REGULATION FCAS CONTRIBUTION FACTOR (CAUSER PAYS) PROCEDURE CONSULTATION

DRAFT REPORT AND DETERMINATION

Published: **April 2018**

AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

NOTICE OF SECOND STAGE CONSULTATION

National Electricity Rules – Rule 8.9

Date of Notice: 6 April 2018

This notice informs all Registered Participants and interested parties (**Consulted Persons**) that AEMO is commencing the second stage of its consultation on amendments to the Causer Pays Procedure – to be renamed the Regulation FCAS Contribution Factor Procedure.

This consultation is being conducted under clause 3.15.6A(m) of the National Electricity Rules (**NER**), in accordance with the Rules consultation requirements detailed in rule 8.9 of the NER.

Invitation to make Submissions

AEMO invites written submissions on this Draft Report and Determination (**Draft Report**).

Please identify any parts of your submission that you wish to remain confidential, and explain why. AEMO may still publish that information if it does not consider it to be confidential, but will consult with you before doing so.

Consulted Persons should note that material identified as confidential may be given less weight in the decision-making process than material that is published.

Closing Date and Time

Submissions in response to this Notice of Second Stage of Consultation should be sent by email to CauserPaysConsultation@aemo.com.au, to reach AEMO by 5.00pm (Melbourne time) on **4 May 2018**.

All submissions must be forwarded in electronic format (both pdf and Word). Please send any queries about this consultation to the same email address.

Submissions received after the closing date and time will not be valid, and AEMO is not obliged to consider them. Any late submissions should explain the reason for lateness and the detriment to you if AEMO does not consider your submission.

Publication

All submissions will be published on AEMO's website, other than confidential content.

EXECUTIVE SUMMARY

The publication of this Draft Report and Determination (Draft Report) commences the second stage of the Rules consultation process conducted by AEMO to consider proposed amendments to the Procedure made under clause 3.15.6A(k) of the National Electricity Rules. This Procedure describes how AEMO determines the contribution factors that are used as the basis for recovering costs associated with procuring regulating raise and lower Frequency Control Ancillary Services (regulation FCAS),

Regulation FCAS is required to counteract small changes in power system frequency caused by changes in the supply-demand balance. AEMO enables this service to either raise or lower system frequency, and once enabled, these services are activated as needed every four seconds based on detected system frequency deviations.

Contribution factors are intended to attribute these costs to those market participants determined to have contributed to the need for frequency regulation in the recent past.

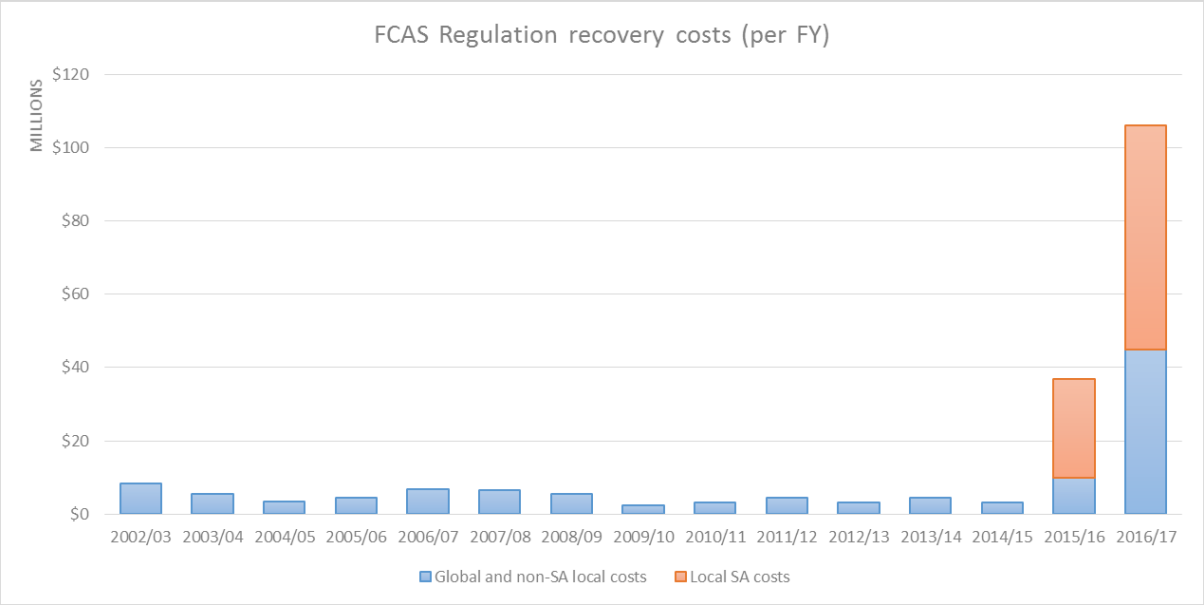
On 5 December 2016, AEMO published an Issues Paper[1] highlighting the key assumptions and settings used when calculating contribution factors, and identified practical options that may improve the current methodology. These options represent compromise between complexity, volatility, accuracy, and the utility of market signals provided.

AEMO received ten distinct submissions from 14 Consulted Persons (one submission was jointly developed by five companies, along with a consultant report, but tendered by each company separately).

AEMO held two workshops with stakeholders to discuss the matters raised in submissions and AEMO's prelimary consideration of these matters.

AEMO recognises the considerable weight of concerns expressed by stakeholders in submissions and through the workshops, which is reflective of a greater focus on regulation FCAS and the recovery arrangements. This is partly as a result of the increased cost of FCAS regulation, as shown below.

Figure 1 – FCAS Regulation costs



[1] https://www.aemo.com.au/-/media/Files/Stakeholder_Consultation/Consultations/Electricity_Consultations/2016/Causer-Pays-Procedures-Issues-Paper-Dec-16.pdf

AEMO also acknowledges the concerns raised by a number of stakeholders with the frequency control of the power system, and the contribution that regulation FCAS recovery may be having. During this Procedure consultation AEMO separately initiated work to better understand the issues with frequency control, and any interaction with the Procedure. This involved forming the Ancillary Service Technical Advisory Group (AS-TAG)[2], and engaging DigSILENT Pacific to investigate the degradation of frequency regulation in the normal operating frequency band.

AEMO initially intended to publish a draft report and determination in April 2017, however due to the concerns raised with the potential impact of the Procedure on frequency control, AEMO considered that it would be prudent to delay making a determination on the Procedure until its role in promoting frequency control could be clarified.

In October 2017 AEMO published a report from DigSILENT[3], which identified that the Procedure is perceived to be a factor in the degration of frequency control. In light of this, AEMO considers that amending the Procedure to address these concerns should be addressed as a priority, requiring those issues to be separated from the remaining proposals canvassed in the Issues Paper. Therefore AEMO's draft determination is to make a change to the Procedure to address issues associated with frequency control and the use of the frequency indicator (FI) value (identified as issue 14, and discussed in Section 4.14 of this Draft Report). AEMO seeks feedback from stakeholders on the implications of implementing changes to address concerns with primary frequency control, and any risks or concerns with the proposed approach.

AEMO proposes that the remaining issues, where alternative arrangements have been recommended, be pursued through subsequent consultations, and submissions to the AEMC's Frequency Control Frameworks Review.

A draft Procedure is published with this Draft Report. AEMO has also taken the opportunity to rename, restructure and streamline the contents of the Procedure based on its objectives under the NER. While these changes are significant in number, they do not affect the process of determining contribution factors, only the clarity, accuracy and readability of the Procedure.

[2] Terms of reference and other material is located at: https://www.aemo.com.au/Stakeholder-Consultation/Industry-forums-and-working-groups/Other-meetings/Ancillary-Services-Technical-Advisory-Group

[3] Report is located at: https://www.aemo.com.au/-/media/Files/Stakeholder_Consultation/Working_Groups/Other_Meetings/ASTAG/371100-ETR1-Version-30-20170919-AEMO-Review-of-Frequency-Control.pdf

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1. STAKEHOLDER CONSULTATION PROCESS

As required by clause 3.15.6A(m) of the NER, AEMO is consulting on proposed amendments to the Causer Pays Procedure, to be renamed the Regulation FCAS Contribution Factor Procedure (Procedure), for the recovery of regulation Frequency Control Ancillary Service (FCAS) costs. This consultation is conducted under the Rules consultation process in rule 8.9 of the National Electricity Rules (NER).

AEMO's Issues Paper described ten key issues relating to the current calculation of contribution factors, summarised in Section 2.3 of this Draft Report.

Submissions in the first stage of consultation were received from:

1. Australian Energy Council (AEC)
2. AGL Energy
3. CS Energy
4. EnergyAustralia
5. Engie
6. ERM Power
7. Hydro Electric Corporation
8. Origin Energy
9. Uniting Communities
10. Infigen Energy (member of Wind Coalition)
11. Pacific Hydro (member of Wind Coalition)
12. Tilt Renewables (member of Wind Coaltion)
13. Waterloo Wind Farm (member of Wind Coalition)
14. Woolnorth Wind Farm (member of Wind Coalition)
15. Consultant report from HARD software and Greenview Strategic Consulting[4]

In addition to the ten issues identified by AEMO, stakeholders also raised six issues AEMO considers to be material, and four other matters. Material issues relating to the options for amendment are summarised in Section 4 of this Draft Report, and a more detailed summary of AEMO's responses to submissions are in Appendix B.

AEMO held two workshops with participants to discuss submissions:

- Causer Pays Workshop #1, 20 March 2017
- Causer Pays Workshop #2, 21 April 2017

Minutes and actions from the workshops are published on the consultation page.

The publication of this Draft Report marks the commencement of the second stage of consultation.

AEMO's timeline for this consultation is outlined below. Future dates are indicative and may be adjusted depending on the number and complexity of issues raised in submissions.

Deliverable	Date
Notice of first stage consultation and Issues Paper published	5 December 2016
First stage submissions closed	24 February 2017
Draft Report & Notice of second stage consultation published	6 April 2018
Submissions due on Draft Report	4 May 2018

[4] The consultant report was engaged by the members of the Wind Coalition, and provided as an attachment to each of the Wind Coalition submissions.

Deliverable	Date
Final Report published	25 May 2018

2. BACKGROUND

2.1 NER requirements

Clause 3.15.6A(k) of the NER requires AEMO to prepare and publish a procedure for determining contribution factors, and sets out principles to be taken into account in preparing that procedure.

AEMO last reviewed the full Procedure with stakeholders in 2008. In March 2017, AEMO completed a consultation on the calculation of factors under clause 3.15.6A(j)(2) of the NER, to comply with an October 2016 decision by the Dispute Resolution Panel. That matter was run as a limited (single issue) consultation because of the tight timeframes associated with the Panel determination.

