



# MANDATORY PRIMARY FREQUENCY RESPONSE

Response to AEMC Draft Determination

February 2020

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**1. Executive summary**

Stanwell welcomes the opportunity to comment on the Australian Energy Market Commission’s (AEMC) draft determination on the Mandatory Primary Frequency Control rule change. The collaboration between industry and market bodies to improve frequency control in the National Electricity Market (NEM) is imperative to guaranteeing the future security of the power system.

Historically the market has never explicitly valued primary frequency control (PFC) as it was intrinsically provided by the multitude and geographic dispersion of dispatchable, primarily steam driven generators. With the ongoing reduction in the fleet size of this type of equipment, ensuring adequate resources for PFC is a complex task.

As envisioned in the AEMC’s Frequency Control Frameworks Review, ensuring adequate and affordable resources are available going forward will require a framework which creates clear and durable incentives for investors and operators. The optimal solution should stabilise frequency control in the NEM at an efficient cost, and preserve investment signals to ensure adequate PFC is available into the future.

Stanwell is concerned the proposed rule promotes sub-optimal market outcomes and incurs unnecessary costs, which ultimately will flow through to consumers. Stanwell urges the AEMC to consider three key metrics that the rule should satisfy:

- **Efficacy:** The proposal should physically deliver on the identified need that prompted the rule change request. Stanwell considers the proposed mandatory requirement to provide PFC fails to enhance the predictability and visibility of the system operating state. In particular, the *no headroom* clause and exemptions guidelines act to decrease transparency of the system operating state for AEMO and inhibit the obligation’s ultimate effectiveness in providing certainty in frequency control.
- **Efficiency:** The rule change should deliver an economically efficient approach to the identified need. The proposed solution should ideally achieve improved frequency control at the most efficient cost to the system and, subsequently, consumers. Stanwell maintains that imposing a universal requirement on both high- and low-cost service providers needlessly increases the total system cost of PFC, resulting in sub-optimal price outcomes for market participants and customers.

- Informing future design:** The rule should address the present frequency issue and accommodate the future power system by creating and then preserving investment signals that will encourage innovation in and provision of the PFC. Stanwell contends that the proposed obligation does not fully consider the changing generation mix, nor provide sufficient transparency or a discrete price signal that will encourage potential investment in PFC capability. These elements may also pose a barrier to entry for potential market participants. Undoubtedly, commandeering PFC capability now will send adverse investment signals for other system services that emerge as the NEM evolves.

The mandatory obligation has been based on an absence of empirical investigation into what is ‘good’ frequency control for the NEM. Furthermore, this rule forecloses on the opportunity to empirically determine the amount and understand the characteristics of PFC that are required to stabilise frequency. Without a set target, there is no ability to evaluate the effectiveness of the rule change, or to determine the value of PFC in developing market-based long-term options.

Though the draft rule contains a sunset clause, the breadth of work to ensure compliance across the market will make unwinding the obligation extremely difficult, if not entirely impractical. The complexity the rule change adds to the measurement of generators’ compliance with their incumbent market obligations also appears to increase the likelihood of additional interventions, further impeding the development of an appropriate long-term mechanism to incentivise PFC. Once the service is mandated without an explicit price signal, AEMO will likely have little motivation to continue investigating long term solutions.

Stanwell recommends the AEMC revise its draft determination to incorporate amendments to the National Electricity Rules that include PFC as a system service, equivalent to inertia and system strength. This would allow procurement on a contractual basis, the simplest solution that can deliver on all three desired outcomes within an expedited timeframe at the lowest cost to consumers. We also advocate additional measures for enhanced transparency of the ongoing work toward improved frequency control.

Stanwell welcomes the opportunity to further discuss this submission. Please contact Luke Van Boeckel on 07 3228 4529 or [luke.vanboeckel@stanwell.com](mailto:luke.vanboeckel@stanwell.com).

## 2. Context

### 2.1. The Frequency control work plan

A mandatory obligation for the provision of PFC was one of the potential interim solutions identified in the *Frequency control work plan* resulting from the 2018 *Frequency Control Frameworks Review* (FCFR). Notably, the review viewed a mandatory requirement as unfavourable:

*“... a mandatory requirement for certain market participants to provide primary regulating services is likely to be an inflexible mechanism that does not allow for innovation in the delivery of these ancillary services and the delivery of services at lowest cost<sup>1</sup>.”*

Other interim options were also considered feasible,

*“Notwithstanding practical viability, potential interim measures may include:*

- those that might not require regulatory change (e.g. AEMO negotiating with generators or issuing directions)*
- those that would likely require regulatory change (e.g. mandatory provision of primary frequency control, a new contracting arrangement or valuing positive contribution factors through the causer pays procedure).<sup>2</sup>*

### 2.2. Prioritisation of this rule change

While the original basis of the FCFR was the widening of frequency distribution under normal operating conditions, the prioritisation of this rule change over the agreed *Frequency control work plan* actions appears to originate with the Queensland and South Australia system separation event of 25 August 2018. Subsequently, AEMO called for increased response from generators to aid in arresting and correcting frequency deviations during major events.

