	Workstream	Outcome
Secure and resilient frequency control under changing system conditions	Primary Frequency Response	<ul style="list-style-type: none"> <li>Implement broad-based primary frequency control.</li> </ul>
	Inertia/ RoCoF/ EFCS	<ul style="list-style-type: none"> <li>Extended existing provisions to cover expected operating conditions for system security.</li> </ul>
Efficient service procurement under lower inertia	Fast Frequency Response	<ul style="list-style-type: none"> <li>Efficient procurement of frequency related services.</li> </ul>
Efficient and effective Frequency Control Ancillary Services (FCAS) services	Frequency Control Ancillary Services	<ul style="list-style-type: none"> <li>Adapting existing Contingency and Regulation FCAS services for current and emerging operating conditions.</li> </ul>
Plan and manage system performance	AEMO frequency management tools	<ul style="list-style-type: none"> <li>Ability to model, plan, and operate the power system under expected and plausible operating conditions.</li> </ul>

## 2.2 Activity List

**Table 2 AEMO frequency control work plan tasks**

ID	Task	Description	Deliverable	Indicative Date <sup>9,10</sup>
<b>Primary Frequency Response</b>				
1	Mandatory PFR Rule implementation	Facilitate implementation of Mandatory PFR Rule.	Facilitate implementation.	Ongoing, target is for facilities over 200 MW to be providing PFR by December 2020, with smaller facilities to follow.
2	Technical input on PFR Incentivisation Rule Change (ERC0263)	Technical input into PFR incentivisation regulatory process: <ul style="list-style-type: none"> <li>• PFR materiality and need for enduring requirements.</li> <li>• Incentivisation options review for small deviations.</li> <li>• Causer pays incentivisation feasibility.</li> </ul>	2a) Data gathering and assessment of PFR rollout. 2b) PFR Incentivisation feasibility report (AEMC briefing and technical report). 2c) Frequency Operating Standard ( <b>FOS</b> ) Criteria Options Analysis (Interim Advice and technical report).	2a) Ongoing with interim output in March 2021. 2b) November 2020 (AEMC briefing); June 2021 (technical report) 2c) February 2021 (interim advice); June 2021 (technical report)
<b>Frequency Control Ancillary Services (FCAS)</b>				
3	Switched Reserve Limits	Applying appropriate limits to the total proportion of switched reserve, this is needed to ensure there is a minimum amount of dynamic frequency control.	Potential application of limit/constraint.	From Q4 2020
4	Regulation FCAS improvement	Regulation FCAS improvements including minimum technical requirements.	Operational improvements (requirements would be reflected in the Market Ancillary Service Specification [ <b>MASS</b> ]).  Additional work may follow, including further tuning of Automatic Generation Control ( <b>AGC</b> ) after system upgrade	From Q4 2020

<sup>9</sup> Indicative dates are calendar year. For example, Q2 2021 refers to April – June 2021.