The matters considered in this consultation are broader and the outcomes from this consultation may ultimately revise or supersede the changes made through the March 2017 consultation.

2.2 Context for this consultation

2.2.1 Driver for review

In October and November 2015, multiple planned network outages in South Australia required regulation FCAS to be sourced locally, resulting in higher than average regulation FCAS costs. In December 2015, AEMO published a Market Event Report[5] analysing these market outcomes.

At the National Electricity Market Wholesale Consultative Forum held on 27 January 2016, AEMO summarised the methodology used to calculate contribution factors and stakeholders supported a review of the Procedure to ensure that it remained appropriate and effective.

In February 2016, a Market Participant initiated a dispute with AEMO under Rule 8.2 of the NER in relation to the FCAS recovery calculations in October and November 2015. To avoid prejudicing the outcomes of either process, AEMO suspended consultation on the Procedure until the disputed matter could be resolved by the Dispute Resolution Panel.

Following resolution of the dispute in October 2016, AEMO recommenced its process to undertake a comprehensive review of the Procedure. This review has moved into Stage 2 Consultation with this draft determination paper.

2.2.2 Delay in consultation

The initial date proposed for publication of a draft report and determination was April 2017. However during the initial stage of consultation AEMO identified fundamental issues in the interaction between the causer pays framework and the operation of frequency control. Concerns were raised that the operation of the Procedure may be impacting on the delivery of regulation services and primary frequency control. AEMO considered that it would be prudent to delay making a determination on the Procedure until its role in promoting frequency control could be clarified.

AEMO formed the Ancillary Service Technical Advisory Group (AS-TAG)[6] in May 2017 to provide assistance to AEMO in on the current and future ancillary service arrangements, and one of the first areas of focus was issues with frequency control. AEMO engaged DigSILENT Pacific to investigate the

[5] http://aemo.com.au/-/media/Files/PDF/NEM--Market-Event-Report--High-FCAS-Price-in-SA--October-and-November-2015.pdf
[6] Terms of reference and other material is located at: https://www.aemo.com.au/Stakeholder-Consultation/Industry-forums-and-working-groups/Other-meetings/Ancillary-Services-Technical-Advisory-Group

degradation of frequency regulation in the normal operating frequency band, and published a report from DigSILENT in October 2017[7].

One of the findings from the DigSILENT report is that the causer pays framework is perceived to be a factor in synchronous generation seeking to reduce governor response, and that this change to governor response is leading to degraded frequency control within the normal operating frequency band.

Based on the DigSILENT findings, AEMO is now proceding with the consultation process on the Procedure, focussing on short-term outcomes to address the governor response concerns.

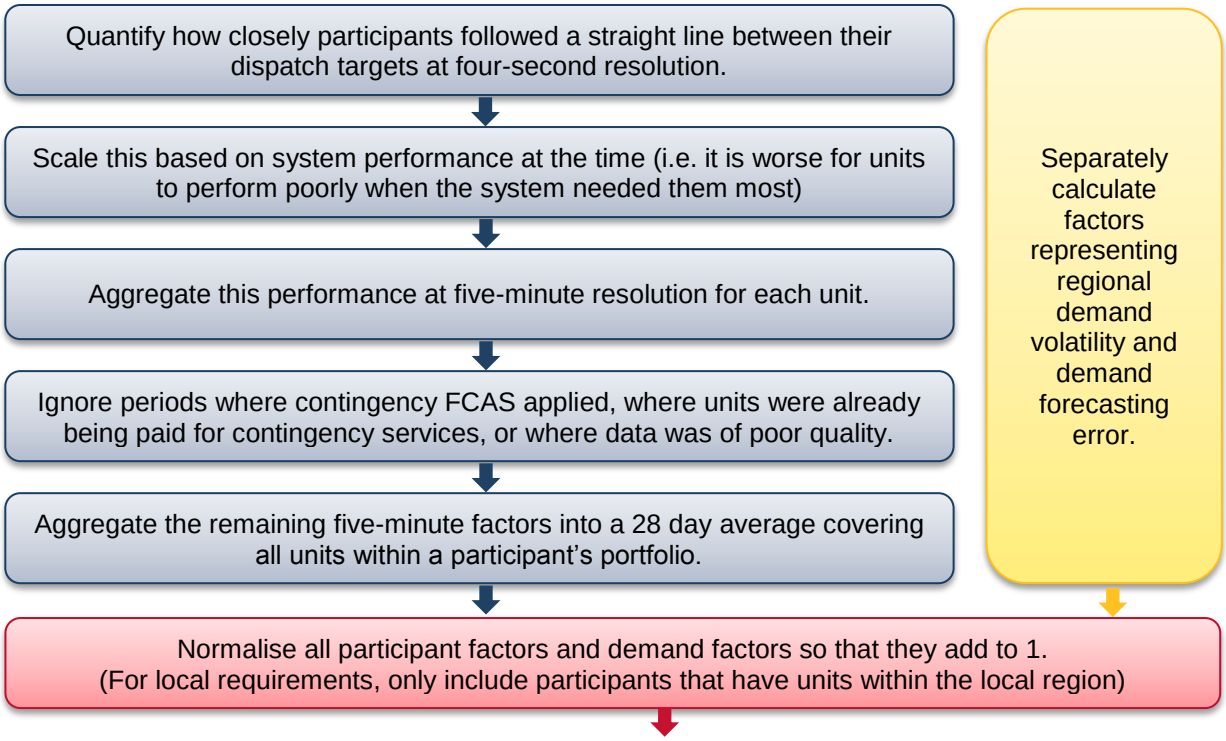
2.2.3 Regulation FCAS and Contribution Factors

Regulation FCAS is used to correct small changes in power system frequency caused by changes in the supply-demand balance. Through a five-minute spot market, AEMO enables regulation FCAS to either raise or lower system frequency. Once enabled, these services are activated as needed every four seconds based on detected system frequency deviations.

The costs of procuring regulation FCAS are recovered from market participants on the basis of contribution factors that attribute costs to those market participants determined to have contributed to the need for frequency regulation in the recent past. This contribution is determined with respect to the performance of a market participant's facilities with four-second metering, assessed on how closely a facility follows their dispatch targets and whether any deviation is helpful or unhelpful to maintaining frequency. A residual contribution factor is then determined to cover the contribution of all load and generation without metering equipment capable of ascertaining individual four-second performance. The residual contribution is recovered from market customers in proportion to total customer energy.

Figure 1 summarises the current procedure for determining the contribution of market participants, and Appendix A provides a more detailed description of the approach.

Figure 2 - Overview of current calculation process for market participant factors



[7] Report is located at: https://www.aemo.com.au/-/media/Files/Stakeholder_Consultation/Working_Groups/Other_Meetings/ASTAG/371100-ETR1-Version-30-20170919-AEMO-Review-of-Frequency-Control.pdf

Multiply these factors by the cost of procuring regulation services to recover costs.

2.3 Summary of Options from Issues Paper

The Issues Paper identified ten issues, and discussed several options for each. In particular:

No.	Issue	AEMO preferred option outlined in Issues Paper
1	Calculation of causer pays factors when regulation FCAS requirements apply within a local region	Calculate separate causer pays factors for each region and region combination. These factors would be based on the performance of units within the region or region combination, would be published in advance, and the appropriate factor would be applied based on the global or local FCAS requirements in effect.
2	Ability for positive and negative performance to balance within a portfolio	Causer pays factors would allow participants to leverage positive performance from one unit against negative performance from another unit within their portfolio (status quo).
3	Ability for positive and negative performance to balance across the sample period	Causer pays factors would be netted across the sample period, allowing a more representative view of average participant performance (status quo).
4	The most appropriate sample period, notice period, and application period	Causer pays factors will be calculated and published each week, based on unit performance over a one week period[8].
5	The treatment of non-metered market generation	Non-metered generators will be apportioned part of the residual factor, to align with their contributions to this factor. Currently non-metered generators are not apportioned any causer pays factor.
6	Resolving cases where all factors are positive	Where all causer pays factors are positive, regulation FCAS costs will be allocated to market customers through the residual demand factor.
7	Treatment of facilities with changing registration status during the sample period	In cases where units are registered or deregistered partway through the sample period, their causer pays factors will only be based on data collected while the units were classified as registered.
8	Producing factors when significant periods of input data are deemed unreliable or inapplicable	Where more than 80% of the sample period contains unreliable data, or uses contingency FCAS, the previous set of good causer pays factors will apply.
9	The appropriate form and granularity of published causer pays datasets	In addition to the causer pays factors for each participant, AEMO will publish the five-minute causer pays contributions for each unit, for regional demand variance, and for demand forecasting error, to allow participants to validate and analyse their factors.
10	Consolidation and clean-up of causer pays documentation	AEMO to clarify the current Procedure, and to include relevant sections of the design specification document in the Procedure.

[8] Note that the preferred option in the Issues Paper is not a recommendation from this draft report and determination.

3. SUMMARY OF MATERIAL ISSUES

The key material issues arising from the proposed options in the first stage of consultation are summarised in the following table:

No.	Issue	Raised by
1	Calculation of contribution factors when regulation FCAS requirements apply within a local region	AEMO
2	Ability for positive and negative performance to balance within a portfolio	AEMO
3	Ability for positive and negative performance to balance across the sample period	AEMO
4	The most appropriate sample period, notice period, and application period	AEMO
5	The treatment of non-metered market generation	AEMO
6	Resolving cases where all individual contribution factors are positive	AEMO
7	Treatment of facilities with changing registration status during the sample period	AEMO
8	Producing contribution factors when significant periods of input data are deemed unreliable or inapplicable	AEMO
9	The appropriate form and granularity of published datasets	AEMO
10	Consolidation and clean-up of procedure documentation	AEMO
11	Suitability of SCADA data as a basis for determining performance	ERM Power, Wind Coalition
12	The profile that is assumed when determining deviations	ERM Power, Wind Coalition
13	Reference trajectory used to determine deviations	ERM Power, Wind Coalition
14	Suitability of frequency indicator as weighting factor for determining performance	ERM Power, Wind Coalition
15	Different treatment of contingency events when determining performance	ERM Power
16	Aggregation of performance in the calculation of contribution factors	Wind Coalition

A detailed summary of the issues raised by Consulted Persons in submissions, together with AEMO's response, is contained in Appendix B. A high level discussion of the material issues, with AEMO's conclusions and reasons on each, is set out in Section 4. The conclusions and reasons have been considered with respect to the principles of the review, as set out in Section 2.4 of the Issues Paper.