As such, the rule change appears to conflate PFC, which is an automatic response to localised deviations, with the global application of Frequency Control Ancillary Services (FCAS). Using system performance subsequent to a single non-credible contingency as justification for a universal PFC obligation under normal operating conditions is a false equivalence.

<sup>1</sup> AEMC, 2018, *Frequency Control Frameworks Review* p. 133.

<sup>2</sup> AEMC, 2018, *Frequency Control Frameworks Review*, p. 38.

While the distribution of frequency under normal operating conditions remains wide, conditions do not appear extraordinarily different to those existing at the time of the FCFR final report.

### 3. Impacts of the draft rule

Stanwell agrees with the advice of AEMO and industry experts that more PFC is required urgently to improve frequency performance and the steady-state predictability and stability of the NEM. Though it is important that frequency is stabilised within an expedited timeframe, we do not consider the mandatory obligation to be either the most effective or timely solution currently available to the market.

Our comments on attributes of the rule change consider its efficacy, costs, and implications for the future NEM.

#### 3.1. Efficacy

##### *No defined target*

Stanwell encourages the AEMC to revise its draft determination to include a metric for good frequency control in the NEM. This should include desired frequency excursion and/or temporal outcomes similar to the existing guidelines for FCAS.

Without a defined system state goal it will be difficult to evaluate the efficacy of the rule or the frequency control required to return the system to an acceptable state. This will impede determination of a value for PFC to incentivise long term market-based solutions. It is particularly important this be defined now, as the universality of the proposed obligation will foreclose on the ability to determine the exact amount and characteristics of PFC that are required to improve frequency performance.

##### *“No headroom” clause*

The foremost and most concerning feature of the proposal is the exclusion of a requirement to store energy, otherwise known as headroom, for the provision of PFC. Stanwell considers this a significant oversight. The “no headroom” clause will fundamentally reduce the effectiveness of the rule and obstruct

AEMO’s ability to accurately determine and operate the system state under normal conditions.

Without a designated headroom reserve, the system relies on the presence of ‘natural’ headroom. This is drawn from generators storing energy either for meeting higher dispatch targets or Frequency Control Ancillary Services (FCAS).

The draft determination characterises this stored energy as additional to the markets for those services<sup>3</sup>, but without headroom explicitly set aside for PFC, energy reserved for other purposes is utilised. Further, though many non-synchronous generation types do not have an in-built capability to store energy, if AEMO desires PFC from as many providers as possible, it seems contradictory to impose what is in practice half an obligation (i.e. to adjust output down, but not always up) on those technologies. Therefore, the greater part of the burden will fall on dispatchable generation with the intrinsic ability to store headroom.

A corollary to the no headroom clause is that there will be no method to determine the amount and location of PFC available in the power system at any point in time. Within the new narrow deadband environment, generators will also be expending energy more often in response to smaller frequency disturbances. This will render it even less practical to quantify the stored energy reserves available. For example, synchronous generators store energy as steam pressure which must constantly be replenished. Once this stored energy is utilised in primary frequency response there is a physical delay of up to several minutes for steam pressure to recover, of which AEMO will have no visibility.

Potential outcomes of the no headroom clause and their implications for industry and AEMO’s operation of the NEM are outlined in Table 1.

<sup>3</sup> AEMC, 19 December 2019, Mandatory PFR – Draft rule determination, p. 20: “Any frequency response that is provided in addition to the markets for contingency capacity reserves, or FCAS, offset the need for generation and load shedding to rebalance supply and demand following a contingency event that exceeds the largest credible contingency event.”