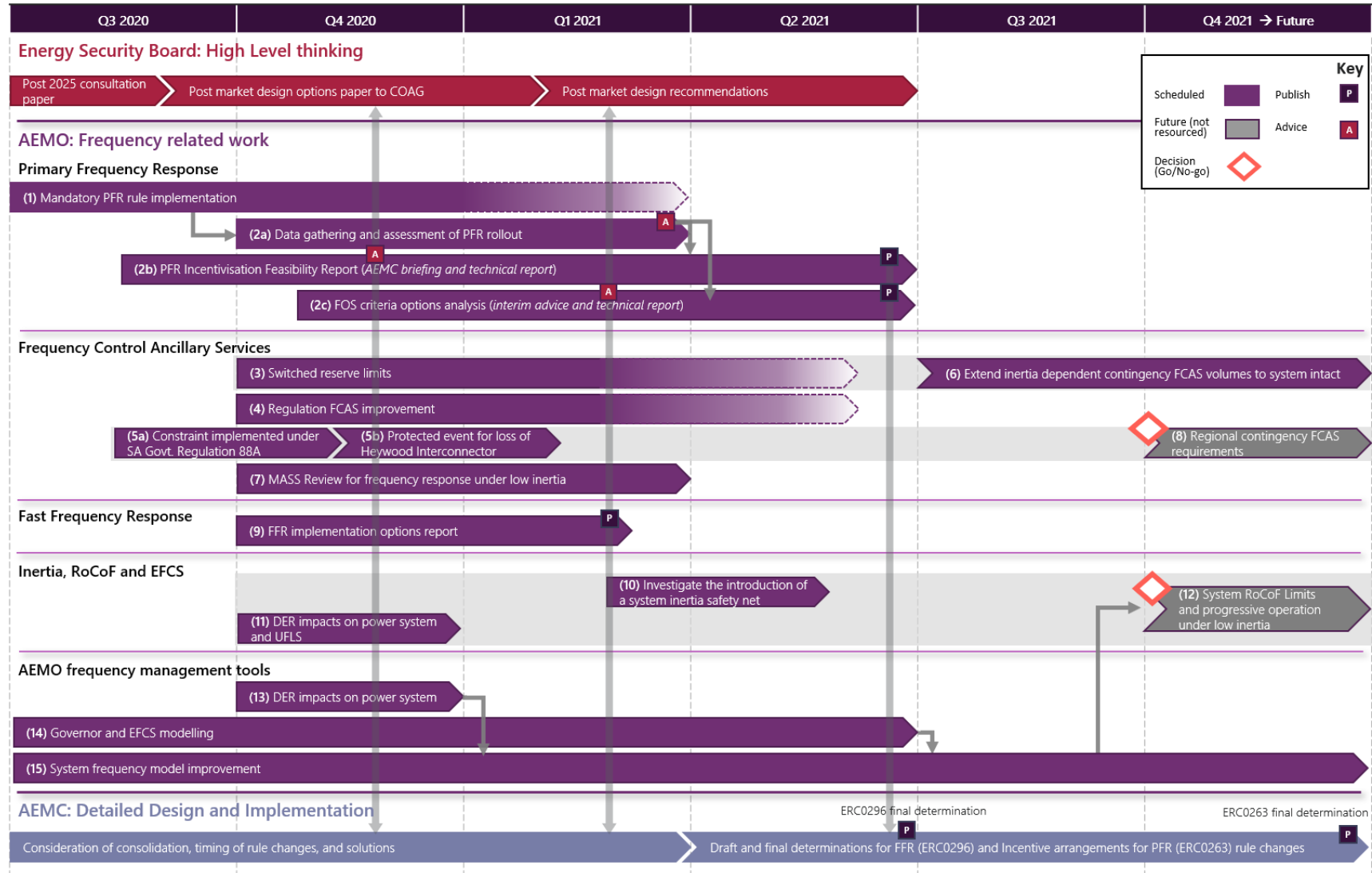
<sup>10</sup> This publication has been prepared by AEMO using information available at the time of publication. Any changes to indicative dates following publication of this document will be communicated through appropriate channels.

ID	Task	Description	Deliverable	Indicative Date <sup>9,10</sup>
			and consideration of regional Regulation FCAS requirements.	
5	Constraint for Heywood Interconnector to manage UFLS inadequacy	Management of South Australia for loss of interconnector in periods where UFLS is insufficient to prevent cascading failure.	5a) Constraint implemented under SA Government Regulation 88A. 5b) Protected event for loss of Heywood interconnector.	5a) October 2020 5b) Early 2021
6	Extend inertia dependent contingency FCAS to system intact	FCAS constraints for inertia dependent contingency FCAS volumes for system intact.	FCAS constraints.	Q3/Q4 2021
7	MASS Review for Frequency response under low inertia	Examine how changing the definition of fast contingency FCAS services may impact the availability and performance of frequency control.	MASS Review.	From Q4 2020
8	Regional contingency FCAS requirements	Consideration of appropriate regional contingency FCAS requirements for South Australia and Queensland	Potential future work leading off from current activities.	TBC Prospective future task.
<b>Fast Frequency Response</b>				
9	FFR Implementation options report (Technical Report)	Technical input into Rule Change (ERC0296)	Technical investigation and implementation options for FFR for Contingency management (system intact).	February 2021
<b>Inertia, RoCoF and EFCS</b>				
10	System inertia safety net investigation	Investigate the introduction of a system inertia safety net for the mainland NEM, under system intact conditions.	Analysis to inform AEMO inertia publications.	From March 2021. Publication date TBC.
11	DER impacts on Under Frequency load Shedding (UFLS)	DER penetration into UFLS	DER penetration into UFLS, South Australia/South Australia Power Networks.	December 2020
12	System RoCoF Limits and progressive operation under low inertia	Specify a set of system RoCoF limits (in addition to generator requirements) and other operational requirements for operation under progressively lower inertia. Assessment of Emergency Frequency Control Schemes (EFCS), including UFLS.	Potential future work leading off from current activities. Communicated for visibility only.	TBC Prospective future task.
<b>AEMO frequency management tools</b>				