4. DISCUSSION OF MATERIAL ISSUES

4.1 Calculation of contribution factors when regulation FCAS requirements apply within a local region

4.1.1 Issue summary and submissions

Local regulation FCAS requirements arise when AEMO requires FCAS services to be provided in a specific region or regions. In these cases, AEMO will put in place constraints in the dispatch process requiring procurement from a subset of regions.

When a local requirement exists within a mainland region, AEMO currently recovers the cost of that requirement from all participants with a market generating unit or customer load in the region, using the NEM-wide (portfolio) contribution factor for each of those participants. Specifically, the process:

- Calculates an individual global contribution factor for each market participant based on the performance of all its appropriately metered facilities[9] in the NEM.
- Ignores the individual factors for market participants that do not have market units in the local area.
- Redistributes the contribution factors, including a local residual factor, so that the cost of the local requirement is fully recovered.

While this approach ensures that local costs are only recovered from local participants, it also allows the performance of all of a market participant's appropriately metered facilities to impact the contribution factor for local requirements, including those that are outside the region of the local requirement. In the Issues Paper AEMO identified an alternative arrangement which involves separate contribution factors for each region or combination of regions, referred to as 'local factors'.

The proposal for local factors was broadly supported by stakeholders, except for the Wind Coalition who raised concerns about AEMO's current use of pre-contingent local requirements to manage power system security in the event of separation events.

4.1.2 AEMO's assessment

AEMO considers that local contribution factors would improve the effectiveness of the Procedure, by improving the locational signal for regulation services. In terms of how local factors are implemented, AEMO considers the most workable arrangement would be for seven sets of factors to be calculated in advance:

- Global factor
- Mainland factor (aggregate of mainland regions)
- Local factor for each separate region (five sets)

This arrangement would then cover the majority of local requirements that occur, both for synchronous and asynchronous operation. In the event of a local requirement that involves multiple regions (other than the entire mainland), local factors would be combined in the settlement process to derive the appropriate contribution factor.

As part of implementing local factors, AEMO considers it is necessary to address the calculation of the residual contribution factor. At the moment the NER require the residual factor for local requirements (referred to as the 'local residual') to be demand-scaled from the global residual factor. This can result in the apportionment between metered and non-metered facilities to diverge from the frequency performance within the region.

An alternative arrangement would be for the local residual to be directly calculated, and published in advance. AEMO believes that a Rule change would be required in order to reflect this change in the Procedure. Significant system changes will be required to implement local factors.

4.1.3 AEMO's conclusion

AEMO recommends that local contribution factors be adopted by a process of pre-calculating seven sets of factors through a change to the NER and subsequent Procedure and system changes.

Based on the additional processes and timeframes required to progress these changes, and the current identified priority of addressing primary frequency control, AEMO's draft determination is not to amend the Procedure to implement local contribution factors as part of this consultation.

[9] This can include generating units and scheduled loads with four-second metering. However, as the vast majority of individual participant contribution factors are derived from generating unit performance, for convenience this Draft Report typically refers only to generation.

4.2 Ability for positive and negative performance to balance within a portfolio

4.2.1 Issue summary and submissions

The current Procedure permits netting between positive and negative performance within a portfolio. This approach is intended to incentivise generating units to assist with frequency control when not enabled for regulation, as a way of offsetting other generation which may have negative performance. In the Issues Paper AEMO identified an alternative approach where netting was not permitted, or only partially permitted.

Stakeholder submissions had differing views on this issue, and raised the following:

- All stakeholders agreed that netting should not occur between generators in different regions where local requirements are in effect (consistent with the proposal for local contribution factors in Section 4.1)
- The AEC, ERM Power, Origin Energy and the Wind Coalition supported netting in other circumstances.
- CS Energy and Engie did not support netting, as they considered that the requirement for generators to follow dispatch instructions is not consistent with netting.
- CS Energy also proposed an alternative arrangement (the 'CS Energy netting proposal'), outlined below.
- Engie proposed an arrangement for a two-way causer pays framework, to replace the existing procurement of regulation FCAS by paying participants for providing positive performance.

The CS Energy netting proposal involves an additional step during aggregation where the contribution of metered and non-metered performance are apportioned:

- Non-metered performance is aggregated the same way as current, with positive and negative performance being allowed to offset.
- Metered performance is aggregated across all generators (i.e. a single portfolio containing all generators), to allow the fullest extext of offsetting.
- The relative weighting of metered and non-metered is then determined, and individual contribution factors are then determined on the basis of the weighting.

4.2.2 AEMO's assessment

AEMO has considered the matters raised by stakeholders, and formed the following view:

- Portfolio netting should not occur with respect to generators in different regions when local requirements are in effect.
- Portfolio netting should be retained, on the basis that it promotes positive frequency performance for generators that are not enabled for regulation FCAS.
- Positive frequency performance is consistent with dispatch compliance. Although during the workshops stakeholders raised concerns about specific examples of enforcement by the AER which may indicate that positive frequency performance is not appropriate, the advice the AER has provided AEMO has clarified they do not believe that positive frequency performance in and of itself is a compliance issue. Furthermore, the principles in clause 3.15.6A(k) of the NER explicitly identify that a scheduled facility that is not enabled but responds in a way that tends to reduce the aggregate deviation (i.e. positive frequency performance) should not be assessed as a contributor.

AEMO has also considered the CS Energy netting proposal, and discussed it with CS Energy. Although the proposal does appear to have merit, AEMO has not formed a view as to whether the proposal better

aligns with the principles of the review, as set out in the Issues Paper. Based on preliminary analysis, the proposal is expected to slightly increase the residual contribution, and consequently reduce the contribution from metered facilities. Further work is required to understand the impact of the proposal, and to seek the views of stakeholders on whether they consider the proposal to deliver an overall benefit.

The Engie proposal for a two-way causer pays framework is discussed in Section 4.4

4.2.3 AEMO's conclusion

AEMO recommends that portfolio netting be retained, and that netting should not occur across regions with respect to local contribution factors. As outlined in Section 4.1.3, AEMO's draft determination is not to amend the Procedure to implement local contribution factors as part of the current consultation.

AEMO is not in a position to recommend the CS Energy netting proposal at this time, but acknowledges that this proposal requires further consideration after the current consultation.

4.3 Ability for positive and negative performance to balance across the sample period

4.3.1 Issue summary and submissions

The current causer pays arrangements permit the netting of positive and negative performance across the sample period. This incentivises a generator to provide positive frequency performance as a way of reducing the impact of periods of negative performance.

Stakeholder submissions diverged on this issue:

- The AEC, Engie, ERM Power, Origin Energy and the Wind Coalition support netting.
- The AEC also suggested that netting should not occur where local requirements are in effect.
- CS Energy did not support netting, unless the CS Energy netting proposal was adopted (as discussed above)

4.3.2 AEMO's assessment

AEMO has considered the matters raised by stakeholders, and formed the view that:

- Netting of positive and negative performance across the sample period should be retained. Netting over the sample period provides an incentive to generators to provide positive performance, rather than to simply avoid negative performance. AEMO considers that positive frequency performance when not enabled is an important factor in reducing the amount of regulation FCAS which is required to operate the power system.
- Positive frequency performance is consistent with dispatch compliance, as discussed in Section 4.2.

4.3.3 AEMO's conclusion

AEMO's draft determination is that netting across the sample period be retained.

4.4 The most appropriate sample period, notice period, and application period

4.4.1 Issue summary and submissions

Market participant contribution factors are intended to reflect the extent to which a participant's facilities contribute to the need for frequency regulation. The NER require factors to be published at least ten

business days in advance, to provide a level of certainty to participants of their share of regulation FCAS costs[10].

The current process is based on a 28-day sample and application period, which has been in place since the Procedure came into operation in 2001. This timeframe represents a balance between:

- The operational practicality of calculating contribution factors.
- The requirement to publish factors in advance in order to provide cost certainty.
- Reflecting the most current frequency behaviour of facilities in a portfolio (i.e. being dynamic to changes in performance).

In the Issues Paper, AEMO identified a number of options:

- Status quo – a 28-day sample period and 28-day application period.
- Real-time factors, which would involve cost recovery being based on the performance within the 30 minute (or some other short) period.
- Seven-day sample and seven-day application period.

Stakeholder submissions had differing views on this issue, and raised the following:

- AGL Energy, EnergyAustralia, and Origin Energy support retaining the status quo.
- Engie proposed a shorter period, and suggested 14 days.
- ERM Power and the Wind Coalition supported a seven-day period.
- Hydro Electric Corporation proposed a longer sample period, and suggested a rolling average over 365 days.
- The Wind Coalition consultant report proposed that the sample period and application period should coincide.
- ERM Power also proposed that facilities that are out-of-service should be considered to have a factor of zero.
- Infigen Energy proposed that the sample and application period should be swapped (i.e. assessment of performance would occur after the period to which costs have accrued).
- CS Energy proposed an alternative arrangement which involved real time factors with no explicit dispatch of regulation services.

4.4.2 AEMO's assessment

AEMO indicated in the Issues Paper a preference for a seven day sample and application period, however AEMO has now formed the view that an adequate case for changing the existing 28-day sample and application period has not been made.

AEMO agrees with stakeholder views that there is some merit in each of the alternative options proposed, but considers that each option also carries disadvantages. The below summarises AEMO's assessment of the relative advantages and disadvantages of each option:

Option	Advantages	Disadvantages
Status quo (28-day sample and application period)	Provides adequate time for factors to be published in advance, within current operational practicalities.	Changes in frequency performance are not reflected for up to one month, which may be too slow to react to short-term changes in FCAS costs.
Real-time factors (including with the option of no explicit dispatch of regulation)	Allows changes frequency performance to be reflected immediately, and allows facilities to react to changing FCAS costs.	Does not allow cost certainty (other than by decommiting facilities), as factors would only be determined at the time they are applied.

[10] Note that the costs that a participant is exposed to will also be based on the ancillary service price for FCAS regulation services, and in the case of Market Customers, their customer energy.