Table 1: Potential impacts from the no headroom clause

Outcome	Impacts to AEMO	Impacts to generation
Insufficient PFC response (MW)	Ineffective arrest of frequency deviation, continued frequency instability.	Additional operational and movement costs incurred providing ineffective PFC, potential impacts to plant from continued frequency deviations.
Insufficient duration of PFC response	Response sustainment is a major determinant of the effectiveness of PFC. Insufficient sustainment from providers will cause frequency oscillations and contribute to further system instability.	Oscillatory behaviour between different interacting governors incurring additional wear-and-tear and operational costs.  Risks to other plant equipment (governors, excitation systems, power system stabilisers, and protection systems etc.) caused by oscillations.
Inability to meet dispatch targets	Impairs dispatch and visibility of the system, reducing system security.	Non-compliance penalties, negative causer pays factors, inability to meet subsequent dispatch targets.
Inability to meet ramping obligations	Impairs dispatch and visibility of the system, reducing system security. More variable supply and demand will necessitate faster ramp rates to balance supply and demand <sup>4</sup> , so this will have a greater impact as time goes on.	Non-compliance penalties, negative causer pays factors, inability to meet subsequent dispatch targets.
Inability to provide full contingency FCAS	Uncertainty of availability of contingency reserves. Delayed recovery of the system following a contingency event.	Penalties related to non-compliance, negative causer pays factors, reduced contingency FCAS revenue.

<sup>4</sup>AEMO response to AEMC request for advice, March 2018: "An increasing proportion of the generation mix during the middle of the day is expected to be supplied by solar generation (and to a lesser degree, wind generation). Solar generation can be highly variable – more so than other types of generation – as it responds very quickly to intermittent clouding. Analysis of the existing utility-scale solar farms in the NEM shows that changes in output >50% of rated capacity may be expected to occur within 4 seconds."

### Exemptions and implementation

Stanwell considers the scope of the exemption guidelines included within the proposed rule may encourage further disputes. These guidelines are broader than seen in international markets where there is a mandatory precedent. For example, the Federal Energy Regulatory Commission requires all newly connecting generating facilities in the United States to provide mandatory PFC<sup>5</sup>, excepting nuclear plant and generators with manufacturer confirmation that the plant is unable to provide PFC.

Further, given the Australian Energy Regulator's (AER) compliance enforcement function, Stanwell believes that it is essential for the AER to facilitate the exemption process rather than AEMO. This would allow any interplay between mandatory PFC and dispatch targets to be properly resolved. It is also in line with the established and functional governance structure of the National Energy Market.

It is noteworthy that batteries have been seemingly pre-exempted at this stage; if partial exemption is required this would duly occur during the implementation process, but this precludes any potential to test the full capability of batteries within the mandated 'trial' environment.

Another aspect that has been generally overlooked within the draft determination is the distribution of PFC providers, geographically and by technology. Though system-wide there may be sufficient headroom, the location and capability of this capacity will be increasingly important, particularly given the increasing number of hours network constraints are invoked on a year-on-year basis<sup>6</sup>. Some regions will be more affected by constraints than others, depending on local network and generation mix.

Stanwell cautions that changes to governor settings must occur on a co-ordinated basis under the joint oversight of the relevant Network Service Providers and AEMO. Failure to do so risks oscillations between machines and their various controllers (e.g. governors, excitation systems, power system stabilisers, and protection systems). Historically it would be normal practice to have at least one machine at each multi-unit site running in speed control

<sup>5</sup> Federal Energy Regulatory Commission, 2018, Essential Reliability Services and the Evolving Bulk-Power System—Primary Frequency Response, Order No. 842.

<sup>6</sup> AEMO, The NEM Constraint Report Summary Data 2018.

mode to prevent potentially dangerous hunting oscillations between generator units connected to a common grid point.

Given the number of implementation issues outlined above, it is unlikely that the proposed rule change will meet the stated objective of sharing the burden of providing PFC across a large number of providers, cost implications aside. Stanwell maintains that a contracting approach would create a pool of willing PFC providers, and ensure firmer, safer and more transparent provision of this service.

### 3.2. Efficiency

Stanwell considers the true costs of universal PFC provision have been fundamentally understated in the draft determination. As any costs incurred will ultimately be passed on to consumers it is important that the AEMC reassess the efficiency of the proposed obligation, or risk outcomes that do not align with the National Electricity Objective.

#### *Universal provision*

Universal provision of PFC is likely to be excessive, incurring capital and ongoing costs for more generators than required to significantly improve frequency performance in the NEM.

For all system services there will be high and low-cost providers and a marginal generator whose cost of providing the service match the benefits derived from their provision. Beyond this point any further PFC procured will be inefficient. Requiring all capable generators to provide this service therefore increases the total system cost unnecessarily and masks the price signal needed to ensure PFC services in the future. This will lead to inefficient outcomes across the entire wholesale market, and subsequently, an artificially high marginal cost for the procurement of headroom.

In the absence of compensated headroom reserve, most PFC providers will recoup the costs of provision through increases to their energy market offer prices; given that many do not participate in FCAS markets. The AEMC acknowledges this in the draft determination, stating: “*Wholesale electricity prices will reflect the necessary cost of providing primary frequency response in*

*order to manage system security*”<sup>7</sup>. However, this invites a cost increase to the energy market, the largest component of the wholesale market.