ID	Task	Description	Deliverable	Indicative Date <sup>9,10</sup>
13	Distributed Energy Resources ( <b>DER</b> ) impacts on power system	DER and load modelling	DER and load modelling (internal AEMO modelling improvement task).	December 2020
14	Governor and Emergency Frequency Control Schemes ( <b>EFCS</b> ) modelling	Power System Frequency Risk Review ( <b>PSFRR</b> ) report including protected event recommendations	Governor and EFCS modelling for PSFRR.	June 2021
15	System frequency model development	Updating existing system frequency model to be able to predict post-contingent frequency outcomes based on generating unit dispatch.	Base model and process for continual maintenance and improvement.	Ongoing
<b>WEM</b>				
16	Wholesale Electricity Market ( <b>WEM</b> ) Reform: Essential System Services	Reform of Ancillary Services provision in the WEM to new Essential System Services framework.	Rule changes, frequency control model, facility accreditation process and markets inputs for co-optimised Regulation, Contingency Reserve and Rate of Change of Frequency ( <b>RoCoF</b> ) Control (inertia) services.	Rule Gazetta: Q4 2020 Go Live October: 2022
17	South West Interconnected System ( <b>SWIS</b> ) Real-time Frequency Stability Tool (WEM)	Online inertia monitoring and contingency simulation for control room	Operation tool, control room support and training.	Trial tool in production
<b>Ongoing AEMO processes</b>				
18	UFLS Adequacy Review	Annual Review	UFLS Adequacy Review	Ongoing
19	Power System Frequency Risk Review	PSFRR report including protected event recommendations	14a) 2020 PSFRR Stage 1 14b) 2020 PSFRR Stage 2	(14a) Published (14b) December 2020
20	Minimum inertia requirements and any shortfalls	Inertia requirements and any shortfalls for each region of the NEM when islanded, which need to be published in the annual Inertia Report or via ad hoc updates where justified.	Shortfalls publication(s)	December 2020 for annual Inertia Report Ongoing shortfalls publications; <a href="#">SA shortfall</a> published August 2020.
21	Technology Trials	Facilitate trials in VPP, Inertia Measurement and Advanced Inverter applications.	Trial facilitation and post-trial activities	Ongoing

## 2.3 Activity Schedule

Figure 4 Frequency control work plan detailed flow chart



Note: WEM and ongoing tasks displayed in Table 2 are not shown in this diagram.