Option	Advantages	Disadvantages
Seven-day or 14-day sample and application period	May provide a marginal improvement in reflecting changes to frequency performance.	More onerous operational process, and reduced period of notice.
Longer sample period (e.g. 365 days)	Addresses some concern about variability of contribution factors month-to-month	Changes in frequency performance will only be reflected progressively over a long period of time.
Sample and application period coincide	Allows facilities to better respond to changing FCAS costs	Promotes operation of power system where facilities are decommitted during periods of high FCAS prices, which may undermine security and reliability.
Swapping sample and application period		
Facilities out of service have a zero factor		

AEMO acknowledges the broader challenges in managing frequency control in light of the the changing generation mix, and considers that in the longer-term it is likely there will be a need for more dynamic quantities of regulation FCAS. Under these circumstances, the existing arrangements for recovery may no longer be appropriate, and some form of real-time recovery (which might include real-time contribution factors) may be more appropriate. On that basis AEMO considers that it would be prudent to retain the existing timing, and for real-time factors to be assessed as part of the AEMC's Frequency Control Frameworks Review.

4.4.3 AEMO's conclusion

AEMO's draft decision is to retain the existing 28 day sample and application period.. This differs from the preferred position identified in the Issues Paper which was a seven-day sample and application period. AEMO no longer considers there is merit in changing the timeframe in the short term.

4.5 The treatment of non-metered market generation

4.5.1 Issue summary and submissions

The current Procedure considers non-metered sources of deviation, which include demand volatility associated with loads and generators which are not metered[11] (primarily where they are not scheduled). The proportion of non-metered market generation has grown in recent years driven by the changing generation mix and the introduction of policy options like the Small Generation Aggregator framework. However the NER and the Procedure only recover the contribution from non-metered sources (which forms the residual factor) from market customers, on the basis of their energy consumption.

In the Issues Paper AEMO proposed a change to the NER and the Procedure for non-metered market generation to be included in the recovery of the residual factor. This proposal was supported in all stakeholder submissions.

4.5.2 AEMO's assessment

AEMO considers changing the recovery of the residual factor to include non-metered market generation appropriate. This would more efficiently allocate the costs of regulation FCAS. To give effect to this change, clause 3.15.6A(i)(2) of the NER will require amendment, as this clause currently restricts the recovery of the residual factor to market customers.

[11] Metering in this context refers to SCADA monitoring which meets AEMO's requirements

AEMO proposes that a Rule change be made to for the residual factor to be recovered from both market customers and non-metered market generators on the basis of energy in the appropriate trading interval. This would require a change to AEMO's settlement system.

4.5.3 AEMO's conclusion

AEMO recommends that the NER be changed to allow the residual factor of regulated FCAS cost recovery to be apportioned to both market customers and non-metered market generators.

Based on the timeframes required to progress this Rule change, and the current priority of addressing primary frequency control, AEMO's draft determination is not to implement the recommendation as part of this consultation.

4.6 Resolving cases where all individual contribution factors are positive

4.6.1 Issue summary and submissions

Under some circumstances, all contributions to frequency performance can be assessed as positive. This is most prevalent where factors are calculated for local requirements, such as the Tasmanian region.

In the Issues Paper, AEMO proposed that under the circumstances where no negative performance is identified, that the costs of regulation FCAS be allocated to market customers through the residual factor. This proposal was supported by all stakeholder submissions.

4.6.2 AEMO's assessment

AEMO considers that allocation of regulation FCAS costs to the residual factor when no negative performance is identified is consistent with the NER.

This arrangement is fully documented in the current Procedure. The arrangement does not require any system changes.

4.6.3 AEMO's conclusion

AEMO recommends that the Procedure be amended to allocate all regulation FCAS costs to the residual factor when all individual participant contribution factors are zero.

Based on the current priority of addressing primary frequency control, however, AEMO's draft determination is not to implement the recommendation as part of this consultation.

4.7 Treatment of facilities with changing registration status during the sample period

4.7.1 Issue summary and submissions

Units that are registered with AEMO for the first time part way during the sample period are currently treated as though they have contributed zero deviation prior to the effective date of the registration. This can result in a performance measure for the unit which is not representative of its actual performance in the first month of operation.

In the Issues Paper AEMO proposed treating the unit as having null deviations for periods prior to registration, so that the average over the sample period would only be based on actual deviations.

Stakeholder views were as follows:

- Engie and the Wind Coalition supported the proposed treatment.

- ERM Power proposed an alternative arrangement, in which the unit is considered to have either zero or null deviation depending on whether the unit results in an increase in the system requirement for regulation FCAS.

4.7.2 AEMO's assessment

AEMO considers that the proposed change to treat new units as a null value prior to registration is a preferable approach, as it minimises the delay in providing a frequency performance signal to the new unit.

AEMO does not support ERM Power's alternative arrangement for the following reasons:

- The proposal would add an additional level of complexity which is not warranted given the materiality of the issue.
- AEMO does not assess the need to increase the requirement for regulation FCAS with each new generator registration. The need for regulation is assessed with respect to frequency performance of the power system in meeting the Frequency Operating Standards.

During operation of the Procedure, AEMO has identified a number of registration scenarios that impact on the calculation and application of contribution factors:

- Changes of unit ownership during the sample period.
- Changes of unit ownership after publication of factors, and during the application period.
- Changes in registration category – specifically between market and non-market.
- Deregistration of a unit, where other generators remain in the portfolio.
- Deregistration of the last unit in a portfolio.

AEMO currently treats each scenario on a case-by-case basis, and in consultation with the impacted participants where a transfer of ownership is involved. However AEMO considers that a clear set of policies regarding registration changes should be included in the Procedure. This will assist market participants to determine how costs will be allocated during unit transfers.

4.7.3 AEMO's conclusion

AEMO recommends that the Procedure be amended to detail the treatment of registration changes during the sample and application period.

Based on the current priority of addressing primary frequency control, however, AEMO's draft determination is not to implement the recommendation as part of this consultation.

4.8 Producing contribution factors when significant periods of input data are deemed unreliable or inapplicable

4.8.1 Issue summary and submissions

AEMO currently disregards any five-minute periods where SCADA data is deemed to have been bad quality. This includes periods in which the frequency is outside the normal operating frequency band, as occurs during a large contingency event.

In the Issues Paper AEMO identified a potential issue if a significant proportion of SCADA data is deemed bad quality, and the remaining data is no longer a good representation of frequency performance. The likelihood of this is increased if a shorter sample period is implemented. AEMO proposed an arrangement for a minimum threshold for reliable SCADA data. If the threshold is not met then the factors to be determined would be based on the previous set of good factors.

Stakeholders were broadly supportive of AEMO's proposal, however ERM Power made an additional suggestion that the use of previous factors are a temporary arrangement until sufficient reliable data is available.

4.8.2 AEMO's assessment

Given AEMO's recommendation to retain the 28-day sample period, the potential for significant periods of unreliable SCADA data is low. However AEMO considers the adoption of a minimum threshold beneficial. This arrangement would not require any changes to the NER or AEMO's systems.

In respect to the ERM Power proposal for factors to be updated once sufficient reliable data is available, AEMO considers this would add additional complexity and uncertainty to the process, and is not warranted given the low risk of significant unreliable data.

4.8.3 AEMO's conclusion

AEMO recommends that the Procedure be amended to include a minimum threshold for reliable SCADA data, and to use a recent set of good performance data if the threshold is not met.

Based on the current priority of addressing primary frequency control, however, AEMO's draft determination is not to implement the recommendation as part of this consultation.

4.9 The appropriate form and granularity of published datasets

4.9.1 Issue summary and submissions

AEMO currently publishes the following datasets with respect to the Procedure:

- The contribution factor for each participant – these are published on AEMO's website in accordance with the NER, and are the factors that are used for settlement.
- A breakdown of performance factors for each DUID – this is intermediate data, and is helpful for participants to understand the individual contribution of generating units in their portfolio.
- Four-second input data – the raw data files that are published on a daily basis.

In the Issues Paper AEMO identified that the existing datasets do not permit participants to readily assess the frequency performance of their units at specific times during the sample period. AEMO proposed an additional dataset should be published, providing the aggregated five-minute performance measures for each DUID.

Stakeholders broadly supported AEMO's proposal. The Wind Coalition indicated that AEMO should also continue to publish the four-second input data.

4.9.2 AEMO's assessment

AEMO considers that the publication of five-minute performance factors for each DUID would provide a useful way for participants to analyse the performance of their generators over time, and identify periods when performance is having a greater impact on contribution factors. This should allow participants to more readily identify improvements to frequency performance, without the need to consume and process the large volume of four-second input data.

To implement the publication of additional data, changes to AEMO systems would be required. AEMO would also include details of the additional data in the Procedure.

4.9.3 AEMO's conclusion

AEMO recommends that additional datasets be published, including the aggregated five-minute performance of each DUID.

Based on the current priority of addressing primary frequency control, however, AEMO's draft determination is not to implement the recommendation as part of this consultation.

4.10 Consolidation and clean-up of procedure documentation

4.10.1 Issue summary and submissions

AEMO currently has multiple published documents relevant to the calculation of contribution factors and their application in settlements – specifically:

- The Procedure, which describes the methodology AEMO uses to calculate global factors, and factors for asynchronous operation[12].
- The Business Specification, which describes (amongst other things) the methodology AEMO has implemented to settle local requirements using the published global factors.

In the Issues Paper AEMO proposed to combine aspects of the Business Specification with the Procedure, to ensure the Procedure includes all matters related to the calculation and application of contribution factors.

Stakeholders were broadly supportive of AEMO's proposed approach.

4.10.2 AEMO's assessment

AEMO considers there is merit in having a Procedure which clearly sets out the calculation of contribution factors for both global and local requirements. AEMO also considers that some aspects of the current Procedure are confusing and potentially inaccurate, as the initial procedure was initially developed as a system document.

4.10.3 AEMO's conclusion

AEMO's draft determination is to amend the Procedure to:

- Remove detailed equations and specifications that are confusing and not required to understand the calculation methodology.
- Address anomalies and ambiguity that has come to light with market development over the past 10 years, making terminology more precise and consistent.
- Clarify the circumstances under which multiple dispatchable units shall be treated as a single unit for performance assessment, where they represent a single physical facility.
- Generally to improve clarity, accuracy and readability of the document.

As these amendments have resulted in a number of existing provisions being moved, expanded or in some cases removed, a mapping reference is provided in Section 6 of this Draft Report to assist stakeholders in their review of the Draft Procedure.

[12] The Procedure was updated in 2017 to include the calculation of factors for asynchronous operation.

4.11 Suitability of SCADA data as a basis for determining performance

4.11.1 Issue summary and submissions

ERM Power raised concerns that the existing mechanisms for receiving SCADA data may introduce a time lag, which can result in a mismatch between the MW SCADA value and the frequency indicator (FI) value which is used to weight deviations in the performance calculations.

The Wind Coalition identified that some generators have SCADA metering on a net basis, which can result in small negative values being recorded when the facility is not exporting energy (but is consuming energy for local purposes). This was raised as being inconsistent with the majority of large generators, which have separately-measured auxillary load.