The universal obligation, when combined with AEMO’s concurrent changes to FCAS measurement, risk significantly impacting the regulation and contingency FCAS market, saturating the market and impacting generators who rely on this service as a primary revenue source. This will also dilute the price signal for new investment in these services.

#### *Compensation through other markets*

The utilisation of other markets for the remuneration of PFC obscures its true costs. The operational costs of providing PFC are distinct from the cost of providing energy and FCAS services, due to the increased wear and tear and movement costs incurred by heightened responsiveness to smaller frequency excursions. With the new narrow deadband proposed, units will be responding on a much more frequent basis than the current environment.

In amendments to the Market Ancillary Service Specification proposed in December 2019, AEMO attempted to address the issue of verifying PFC provided by generators as part of a full contingency response. Under this scheme, generators enabled for contingency services would be credited with providing a primary frequency response from the edge of the mandated deadband, rather than the edge of the NOFB, that would be verified as part of a full contingency response.

Stanwell questions the probable impacts on the ability to respond to actual contingencies (rather than frequency excursions due to normal operation). Should contingency providers exhaust their headroom through normal operation they may be unavailable in the case of an actual contingency. The proposal would appear to reduce the security of the power system.

Stanwell does not support this proposal as it conflates the separate applications and costs of provision of primary and contingency frequency services, and did not address concerns of how a generator providing PFC but not enabled for FCAS would be compensated.

<sup>7</sup> AEMC, 19 December 2019, Mandatory PFR – Draft rule determination, p. 20.

*Exemptions and implementation*

Stanwell is concerned that the proposed implementation procedure, which would see generators over 200 MW switch on PFC capability first, exposes the first enabled units to a greater share of the initial frequency burden compared to those generators added later. These first-movers are likely to encounter more of the initial unresolved impacts of the new obligation, such as oscillatory interactions between different governors or hunting oscillations.

Additionally, should frequency dramatically stabilise subsequent to the first tranche there is a risk that subsequent generators are able to delay or gain exemption from provision of the service without compensation to those already providing the service. Thus, the burden of costs will once again shift to predominantly dispatchable technologies with the in-built capability to provide system services.

Stanwell notes that the decision to not provide compensation for the costs of equipment augmentation may inadvertently increase the number of applications for partial or full exemptions for cost-prohibitive modifications. This decision also appears to discount the costs of upgrading high-speed data acquisition equipment that will enable the measurement of primary responses occurring more frequently than the current four-second measurement interval allows. For many participants, this equipment may be provided externally by the local Network Service Provider, adding an additional degree of complexity and cost to comply with the obligation.

**3.3. Informing future design**

Considering the potential distortionary impacts of the rule change and the scope of significant concurrent reforms, Stanwell strongly urges the AEMC to reassess the appropriateness of implementing a short-term mandatory obligation as an interim measure.

*Investment signals*

The proposed rule imposes a universal 'one size fits all' command-and-control policy that is unlikely to foster competition, drive innovation or meet the present security needs of the NEM at the least cost. The decision to commandeer the capability of generators to provide any service, even temporarily, sends an adverse investment signal to future providers of frequency control and other

emerging system services in the NEM. Additionally, the utilisation of separate market services as avenues for PFC compensation obscures the signals for these services and adds an unnecessary layer of complexity to existing markets that will deter innovation and investment in those areas.

Stanwell considers that the absence of adequate transparency may foster continued interventions in the market, eroding current and future market participant confidence, and potentially making it difficult for new entrants to secure project financing. This would inhibit innovation in new and existing system services. It is possible that delays or future market conditions may prolong the mandatory obligation beyond the sunset date, as observed with the indefinite extension of the Reliability and Emergency Reserve Trader function. This outcome would have unknown adverse impacts on the market signals for PFC during a critical transitional period for the NEM.

*The future NEM*

The capabilities of new participants in the power system, and their interface with the future generation mix, have not been given adequate consideration in the draft determination. For example, as dispatchable services leave the NEM, there may be a trade-off between utilisation of PFC and other emerging system services, such as Fast Frequency Response<sup>8</sup>.

In the near term, the obligation may also deter alternate sources of frequency responsiveness from new market participants, e.g. distributed energy resources, by reducing a potential income source or presenting a prohibitive cost increase for those technologies that cannot easily add PFC capability. Given the relative heterogeneity of opportunity costs experienced by system loads that could potentially provide frequency control, this may unduly exclude a cost-effective future resource for this service.