# 3. Key Dependencies

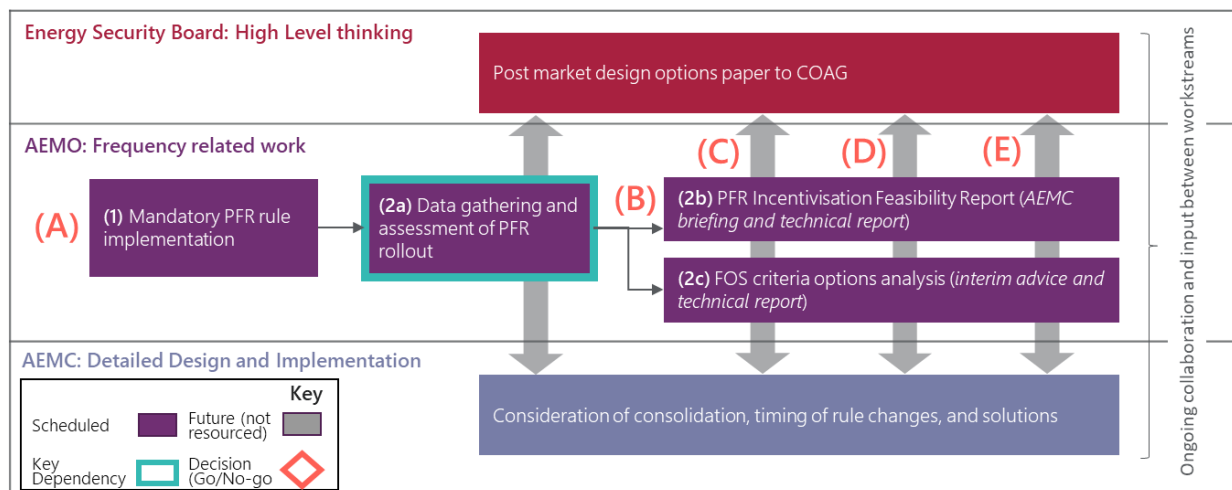
This section highlights key task dependencies and how they interact with other tasks in the frequency control work plan, including linkages to the AEMC and ESB regulatory processes.

## 3.1 Primary frequency response incentive arrangements

AEMO has identified the data gathering and assessment of PFR rollout (Task 2a) as a key dependency for the AEMC’s primary frequency response incentive arrangements (ECR2063)<sup>11</sup>, as well as the ESB’s post 2025 program and a number of AEMO technical reports.

Figure 5 relates to key dependencies on analytical work related to the PFR incentive arrangements rule change. Task numbering in the diagram relates to the task ID in Table 2 (Section 2).

**Figure 5 Key Dependency – Data gathering and assessment of PFR rollout**



### Target timeframe:

- (A) PFR rollout is ongoing, target is for facilities over 200 MW to be providing PFR by December 2020, with smaller facilities to follow.
- (B) Data gathering and assessment of PFR rollout is ongoing with interim output to inform technical reports in March 2021.
- (C) PFR Incentivisation feasibility report briefing to AEMC (November 2020).
- (D) Interim advice on Frequency Operating Standard (FOS) Criteria Options Analysis (February 2021).
- (E) Publication of PFR Incentivisation Feasibility report and FOS Criteria Options Analysis (June 2021).

## 3.2 Relaxation of the FOS Generation Event Frequency Containment band

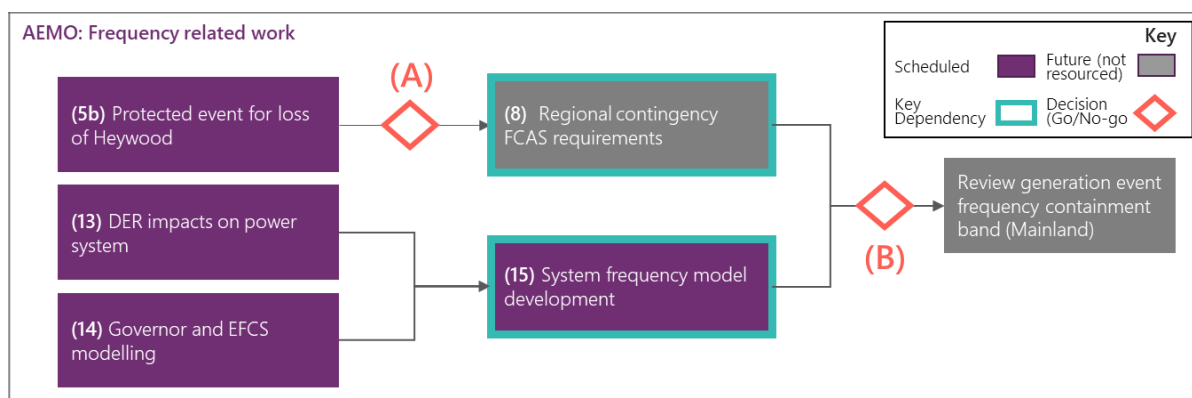
Relaxation of the FOS Generation Event Frequency Containment band has been raised within industry as a possible option to assist in managing contingent events.