The Wind Coalition consultant report provided analysis on the potential impact of SCADA delays. This analysis indicated that small delays (up to 16 seconds) do not have a material impact on the resulting causer pays factors.

4.11.2 AEMO's assessment

The provision of SCADA data to AEMO is critical to power system operations, and is governed by the Standard for Power System Data Communications[13]. Delays in communication can impact on AEMO's ability to manage power system security, and AEMO routinely follows up on issues with SCADA data.

AEMO acknowledges the analysis provided in the consultant report and undertook independent modelling of SCADA delays. The results of AEMO's analysis are consistent with the consultant report, which indicate that small SCADA delays (less than 16 seconds) do not introduce any material distortion into the calculation of causer pays factors. With respect to larger delays (greater than 16 seconds), AEMO would be concerned about the potential impact this may have to power system monitoring and dispatch.

In respect to the issue raised with negative SCADA values for generators, AEMO agrees that the metering arrangements can result in an inequity for generators. AEMO has formed the view that it would be appropriate to treat any negative SCADA values as 0 MW, in order to prevent generators being unfairly assessed for frequency performance when they are not exporting.

4.11.3 AEMO's conclusion

AEMO recommends that the existing process of using SCADA data be retained, however the Procedure should be amended to consider small negative SCADA values for generating units as 0 MW.

Based on the current priority of addressing primary frequency control, however, AEMO's draft determination is not to implement the recommendation as part of this consultation.

4.12 The profile that is assumed when determining deviations

4.12.1 Issue summary and submissions

ERM Power and the Wind Coalition consultant report raised concerns with the current approach of using a linear (straight line) trajectory between targets as the assumed profile for performance assessment. They identified that in some cases generators will operate in a way that is non-linear, for instance when their ramp rate allows a faster rate of change and where automatic generation control (AGC) utilises this higher ramp rate.

[13] Document located at: https://www.aemo.com.au/Electricity/IT-Systems/NEM

The Wind Coalition consultant report analysed alternative assumed profiles, including a “Heaviside” and “Logistic” profile.[14]

4.12.2 AEMO’s assessment

AEMO acknowledges the analysis conducted in the Wind Coalition consultant report, which identified that resultant causer pays factors are relatively insensitive to the choice of profile.

AEMO considers that the concept of the linear trajectory is an important aspect of power system operation, and it would be inconsistent to assess causer pays performance against a non-linear trajectory. On this basis and the analysis provided in the consultant report, AEMO considers that a linear trajectory remains appropriate.

4.12.3 AEMO’s conclusion

AEMO’s draft determination is to retain the existing linear profile.

4.13 Reference trajectory used to determine deviations

4.13.1 Issue summary and submissions

ERM Power and the Wind Coalition consultant report identified an issue with the current reference trajectory for scheduled and semi-scheduled facilities. At the moment, the reference trajectory is based on a target-to-target approach, using a linear trajectory from a previous dispatch target to the next dispatch target.

An issue arises when a facility is not able to meet the dispatch target at the end of the dispatch interval, and this results in the facility being assessed as having a deviation in the next dispatch interval as well.

An alternative approach proposed by ERM Power and the Wind Coalitiion consultant report is for an initial-to-target trajectory, which involves the trajectory starting at the metered output of the facility at the start of the dispatch interval.

4.13.2 AEMO’s assessment

AEMO acknowledges that this issue has been raised previously, and was considered as part of a Procedure consultation in 2007.

AEMO recognises that there are advantages and disadvantages of both reference trajectories, including:

- A target-to-target trajectory results in a continuous trajectory, with the starting point for each dispatch interval being the same as the end point of the previous dispatch interval. An initial-to-target trajectory results in a piecewise (i.e. non-continuous) trajectory, with a discontinuity at the dispatch interval boundary.
- When a facility is unable to meet its dispatch target at the end of a dispatch interval, a target-to-target trajectory results in deviations in both the dispatch intervals. An initial-to-target trajectory would not involve a deviation in the subsequent dispatch interval if the facility was able to follow a linear trajectory from it’s initial MW value to the dispatch target.

The diagrams below provide examples of the different trajectories for a scheduled generator and a semi-scheduled generator.

[14] Refer to page 13 of the Wind Coalition consultant report

Figure 3 – Reference trajectory for scheduled generator

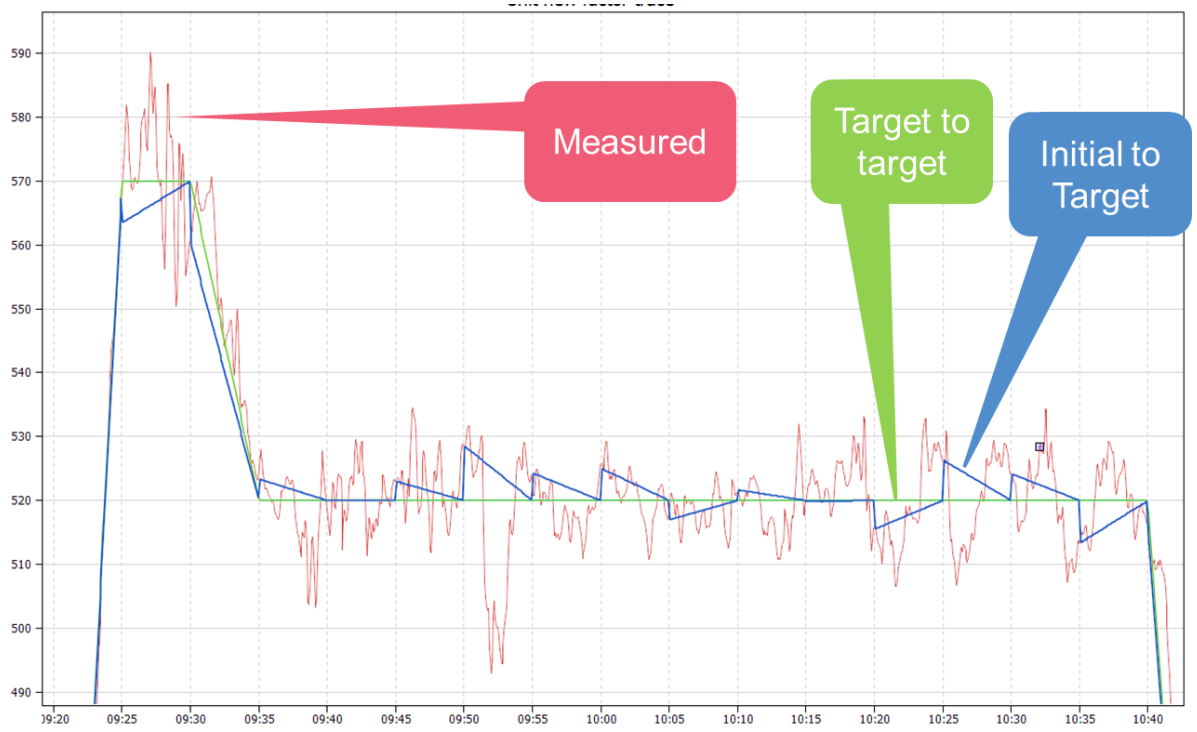


Figure 4 – Reference trajectory for semi-scheduled generator

AEMO has not conducted extensive modelling of the different trajectory options. However, based on a small sample of data it appears that the impact on contribution factors is relatively minor.

In consideration of the relative advantages and disadvantages of the existing and alternative reference trajectories and the small sample results, AEMO has not identified a case for change.

4.13.3 AEMO's conclusion

AEMO recommends that the existing target-to-target reference trajectory be retained. AEMO acknowledges the potential that alternative reference trajectories may lead to improved incentives for frequency performance, however further work would need to be undertaken to assess this.

4.14 Suitability of frequency indicator as weighting factor for determining performance

4.14.1 Issue summary and submissions

ERM Power raised concerns that the Frequency Indicator (FI) which is currently used as a weighting factor for deviations in the assessment of performance can introduce distortions in the calculation, because FI is not truly reflective of system frequency.

CS Energy, ERM Power and the Wind Coalition consultant report also identified that FI is not visible to participants in real time, and so does not permit participants to use the value as part of operational decision making to improve frequency performance.

4.14.2 AEMO's assessment

AEMO agrees with stakeholders that the FI value can in some cases not match the system frequency, and that this can lead to a distortion of the aseessment of frequency performance. AEMO's analysis shows that a mismatch between FI and system frequency can occur between 5% and 20% of the time, but is more likely when FI is at values close to zero (and system frequency is close to 50Hz).

This issue has been raised through the Ancillary Service Technical Advisory Group, and also identified in the DigSILENT report on Frequency Control Performance in the NEM under Normal Operating Conditions[15]. Given the concerns raised through AS-TAG that this issue may be leading to incentives for generators to limit their frequency response within the Normal Operating Frequency Band, AEMO considers that resolution of this issue is a high priority.

AEMO has considered several options to address the mismatch, including using alternative weighting factors in the contribution factor calculation. These options are set out in the following table.

Option	Implications	AEMO's assessment
Use locally-measured frequency	Involves all appropriately-metered facilities providing a locally-measured frequency with their MW value. Additional complexity introduced into the contribution factor calculation to account for each facility being assessed using a different weighting to ensure that factors are appropriately apportioned between categories.	AEMO does not consider this to be a workable solution in the short term. This option does have an additional benefit of resolving any SCADA delay concerns.
Use system frequency	Involves using the system frequency as a weighting factor.	AEMO considers this to be a workable solution, however acknowledges that it may not fully address concerns given the possibility for system frequency to be mismatched to locally-measured frequency due to SCADA delays.

[15] The report is published at: https://www.aemo.com.au/Stakeholder-Consultation/Industry-forums-and-working-groups/Other-meetings/Ancillary-Services-Technical-Advisory-Group

Option	Implications	AEMO's assessment
Ignore mismatched FI and system frequency	Involves AEMO ignoring 4-second samples where the FI value and system frequency are mismatched.	AEMO considers this as the most practical solution which would be relatively straightforward to implement.

AEMO's preferred approach is to implement changes to the performance measure calculations to ignore 4-second samples where the FI value is mismatched with system frequency. As identified in AEMO's analysis, this is expected to result in 5 to 20% of samples being ignored, which under most circumstances should not impact the integrity of the calculation process. In cases where a significant number of samples are excluded (for example, more than 50%), AEMO's approach would be to reject the values for the entire dispatch interval as not being of acceptable quality.