*Timing*

The timing of the reform must be given due consideration. Despite the inclusion of the sunset clause, given the level and complexity of adaption required across the NEM to ensure generator compliance with the rule, it is

<sup>8</sup> ARENA, 2019, Response to Post 2025 market design issues paper p. : "ARENA considers that a flexible framework of incentives for primary frequency control can make use of the potential of batteries and other inverter based generation for fast frequency response (response in millisecond timescales). The total requirement for such capacity is relatively small (<500 MW)..."

likely that there will be overlap with the Energy Security Board’s pre- and post-2025 market design process. Though the draft determination acknowledges this, there may be unforeseen outcomes of the obligation that delay or limit facets of the post-2025 market reform process. Similarly, aspects of that process may require the undoing of changes implemented as part of the mandatory obligation.

### 4. Recommendations

Stanwell considers the AEMC should revise its draft determination and ensure the National Electricity Rules include provision for PFC as a system service, similar to existing provisions for inertia and system strength. Major elements of the proposed obligation require additional clarification, particularly the absence of a target system state that will ultimately be the standard against which the effectiveness of any changes to frequency control should be weighed.

#### 4.1. Contracting as an interim solution

As an interim solution, contracting removes much of the risk inherent within the mandatory obligation, and allows and incentivises generators to value their separate costs of PFC and tender competitively. This facilitates procurement of the service in an expedient timeframe, at the lowest price. Table 2 compares the features of a voluntary approach to securing PFC to the mandatory obligation.

An invaluable benefit of the contracted approach is the ability to observe the impacts of incrementally changing the number of providers, droop settings etc. This will enable clear determination of the optimal capacity of headroom reserve within the system without any of the issues or market distortions inherent in the present proposal.

Table 2: Contracted PFC versus the mandatory obligation

Procurement method	Contracted (voluntary)	Mandatory
Guaranteed headroom available	✓	✗
Discrete price for service	✓	✗

Procurement method	Contracted (voluntary)	Mandatory
Simple and transparent implementation process	✓	✗
Separation from and preservation of existing markets	✓	✗
Incentive for generators to provide service at least cost	✓	✗
Incentive for generators to provide service expediently	✓	✗
Technology neutral	✓	✗
Incremental adjustments to number of providers, response settings etc. and observation of impacts	✓	✗

A suggested approach to contracting is shown below.

<b>Contract duration</b>	<ul style="list-style-type: none"> <li>• Minimum: One year</li> <li>• Maximum: Up to currently proposed sunset date (4 June 2023)</li> </ul>
<b>Contract specifications</b>	<ul style="list-style-type: none"> <li>• Similar to proposed mandatory scheme, with inclusion of headroom requirement</li> <li>• Allowance for alternate provision based on cost and/or capability (e.g. 8 per cent droop at lower cost)</li> </ul>

#### 4.2. Clarification of features of the proposal

The AEMC should also revise the draft determination to clarify critical aspects that remain unclear within the work plan toward improved PFC:

- The target system state or performance metric for ‘good’ frequency control;
- Proposed provisions for cost recovery for PFC from generators and/or loads not providing it;
- Identification of stages and reporting requirements relating to the development of the long term incentive scheme, including further information on how the frequency control work will integrate with the Energy Security Board’s post-2025 market reform process.

### 4.3. Progressing the *Frequency control work plan*

Without milestones beyond the *Primary Frequency Response Requirements*, which AEMO are required to publish later in 2020, it is possible that the revised work plan will experience interruptions and delays similar to the original plan. Progress through the original work plan was also difficult to discern as there was no external reporting or stakeholder engagement provided during that period. Deferments within the three-year period may potentially lead to the extension of the obligation beyond the 4 June 2023 sunset, with unknown adverse impacts on future investment in PFC capability.

Stanwell suggests additional reporting obligations for AEMO to ensure timely progress through the work plan and sufficient transparency for affected stakeholders. This would be congruent with the recent *Monitoring and reporting on frequency control framework* rule. As AEMO will be internally monitoring outcomes of the work plan, publishing this information for the benefit of affected market participants should not be an onerous undertaking.

Stanwell recommends a regular reporting requirement on the two separate aspects encompassed by work toward improved PFC:

1. Actions taken to secure additional PFC, and frequency performance as a result. AEMO could incorporate this into their existing obligations to provide regular monitoring and reporting on frequency performance.
2. Progress toward the development of a suitable long term incentive mechanism for PFC.

To further enhance transparency for the benefit of market participants, it would be appropriate for AEMO to publish on their website:

- Details of the tranches being switched on, and the affected and exempted participants;
- Technical parameters for PFC providers such as deadband and droop requirements. This would be consistent with information already published regarding FCAS participants.



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