<sup>11</sup> See <https://www.aemc.gov.au/rule-changes/primary-frequency-response-incentive-arrangements>.

The RIS recommended that this is not done at this time as relaxing this requirement would reduce the margin for triggering Under Frequency Load Shedding (**UFLS**) for credible events and affect the outcomes for non-credible events<sup>12</sup>. For relaxation of the FOS Generation Event Frequency Containment band to be considered in the future (long term) AEMO would need the ability to better model frequency events and have additional management of non-credible events in place as a minimum. The FOS Generation Event Frequency Containment band should not necessarily be revised following the outcome of the pre-requisite tasks. The intention of including this task on the frequency work plan is to show that this action can't be taken independently and should be considered at the appropriate time.

Figure 6 relates to key dependencies on analytical work required as pre-requisites to considering relaxation of the FOS Generation Event Frequency Containment band. Task numbering in the diagram relates to the task ID in Table 2 (Section 2).

**Figure 6 Key Dependencies – Relaxation of the FOS Generation Event Frequency Containment band**



- (A) Consideration of appropriate regional contingency FCAS requirements. It requires input from the Protected event for loss of Heywood and is a pre-requisite for reviewing the FOS Generation Event Frequency Containment band.
- (B) For relaxation of the FOS Generation Event Frequency Containment band to be considered in the future (long term) AEMO would need the ability to better model frequency events (15task) and as a minimum, ensuring the impacts to non-credible events are managed where needed (8).

## 4. Next Steps

Following publication of this frequency control work plan, AEMO will track and communicate the progress of the activities in Table 2.

The frequency control work plan forms a core part of AEMO's ongoing work to prepare and support the changing NEM power system.

For any questions or comments regarding the AEMO frequency control work plan, please contact [FutureEnergy@aemo.com.au](mailto:FutureEnergy@aemo.com.au).

<sup>12</sup> AEMO, Renewable Integration Study Stage 1, Appendix B, April 2020, available at <https://aemo.com.au/-/media/files/major-publications/ris/2020/ris-stage-1-appendix-b.pdf?la=en>

# A1. AEMC Frequency Control Work Plan

On 26 March 2020, the AEMC published a revised frequency control work plan in the final determination for the Mandatory Primary Frequency Response Rule Change<sup>13</sup>. The following provides an update on the immediate term actions in this work plan that were allocated to AEMO.

**Table 3 AEMO updates on AEMC revised frequency control work plan**

Timing	Action	AEMO Update
<b>IMMEDIATE TERM (PRESENT — DECEMBER 2023)</b>		
<p>During this period, AEMO continues with a range of actions to better understand the current and future frequency control needs of the power system and takes steps towards addressing these needs through a revision of current AEMO operating practices and procedures.</p> <p>This period also contains the AEMC’s assessment of the Mandatory primary frequency response rule change and the Removal of disincentives to primary frequency response rule change. The AEMC is focused on the implementation of a mandatory requirement for scheduled and semi-scheduled generators to provide PFR to support frequency control in the NEM in the interim through the Mandatory primary frequency response rule change. However, through the Removal of disincentive to primary frequency response rule change and other related rule change requests received, the AEMC will investigate the appropriateness of the existing incentives for PFR during normal operation and amend these arrangements as required.</p> <p>In Q2 2020, the Commission will work with stakeholders and AEMO on the detailed directions for this rule change which will consider:</p> <ul style="list-style-type: none"> <li>• the arrangements for allocation of costs associated with regulation services — ‘causer-pays’</li> <li>• the potential development of additional complementary measures to effectively remunerate providers of primary frequency response</li> <li>• how best to meet the future needs of the power system</li> <li>• interaction with the arrangements in the Mandatory primary frequency response rule including the sunset provision.</li> </ul> <p>This will also be an input into the ESB’s post 2025 market design work.</p>		
<b>Ongoing</b>	AEMO commissioned a further review of AGC systems in July 2019, which may result in further adjustments to AGC tuning. In particular, AEMO will be monitoring the control changes associated with the Mandatory PFR rule and adjusting AGC to operate optimally in this revised environment.	<b>ONGOING.</b> AGC software upgrade may enable further AGC optimisation.
<b>Ongoing</b>	AEMO, the AEMC and the AER began a NEM virtual power plant trial program in November 2018 to support an understanding of the technical and regulatory	<b>ONGOING.</b>