In analysing the occurrence of mismatches between FI and system frequency, AEMO reviewed the current approach to identifying dispatch intervals that may be subject to contingency events. At present a dispatch interval is treated as subject to a contingency event if there is one or more 4 second samples in which the system frequency is outside the normal operating frequency band. In implementing AEMO's preferred approach to ignore samples where the FI is mismatched, it will be necessary to amend the threshold for contingency events. AEMO proposes that the threshold would be set based on historical analysis of frequency data.

In addition, AEMO considers that publication of the FI value in close to real time is an important measure to provide participants with better information on which to make operational decisions to improve frequency performance.

4.14.3 AEMO's conclusion

AEMO's draft determination is to amend the Procedure to provide that 4-second samples in which the FI and system frequency are mismatched will be ignored, and that will AEMO publish FI values close to real-time.

4.15 Different treatment of contingency events when determining performance

4.15.1 Issue summary and submissions

ERM Power raised a concern that the current arrangements unfairly discriminate against small generation which is subject to a rapid generator trip (for example through the action of protection equipment). When a large generator trips, it is likely that the resulting supply-demand imbalance will lead to the frequency falling outside the normal operating frequency band and for contingency FCAS to be required. Trips of small generators will have less impact on the supply-demand imbalance and are likely to be addressed by the operation of AGC procured through regulation FCAS. This can result in the frequency remaining within the normal operating frequency band, and the small generator being assessed as having negative performance due to the deviation between actual output and their reference trajectory.

It was proposed that a generator trip of any size should result in the dispatch interval being excluded from the contribution factor calculation.

4.15.2 AEMO's assessment

AEMO has considered the issue, and formed the view that the current arrangements unfairly discriminate between generation (and also metered loads) of different sizes.

In order to address this, a process would need to be established which involves:

- Notification to AEMO by the market participant where they believed that a generator trip has occurred.
- Confirmation by AEMO of the generator trip.
- Exclusion of associated dispatch intervals (and potentially the subsequent dispatch interval) for confirmed generator trips.

AEMO proposes that this process would operate for scheduled, semi-scheduled and non-scheduled generators, as well as metered loads.

4.15.3 AEMO's conclusion

AEMO recommends that the Procedure allows for the notification of generator trips to AEMO, and where an unforced outage has been confirmed that the corresponding dispatch interval is excluded from the contribution factor assessment.

Based on the current priority of addressing primary frequency control, however, AEMO's draft determination is not to implement the recommendation as part of this consultation.

4.16 Aggregation of performance in the calculation of contribution factors

4.16.1 Issue summary and submissions

The Wind Coalition consultant report raised concerns that the existing process of aggregating performance across multiple time horizons may result in unfavourable outcomes, particularly where there are short periods of poor performance. At present, performance is aggregated by using a time-weighted average calculation, both at the four-second level and the five-minute level.

The report proposed an alternative arrangement based on a median calculation for aggregation of five-minute factors. The analysis provided indicated that performance for intermittent generation was improved, as the median calculation is relatively insensitive to outliers caused by extremely poor performance.

4.16.2 AEMO's assessment

AEMO has considered the proposal and the analysis provided, and formed the view that a change is not warranted. AEMO believes that the requirement for regulation FCAS is better reflected by average frequency performance of metered and non-metered facilities, rather than median (i.e. mid-point) performance. A median calculation would tend to ignore extremely good or poor performance, which may lead to weaker incentives for improving performance.

4.16.3 AEMO's conclusion

AEMO's draft determination is to retain the existing average calculation for aggregation of performance in the calculation of contribution factors.

5. OTHER MATTERS

A number of other matters were raised by stakeholders during the first round of consultation, which AEMO considers not to be material issues to the matter under consultation. The following sections outline these matters, and AEMO's consideration of them.

5.1 Price settings for FCAS

Engie suggested an alternative approach to addressing concerns with the cost recovery of regulation FCAS, by changing the Market Price Cap (MPC) and Cumulative Price Threshold (CPT) for the FCAS market. They considered this a more practical solution, rather than introducing additional complexity into the Procedure.

AEMO considers this option outside the scope of the review, and not a matter that AEMO can directly address. The reliability settings (which include the MPC and CPT) are a matter for the Reliability Panel, and stakeholders may wish to raise this matter during consultation as part of the Panel's regular reviews of reliability settings.

5.2 Intermittent generation forecasting

The Wind Coalition raised concerns that issues with forecasting of intermittent generation are contributing to higher regulation FCAS costs for some generators.

AEMO has engaged with generators on these concerns, and has identified that they do not directly relate to the Procedure. On this basis AEMO considers the matter outside the scope of this review.

AEMO acknowledges there are a range of factors that may be impacting on the suitability of intermittent generation forecasts, and has been progressing these through several measures including:

- Changes to the Energy Conversion Model (ECM) Guidelines to permit estimated power information to be directly supplied through SCADA.
- Working with distribution network service providers to allow network constraints to be in place to better reflect export limitations for distribution-connected generators (particularly during planned network outages).

5.3 Potential barriers to entry

Uniting Communities raised concerns that the existing arrangements for recovering regulation FCAS costs may act as a barrier to entry for prospective participants, and provide an advantage to incumbent participants with a range of generation in their portfolio.

AEMO acknowledges that the existing arrangements may present risks for new participants, particularly with respect to high regulation FCAS costs and potentially limited options to manage this exposure. However AEMO considers that the arrangements are required to provide appropriate incentives for good frequency performance, both for incumbent participants with a range of generation, and for prospective participants. If generators are incentivised to invest in plant to better manage frequency performance, in the longer term this can be expected to reduce the overall requirement for AEMO to procure regulation FCAS.

5.4 Market complexity

Uniting Communities raised concerns that the existing arrangements for recovering regulation FCAS costs are highly complex, and any further changes are likely to only increase this complexity.

AEMO shares the concern that the arrangements (including the Procedure) are complex, and this can present challenges in determining how costs are passed through to consumers. However AEMO considers that the essential structure of the current recovery arrangements should be preserved to provide adequate incentives for good frequency performance, and thereby reduce the overall costs of regulation FCAS in the long term interests of consumers. A simple user pays approach is unlikely to provide adequate incentives.

6. DRAFT DETERMINATION

After considering the submissions received, AEMO's draft determination is to amend the Procedure to:

- Adopt changes to address issue 14, as set out in Section 4.14. This is consistent with the findings from the DigSILENT report, and AEMO's assessment of the need to address concerns with primary frequency control as a priority.
- Consolidate and clean-up the Procedure documentation to address issue 11, as set out in Section 4.11. These drafting changes are intended to streamline the documentation, ensure consistency with the purpose of the Procedure as specified in the NER, and improve the readability, accuracy and clarity of the Procedure.

AEMO proposes that the remaining issues, where alternative arrangements have been recommended, be pursued through subsequent consultations, and submissions to the AEMC's Frequency Control Frameworks Review.

The draft Procedure is published with this Draft Report as Attachment 1. In order to address issue 11, the draft Procedure is significantly different to the current Procedure, although the extent of material changes is relatively small. AEMO is therefore not able to provide a change-marked version of the draft Procedure. However to assist participants in understanding the scope and structure of the new document, the following table maps the provisions of the current Procedure to the revised draft Procedure, and indicates any deleted material.

Existing Procedure Section	Existing Procedure section title or note	Draft Procedure Section	Draft Procedure section title or note
1	Introduction		
1.1	Purpose and scope	1.1	Purpose and scope
1.2	Definitions and interpretation	1.2	Definitions and interpretation
1.3	Related documents	1.3	Related documents
2	General principles	2	General principles
3	Calculation of contribution factors		
3.1	Process overview	3	Overview of the calculation process
3.2	Gather and store data		
3.2.1	Data sources and types	4.1	Gather 4-second data
-	Note: Not in existing Procedure	4.2	Estimating FIs and preprocessing
3.2.2	Process	5.1	Determine 4-second deviation values
3.3	Determine reference trajectories	5.1	Determine 4-second deviation values
3.4	Calculate and store deviations for all causer types		
3.4.1	Overview	5.1	Determine 4-second deviation values
3.4.2	Deviation components	-	Note: Section removed, as not relevant to Procedure
3.4.3	Determine the deviation components	5.1	Determine 4-second deviation values
3.4.4	Process to calculate the deviation components	5.1	Determine 4-second deviation values
3.4.5	Allocate the deviation components	5.1	Determine 4-second deviation values
3.5	Calculate and assign 5-minute factors		
3.5.1	Calculate 4-second performance measures	5.2	Scale deviations by the FI

Existing Procedure Section	Existing Procedure section title or note	Draft Procedure Section	Draft Procedure section title or note
3.5.2	Calculate 5-minute factors	6.1	Categorise and aggregate 4-second performance measures
3.5.3	Remove factors that have been affected by contingency events	6.2	Exclude periods affected by contingencies or bad SCADA
3.6	Settlement factor calculation	3	Overview of the calculation process
3.7	Allocate each 5-minute factor to a category	6.1	Categorise and aggregate 4-second performance measures
3.8(a) – (e)	Sum the 5-minute factors	6.3	Aggregate to 28-day factors for a unit or load
3.8(f) – (k)	Sum the 5-minute factors	7.2	Aggregate unit or load factors into area portfolio factors
3.8(l) – (o)	Sum the 5-minute factors	7.3	Calculate area totals for component types
3.8(p)	Sum the 5-minute factors	7.4	Calculate additional derived totals
3.9	Normalise factors across all regions	7.5	Normalise to produce area contribution factors
3.10	Aggregate contribution factors	7.3	Calculate area totals for component types
3.11	Process for positive contribution factors	7.3	Calculate area totals for component types
3,12	Determine monthly contribution factors (percentage attributable)	7.3	Calculate area totals for component types
3.13	Determine the residual	7.3	Calculate area totals for component types
3.14	Applying contribution factors in AEMO's settlement systems	-	Note: Section removed, as not relevant to Procedure
3.15	Allocate residual costs	-	Note: Section removed, as not relevant to Procedure
-	Note: Not in existing Procedure	7.6	Normalise to produce global requirement contribution factors
4	Published informaiton	9	Published data
5	Dealing with regions when they become electrically separated		
5.1	Separation during sample period	8	Local requirement contribution factors
5.2	Contribution factors for periods of asynchronous operation		
5.2.1	Overview	8.1	General
5.2.2	Identifying relevant market participants	8.2	Identifying relevant market participants
5.2.3	Calculating CMPF, CRMPF and RAMPF values	8.3	Calculating CMPF, CRMPF and RAMPF values
5.2.4	Calculating individual market participant contribution factors for asynchronous operation	8.4	Individual and residual contribution factors
5.2.5	Calculating aggregate residual contribution factors for asynchronous operation	8.4	Individual and residual contribution factors
5.2.6	Estimating CMPF and CRMPF values	8.5	Estimating CMPF and CRMPF values

APPENDIX A. GLOSSARY

Term or acronym	Meaning
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator Limited
AGC	Automatic generation control
Application period	The period over which calculated Market Participant Factors are used to allocate Regulation FCAS costs to individual participants.
Appropriate metering	Metering (of generating plant or load) sufficient to allow the individual contribution of the relevant Market Participant to the aggregate deviation in frequency of the power system to be addressed.
AS-TAG	Ancillary Service Technical Advisory Group
Asynchronous	Not connected to another part of the NEM transmission grid by an operational alternating current (AC) link.
AWEFS	Australian Wind Energy Forecasting System
Business Specification	The Efficient Dispatch and Localised Recovery of Regulation Services Business Specification as published by AEMO.
Causer pays factor	Same as MPF
Causer Pays Procedure or CPP	The "Causer Pays: Procedure for Determining Contribution Factors" prepared under clause 3.15.6A(k) of the NER.
CMPF	Constraint Market Participant Factor – the sum of the MPFs applicable to the recovery of the costs of a local requirement from Market Participants with appropriate metering in the region(s) where that requirement applies.
Contribution factor	Same as MPF
CPT	Cumulative Price Threshold
CRMPF	Constraint Residual Market Participant Factor – the RMPF applicable to the recovery of the costs of a local requirement from Market Customers without appropriate metering in the region(s) where that requirement applies.
DRP	Dispute Resolution Panel constituted for a decision under rule 8.2 of the NER.
DRP determination	Determination of the DRP (PRD Gray QC, GH Thorpe and LM McMillan) dated 3 October 2016 and Reasons dated 2 September 2016 in relation to a dispute between Origin Energy Electricity Ltd, AEMO, a group of South Australian wind farm operators, and others.
FCAS	Frequency control ancillary services
FI	Frequency indicator, a parameter derived from AGC that indicates the requirement for Regulation FCAS.
Global, global requirement	Global ancillary service requirement as defined in the NER
Local, local requirement	Local ancillary service requirement as defined in the NER (this arises from a constraint imposed by AEMO that requires FCAS to be sourced from an identified NEM region or regions).
MPC	Market Price Cap
MPF	Market Participant Factor (contribution factor) for a Market Participant with appropriate metering (NER clause 3.15.6A(i)(1)).

Term or acronym	Meaning
Negative (unhelpful) performance	Refers to a frequency performance that results in a greater need for regulation FCAS.
NEM	National Electricity Market
NER	National Electricity Rules
Positive (helpful) performance	Refers to frequency performance that reduces the need for regulation FCAS.
Regulation FCAS	A regulating raise service or regulating lower service as defined in the NER.
Residual factor or RMPF	The residual factor represents frequency deviations not caused by facilities with adequate metering. This component of regulation FCAS costs are currently recovered from market customers in proportion to their energy.
SA	The South Australia region of the NEM.
Sample period	The period over which 4-second performance data is collected and processed to calculate Market Participant Factors.
SCADA	Supervisory Control and Data Acquisition
Wind Coalition	Group of Registered Participants, consisting of Infigen Energy, Pacific Hydro, Tilt Renewables, Waterloo Wind Farm, and Woolnorth Wind Farm Holdings

APPENDIX B. SUMMARY OF SUBMISSIONS AND AEMO RESPONSES

No.	Name	Issue	AEMO response
Issue 1: Calculation of contribution factors when regulation FCAS requirements apply within a local region			
1.	Australian Energy Commission	Support calculating local factors only on the basis of units within local requirements, however notes the proposed Option 2 involves a considerable amount of additional analysis by AEMO for outcomes which may never eventuate. Suggest an alternative approach of publishing pre-calculated factors for the five regions, and the recalculate accurate factors based on the actual local requirements on an as required basis.	This is consistent with AEMO's proposed approach, as set out in Section 4.1.
2.	AGL Energy	Support calculating local factors only on the basis of units within local requirements.	This is consistent with AEMO's proposed approach, as set out in Section 4.1.
3.	CS Energy	Support calculating local factors only on the basis of units within local requirements	This is consistent with AEMO's proposed approach, as set out in Section 4.1.
4.	Engie	Support calculating local factors only on the basis of units with local requirements, however considers Option 3 to be more preferable as it a simplified version of Option 2.	This is consistent with AEMO's proposed approach, as set out in Section 4.1.
5.	ERM Power	Support calculating local factors only on the basis of units within local requirements, however notes the proposed Option 2 involves a considerable amount of additional analysis by AEMO for outcomes which may never eventuate. Suggest an alternative approach of publishing pre-calculated factors for the five regions, and the recalculate accurate factors based on the actual local requirements on an as required basis.	This is consistent with AEMO's proposed approach, as set out in Section 4.1.
6.	Origin Energy	Support calculating local factors only on the basis of units within local requirements, and considers that Option 2 is the most appropriate approach.	This is consistent with AEMO's proposed approach, as set out in Section 4.1.
7.	Wind Coalition	Does not support calculating local factors for synchronous operation due to a lack of clarity of what is actually occurring at a power system level. However does support local factors for asynchronous operation.	AEMO does not agree with the stated position, and believes there is adequate clarity on what constitutes a local requirement both for synchronous and asynchronous operation.
Issue 2: Ability for positive and negative performance to balance within a portfolio			
8.	Australian Energy Commission	Support allowing positive and negative performance to be netted within a portfolio, except where local requirements are activated.	This is consistent with AEMO's proposed approach, as set out in Section 4.2.

No.	Name	Issue	AEMO response
9.	CS Energy	Concerned that the NER requirement for participants to strictly follow dispatch instructions (except where they are enabled to provide regulation services) is not consistent with allowing offsetting of positive and negative performance within a portfolio. However considers that offsetting may be appropriate if the approach outlined ("CS Energy netting proposal") is adopted.	AEMO does not agree, and contends that the provision of positive frequency performance when not enabled is consistent with dispatch compliance – this is discussed in Section 4.2. AEMO acknowledges the CS Energy netting proposal does have merit, and has considered this option in Section 4.2.
10.	Engie	Does not support offsetting positive and negative performance within a portfolio, on the basis that dispatch compliance must be done on individual units (and not the portfolio). However proposes an alternative option of a two-way causer pays framework.	AEMO does not agree, and contends that the provision of positive frequency performance when not enabled is consistent with dispatch compliance – this is discussed in Section 4.2. AEMO acknowledges there may be merit in a two-way causer pays framework, and has suggested this be considered in the AEMC's Frequency Control Framework Review – this is discussed in Section 4.4.
11.	ERM Power	Support allowing positive and negative performance to be netted within a portfolio, except where local requirements are activated. Confirmation was sought on whether enabled generators are also permitted netting.	This is consistent with AEMO's proposed approach, as set out in Section 4.2. In regards to facilities that are enabled for regulation, these are separately aggregated to facilities that are not enabled. This ensures that positive contributions from enabled generators can be excluded.
12.	Origin Energy	Support allowing positive and negative performance to be netted within a portfolio.	This is consistent with AEMO's proposed approach, as set out in Section 4.2.
13.	Wind Coalition	Support allowing positive and negative performance to be netted within a portfolio, however concerned about the impact of local requirements.	This is consistent with AEMO's proposed approach, as set out in Section 4.2.
Issue 3: Ability for positive and negative performance to balance across the sample period			
14.	Australian Energy Commission	Support allowing positive and negative performance to be netted within a portfolio across the sample period, except where local requirements are activated.	This is consistent with AEMO's proposed approach, as set out in Section 4.3.
15.	CS Energy	As per issue 2, does not support offsetting, unless CS Energy netting proposal is adopted.	AEMO does not agree, and contends that the provision of positive frequency performance when not enabled is consistent with dispatch compliance – this is discussed in Section 4.3. AEMO acknowledges the CS Energy netting proposal does have merit, and has considered this option in Section 4.2.
16.	Engie	Support allowing positive and negative performance to be netted within a portfolio across the sample period.	This is consistent with AEMO's proposed approach, as set out in Section 4.3.

No.	Name	Issue	AEMO response
17.	ERM Power	Support allowing positive and negative performance to be netted within a portfolio across the sample period, except where local requirements are activated.	This is consistent with AEMO's proposed approach, as set out in Section 4.3.
18.	Origin Energy	Support allowing positive and negative performance to be netted within a portfolio across the sample period.	This is consistent with AEMO's proposed approach, as set out in Section 4.3.
19.	Wind Coalition	Support allowing positive and negative performance to be netted within a portfolio across the sample period.	This is consistent with AEMO's proposed approach, as set out in Section 4.3.
Issue 4: The most appropriate sample period, notice period, and application period			
20.	AGL Energy	Does not support changing the sample period, and considers the existing 28-day sample and application period is appropriate.	This is consistent with AEMO's proposed approach, as set out in Section 4.4.
21.	CS Energy	Does not support real time factors, unless implemented as part of a two-way causer pays framework that procures regulation by positive causer pays performance (instead of the current enablement).	AEMO acknowledges there may be merit in a two-way causer pays framework, and has suggested this be considered in the AEMC's Frequency Control Framework Review – this is discussed in Section 4.4.
22.	EnergyAustralia	Supports the retention of the current 28-day sample and application period. Considers that real-time factors would not be appropriate, and would create perverse incentives.	This is consistent with AEMO's proposed approach, as set out in Section 4.4
23.	Engie	Support a shorter sample and application period, but suggests a 14 day period.	AEMO does not agree, and considers that the merits of a shorter sample and application period are outweighed by the impacts of greater volatility and poorer data reliability – this is discussed in Section 4.4.
24.	ERM Power	Support a shorter sample and application period, preferably real-time, but considers that 7-day period would be acceptable. However if real-time factors are not implemented, proposes that facilities that are out of service are considered to have a factor of zero.	AEMO does not agree, and considers that the merits of a shorter sample and application period are outweighed by the impacts of greater volatility and poorer data reliability – this is discussed in Section 4.4. AEMO does not support out of service generators being treated as a factor of zero, as this is not consistent with the incentives to improve performance.
25.	Infigen Energy	Proposes that the application period and sample period be swapped (i.e. assessment of performance would occur after the period to which costs have accrued).	AEMO does not support this proposal, as it undermines incentives to make investment decisions on better frequency performance, in favour of opportunistic frequency behaviour.
26.	Hydro Electric Corporation	Support a longer sample period of 365 days, and considers that real-time factors are not appropriate.	AEMO does not agree, and considers that extending the sample and application period to 365 days would diminish the incentives to improve performance – this is discussed in Section 4.4.