<sup>13</sup> AEMC, Mandatory primary frequency response, Rule determination, March 2020, pp.40-43, available at [https://www.aemc.gov.au/sites/default/files/2020-03/ERC0274%20-%20Mandatory%20PFR%20-%20Final%20Determination\\_PUBLISHED%2026MAR2020.pdf](https://www.aemc.gov.au/sites/default/files/2020-03/ERC0274%20-%20Mandatory%20PFR%20-%20Final%20Determination_PUBLISHED%2026MAR2020.pdf)



Timing	Action	AEMO Update
	requirements associated with virtual power plants providing FCAS, as well as energy and network support services. This work will inform AEMO's review of the MASS and the AEMC's ongoing work on removing barriers to distributed energy resources participating in wholesale markets	<p>On 22 July 2020, AEMO in conjunction with ARENA published the <a href="#">VPP knowledge sharing stage 2 report</a>.</p> <p>On 30 July 2020 AEMO confirmed extension of the VPP demonstration to June 2021, on the condition that at least three additional participants enrol.</p> <p>For further information refer to AEMO's <a href="#">Virtual power plant demonstration page</a>.</p>
Ongoing	<p>AEMO continues its review of contingency FCAS quantities, including:</p> <ul style="list-style-type: none"> <li>• The staged reduction of NEM load relief factors</li> <li>• Review of maximum switch reserve quantity</li> <li>• Consideration of regional FCAS requirements</li> </ul> <p>Minimum technical requirements for Regulation FCAS.</p> <p>In December 2019, AEMO reduced the assumed mainland load relief to 0.5%</p>	<p><b>ONGOING.</b></p> <p>The staged reduction of NEM load relief factors to 0.5% is complete.</p> <p>A review of maximum switched reserve quantity has been incorporated into task 3 (table 2) of the AEMO frequency control work plan.</p> <p>Consideration of regional FCAS requirements have been incorporated into task 4 (table 2) of the AEMO frequency work plan.</p>
Ongoing	AEMO reports on the outcomes of the actions set out above as results become available through its Ancillary Services Technical Advisory Group, Frequency Control Working Group and/or published reports.	<p><b>ONGOING.</b></p> <p>For updates, refer to AEMO's <a href="#">Ancillary Services Technical Advisory Group page</a>.</p>
Q2 2020	<p>AEMO evaluates the requirement to submit a rule change request to:</p> <ul style="list-style-type: none"> <li>• allow Small Generation Aggregators to classify small generating units as market ancillary service generating units for the purposes of providing market ancillary services, and</li> <li>• to clarify that Market Ancillary Service Providers are able to satisfy their obligations to provide market ancillary services through enabling small generating units. This action will be informed by the outcomes of the NEM virtual power plant trial program described above</li> </ul>	<p><b>ONGOING.</b></p> <p>AEMO published <a href="#">Interim arrangements for Frequency Control Ancillary Services (FCAS) provision from Distributed Energy Resources</a> (DER) in December 2019.</p> <p>AEMO will initiate a DER MASS review in early 2021 to consult on the interim arrangements for contingency FCAS provision from aggregated ancillary service loads (VPPs).</p>
Q1 2020	AEMO to publish its Renewable Integration Study report which will quantify the technical renewable penetration limits of the power system for a projected generation mix and network configuration in 2025.	<p><b>COMPLETE.</b></p> <p>On 30 April 2020, AEMO published the Renewable Integration Study report, including 3 technical appendices.</p> <p>For the report and appendices, see AEMO's <a href="#">Renewable Integration Study page</a>.</p>
April 2020	Generator self-assessments begin.	N/A
9 April 2020	AEMO releases interim PFRR for consultation.	<p><b>COMPLETE.</b></p> <p>On 1 April 2020, AEMO started its consultation process on the interim PFRR.</p>

Timing	Action	AEMO Update
		Refer to AEMO's <a href="#">Primary frequency response requirements consultation page</a> .
29 April 2020	AEMO publishes the Market Ancillary Service Specification and Causer Pays Procedure Final Determination and Final Report.	<b>PARTIALLY COMPLETE.</b> On 1 June 2020, AEMO published the <a href="#">MASS final determination</a> and <a href="#">MASS report</a> . The Causer Pays procedure consultation has been delayed until AEMC draft determination on PFR incentive arrangements. Refer to AEMO's <a href="#">Primary frequency response under normal operating conditions consultation page</a> .
May 2020	AEMO publishes Interim Primary Frequency Response Requirements.	<b>COMPLETE</b> On 1 June 2020, AEMO published the <a href="#">final interim PFRR</a> . Refer to AEMO's <a href="#">Primary frequency response requirements consultation page</a> .
Q2 2020	AEMC publishes directions paper for the Removal of disincentives to primary frequency response rule change.	N/A
4 June 2020	The substantive elements of the Mandatory primary frequency response rule commence.	N/A
Q2/Q3 2020	AEMO to provide technical advice to support the AEMC's assessment of policy options for the Removal of disincentives to primary frequency response rule change	<b>WORK COMMENCED.</b> AEMO has commenced work on this technical advice to support the AEMC's <a href="#">PFR Incentive arrangements rule change (ERC0263)</a> . AEMO's technical advice is scheduled for publication in June 2021, as per the work plan above, with interim advice to be provided to the AEMC in December 2020 (task 2b), table 2.
Q4 2020	AEMO reports on the requirement to add or amend performance objectives for frequency control in the NEM.	<b>ONGOING.</b> This task has been incorporated into the AEMO frequency work plan as part of the FCAS work stream (see above). FOS Criteria Options Analysis (Technical Report) scheduled in June 2021, with Interim advice on FOS Criteria Options Analysis scheduled in February 2021 (task 2c, table 2).
September 2020	AEMC publishes the Removal of disincentives to primary frequency response draft determination.	N/A
December 2020	AEMC publishes Removal of disincentives to Primary frequency response final determination.	N/A

Timing	Action	AEMO Update
Q1 2021 to 2023	If necessary, AEMO works with stakeholders to implement the changes to systems and procedures as required by the Removal of disincentives to primary frequency response rule.	tbc
4 June 2023	Sunset for the Mandatory PFR requirement (subject to amendment or removal in the Removal of disincentives to Primary frequency response final determination).	N/A

#### OTHER RELATED WORK

In addition to the above, as noted earlier, AEMO, the AER, the ESB and the AEMC are all working together in coordination with the ESB's Post-2025 Market Design plan. This work includes looking at system security and resilience, including such key challenges as:

- identifying which additional services may be required given the changing mix of supply with more non-synchronous generation
- determining how the market can efficiently procure the system services needed, valuing those services in ways which drive both the investment needed and their efficient delivery providing incentives to minimise the cost of those services and provide for innovation and new technology in their provision

The development of frequency control markets and frameworks through this work program will therefore need to be undertaken coherently with the ESB's work. As per the Post-2025 Market Design Forward Work Program, the ESB is scheduled to develop the rule changes required to implement its recommended changes to existing market design throughout 2021 with finalisation of these changes by 1 July 2022.

Throughout this period, AEMO continues monitoring and reporting on power and generation system behaviour, which informs the work of all market bodies on enduring solutions for frequency control.