No.	Name	Issue	AEMO response
27.	Origin Energy	Does not support changing the sample period, and considers the existing 28-day sample and application period is appropriate.	This is consistent with AEMO's proposed approach, as set out in Section 4.4.
28.	Wind Coalition	Supports moving to a 7-day sample period, as an interim step whilst a framework for real-time factors is constructed.	AEMO does not agree, and considers that the merits of a shorter sample and application period are outweighed by the impacts of greater volatility and poorer data reliability – this is discussed in Section 4.4.
29.	Wind Coalition consultant report	Proposed that the sample period and application period should coincide, on the basis that this is a fairer implementation of the causer pays principle.	AEMO does not agree, and considers that publication of the factors in advance of the application period is an important principle in providing cost certainty for participants – this is discussed in Section 4.4.
Issue 5: The treatment of non-metered market generation			
30.	CS Energy	Support the allocation of a portion of the residual to non-metered generation.	This is consistent with AEMO's proposed approach, as set out in Section 4.5.
31.	Engie	Support the allocation of a portion of the residual to non-metered generation.	This is consistent with AEMO's proposed approach, as set out in Section 4.5.
32.	ERM Power	Support the allocation of a portion of the residual to non-metered generation.	This is consistent with AEMO's proposed approach, as set out in Section 4.5.
33.	Wind Coalition	Support the allocation of a portion of the residual to non-metered generation.	This is consistent with AEMO's proposed approach, as set out in Section 4.5.
Issue 6: Resolving cases where all individual contribution factors are positive			
34.	CS Energy	Support the allocation of costs to market customers with all factors are positive.	This is consistent with AEMO's proposed approach, as set out in Section 4.6.
35.	Engie	Support the allocation of costs to market customers with all factors are positive.	This is consistent with AEMO's proposed approach, as set out in Section 4.6.
36.	ERM Power	Support the allocation of costs to market customers with all factors are positive. Also suggests that the contribution of non-metered generation should be recovered from these facilities.	This is consistent with AEMO's proposed approach, as set out in Section 4.6.
37.	Wind Coalition	Support the allocation of costs to market customers with all factors are positive.	This is consistent with AEMO's proposed approach, as set out in Section 4.6.

No.	Name	Issue	AEMO response
Issue 7: Treatment of facilities with changing registration status during the sample period			
38.	Engie	Support AEMO's proposal for treatment of registration changes.	This is consistent with AEMO's proposed approach, as set out in Section 4.7.
39.	ERM Power	Proposes that a NULL should be used if there is a change to the system requirement for FCAS regulation, otherwise a ZERO should be used.	AEMO does not support this proposal, as the level of complexity required to perform the assessment is not warranted given the issue only occurs during the first few weeks of registration.
40.	Wind Coalition	Support AEMO's proposal for treatment of registration changes.	This is consistent with AEMO's proposed approach, as set out in Section 4.7.
Issue 8: Producing contribution factors when significant periods of input data are deemed unreliable or inapplicable			
41.	Engie	Support AEMO's proposal for treatment of unreliable data	This is consistent with AEMO's proposed approach, as set out in Section 4.8.
42.	ERM Power	Support AEMO's proposal for treatment of unreliable data. An additional suggestion was made that this be a temporary arrangement until sufficient reliable data is available.	This is consistent with AEMO's proposed approach, as set out in Section 4.8. AEMO does not support the additional suggestion, as it would add additional complexity and uncertainty to the process and is not warranted given the low risk of significant unreliable data.
43.	Wind Coalition	Concerned that no clear position has been identified where major data errors occur.	AEMO expects that the risk of unreliable data will be very low, based on the proposed approach of retaining the 28-day sample period.
Issue 9: The appropriate form and granularity of published datasets			
44.	Engie	Support AEMO's proposal for publication of causer pays datasets	This is consistent with AEMO's proposed approach, as set out in Section 4.9.
45.	ERM Power	Support AEMO's proposal for publication of causer pays datasets	This is consistent with AEMO's proposed approach, as set out in Section 4.9.
46.	Wind Coalition	Support AEMO's proposal for publication of causer pays datasets, however proposes that existing 4 second data continue to be made available	This is consistent with AEMO's proposed approach, as set out in Section 4.9.
Issue 10: Consolidation and clean-up of procedure documentation			
47.	Engie	Supports AEMO's proposal for documentation to be consolidated and cleaned up.	This is consistent with AEMO's proposed approach, as set out in Section 4.10.

No.	Name	Issue	AEMO response
48.	Wind Coalition	Support further information being included in the procedure to assist participants with understanding the process.	This is consistent with AEMO's proposed approach, as set out in Section 4.10.
Issue 11: Suitability of SCADA data as a basis for determining performance			
49.	ERM Power	Concerned that latencies that may exist in the transmission of SCADA data may result in a time mismatch for the MW values being used in the causer pays calculation.	AEMO has considered the potential for time mismatches to arise in the collection of SCADA data, but formed the view that the occurrence and likely impact is very small – this is set out in Section 4.11.
50.	Wind Coalition	Proposed that metered values less than 0MW should be ignored in the causer pays calculation, to maintain consistency with generation that has separately metered auxiliaries.	AEMO agrees with the proposed approach – this is set out in Section 4.11.
51.	Wind Coalition consultant report	Provided analysis on the potential impact of SCADA delays – results indicate that small delays (less than 16 seconds) do not have a material impact on causer pays factors.	AEMO has conducted similar analysis, and we agree that small delays have minimal impact.
Issue 12: The profile that is assumed when determining deviations			
52.	ERM Power	Concerned that some generators (in particular those with higher ramp rates and/or participating in the Fast Start Inflexibility Profile process) may have trajectories that are not linear, and may be subject to increased causer pays costs.	AEMO acknowledges the analysis conducted by the Wind Coalition consultants, that indicates the assumed profile has little impact on causer pays factors – this is set out in Section 4.12
53.	Wind Coalition consultant report	Provided analysis on several assumed profiles to be applied as a reference trajectory – results indicate that causer pays factors are relatively insensitive to the choice of assumed profile.	AEMO agrees with the analysis conducted, and proposes to maintain the existing linear profile.
Issue 13: Reference trajectory used to determine deviations			
54.	ERM Power	Identified that the current approach of target-to-target trajectories may unfairly penalise generators across the dispatch interval boundaries.	AEMO has considered the advantages and disadvantages of alternative reference trajectories, but has not identified a case for changing from the existing target-to-target approach – this is set out in Section 4.13.
55.	Wind Coalition consultant report	Provided analysis comparing the existing target-to-target reference trajectory to an initial-to-target trajectory – identified some variation for particular generating units.	AEMO has considered the advantages and disadvantages of alternative reference trajectories, but has not identified a case for changing from the existing target-to-target approach – this is set out in Section 4.13.

No.	Name	Issue	AEMO response
Issue 14: Suitability of frequency indicator as weighting factor for determining performance			
56.	CS Energy	Support the provision of FI data to participants to allow the assessment of performance on a five-minute basis.	AEMO agrees with the suggestion, and proposes an approach which addresses this – this is set out in Section 4.14.
57.	ERM Power	Concerned that the use of FI as a weighting factor can introduce distortions into the calculation of factors, because there are a number of variables which cause FI to not be truly reflective of system frequency. Also points out that FI is not visible to participants in real-time, which makes it impossible for participants to implement control systems that can minimise exposure to causer pays.	AEMO agrees that under some circumstances the use of FI may act as a disincentive for positive performance for facilities not enabled for regulation – this is set out in Section 4.14.
58.	Wind Coalition consultant report	Suggests that FI should be published in the dispatch timeframes	AEMO agrees with the suggestion, and proposes an approach which addresses this – this is set out in Section 4.14.
Issue 15: Different treatment of contingency events when determining performance			
59.	ERM Power	Identified that the exclusion of large contingency events provides favourable treatment to larger units, whereas unforced outages of smaller units is likely to treated as a negative deviation. Suggests that to maintain consistency that any dispatch interval that involves an unforced outage should be excluded.	AEMO agrees that the current treatment does unfairly favour larger units, and proposes an arrangement to permit smaller contingency events to be excluded – this is set out in Section 4.15.
Issue 16: Aggregation of performance in the calculation of contribution factors			
60.	Wind Coalition consultant report	Provided analysis on several aggregation methods in comparison to the existing linear average – the results indicate improved causer pays performance using a median aggregation method.	AEMO has considered the potential for alternative aggregation methods, however does not believe there is a case that any altervative provides clearer incentives for good performance – this is set out in Section 4.16.
Issue 17: Price settings for FCAS			
61.	Engie	Suggest that rather than introducing additional complexity into causer pays, the MPC and CPT for FCAS should be reduced.	AEMO does not consider this part of the scope of the review, and suggests the proposal is raised with the Reliability Panel – this is discussed in Section 5.1.
Issue 18: Intermittent generation forecasting			
62.	Wind Coalition	Concerned that issues with the forecasting of intermittent generation may be resulting in unfavourable treatment in causer pays.	AEMO acknowledges that intermittent generation forecasts are impacted by a range of factors, which are being addressed separately to causer pays – this is discussed in Section 5.2

No.	Name	Issue	AEMO response
	Issue 19: Potential barriers to entry		
63.	Uniting Communities	Concerned that the existing causer pays arrangements may act as a potential barrier to entry for prospective participants, and similarly allows incumbent participants with a range of generation to gain an advantage by balancing their portfolio.	AEMO shares the concern that the causer pays arrangements may act as a barrier to entry, particularly with respect to high regulation FCAS costs and the challenges for some participants to be able to manage their exposure. However AEMO considers that the arrangements do provide an appropriate incentive for good frequency performance, including for prospective participants to invest in plant to better manage frequency performance – this is discussed in Section 5.3.
	Issue 20: Market complexity		
64.	Uniting Communities	Concerned that the current market arrangements and the number of submarkets may be leading to inefficient outcomes for consumers, and proposes an alternative approach of including frequency control costs as part of wholesale energy costs on a fixed cost per megawatt hour.	AEMO shares the concern about the complexity of the market arrangements, and the way in which frequency control costs may be passed onto consumers. However AEMO considers that although the causer pays arrangements are far from perfect, they are able to deliver better long term outcomes for consumers than more simplified cost recovery such as a user pays approach – this is discussed in Section 5.4.

ATTACHMENT 1 – DRAFT PROCEDURE

Refer to separate document published with this Draft Report.