



Your Ref: ERC0274

20 February 2020

Mr Ben Hiron
Australian Energy Market Commission
SYDNEY NSW 1235
Submitted online to: www.aemc.gov.au

Dear Mr Hiron

Submission: Mandatory Primary Frequency Response Draft Determination

CS Energy welcomes the opportunity to provide a submission on the Draft Rule Determination National Electricity Amendment (Mandatory Primary Frequency Response) Rule 2020 (**Draft Determination**).

About CS Energy

CS Energy is a Queensland energy company that generates and sells electricity in the National Electricity Market (**NEM**). CS Energy owns and operates the Kogan Creek and Callide coal-fired power stations. CS Energy sells electricity into the NEM from these power stations, as well as electricity generated by other power stations that CS Energy holds the trading rights to.

CS Energy also operates a retail business, offering retail contracts to large commercial and industrial users in Queensland, and is part of the South-East Queensland retail market through our joint venture with Alinta Energy.

CS Energy is 100 percent owned by the Queensland government.

General comments

CS Energy accepts the observed and measured degradation of frequency performance in the NEM, as detailed in the Draft Determination, and that action is required to address this degradation. CS Energy however remains of the opinion, as expressed in our submission on the Consultation Paper, that the proposed Rule change addresses symptoms rather than the underlying cause. CS Energy considers that the system operator has chosen not to fully utilize all the opportunities and mechanisms currently available to manage power system frequency outcomes in the NEM's power system, which would arguably render this Rule change as unnecessary.

CS Energy reiterates its view that it does not support a mandated approach and is disappointed in the delay in developing compensation mechanisms to incentivise participants in the provision of primary frequency control (**PFC**). As set out in our

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submission on the Consultation Paper, CS Energy considers the direct way to encourage narrow band PFC is to provide appropriate compensation for its provision. As the AEMC continues to progress reform of the frequency control framework, CS Energy would welcome the opportunity to work with the AEMC and AEMO to explore and further develop the alternative compensation pathways we proposed in our submission on the Consultation Paper.

If the proposed Rule is made, CS Energy supports the AEMC's proposal that it should apply only for a limited three (3) year period and that genuine and meaningful progress must be made to implement a market-based solution for the provision of enhanced power system frequency services. CS Energy considers this will incentivise all stakeholders to deliver an appropriate market and sustainable outcome.

It is also imperative, if the Rule is made, that the Final Determination consider in greater detail the potential for unforeseen outcomes and learnings arising from the early implementation of the proposed ± 0.015 Hz deadband for mandatory primary frequency response. CS Energy encourages the AEMC to consider a more staged approach, to be governed by the Reliability Panel, which implements on commencement a ± 0.10 Hz deadband (instead of the proposed ± 0.015 Hz deadband).

CS Energy also considers it important that the Rule, if made, explicitly state that generating units are not required to provide headroom, foot-room or stored energy in meeting any obligation imposed under this Rule change.

Our detailed comments on the Draft Determination are set out in the Attachment.

Please contact us if you would like to discuss this submission further.

Yours sincerely



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ATTACHMENT

1. What issue is this Rule change seeking to address?

Following the power system event on 25 August 2018, which resulted in the electrical separation of the Queensland and South Australia regions from the NEM, AEMO expressed its concerns with frequency performance in the NEM and advised that, unless immediately addressed, a potentially catastrophic outcome would likely result following an onerous power system event. As expressed in our comments on the Consultation Paper, CS Energy was disappointed that the key findings arising from the power system event appear to inappropriately conflate issues, while at the same time ignore relevant issues, and then concludes that primary frequency control was the critical success factor. This appears to be the primary driver behind ERC0274.

CS Energy accepts the observed and measured degradation of frequency performance in the NEM as detailed in the Draft Determination and that action is required to address the degradation of frequency performance in the NEM. However, CS Energy reiterates the views expressed in our submission on the Consultation Paper that the proposed Rule change addresses symptoms rather than the underlying causes. CS Energy encourages the AEMC to take a holistic approach that:

- (a) incorporates the integration of existing mechanisms available to AEMO to manage power system frequency;
- (b) addresses existing ambiguity in the Rules about frequency control;
- (c) addresses consequences arising from previous positions taken by the Regulator that has resulted in synchronous generators disabling their primary frequency response capability to ensure Rules compliance by not allowing operation with no deadband¹; and
- (d) incorporates a comprehensive review of the Market Ancillary Services Specification (**MASS**), to allow FCAS regulation to include primary frequency response.

Eighteen (18) months have expired since the NEM power system event on 25 August 2018. CS Energy considers the opportunity to holistically address the root cause of the degradation of frequency performance in the NEM has been arguably lost, with the emphasis during this period being the system operator's mantra that *'mandated primary frequency response needs to be implemented as soon as possible to restore power system frequency outcomes to an acceptable level'*.

CS Energy is also disappointed that the system operator was not willing to take a lead role in response to an offer coordinated by the Australian Energy Council of a voluntary PFC trial across the NEM, replicating the recent trial conducted in the Tasmania region. CS Energy acknowledges that the trial offered only one-third of connected mainland capacity, which did not align with the system operator's objective of maximising participation by

¹ In 2016, the AER took enforcement action against a generator for operating its units with no dead band. This led to the large NSW thermal generators updating their Digital Control Systems (DCS) controls to defeat hydraulic governor action inside the NOFB. Prior to this, CS Energy submits frequency was well controlled with a normal distribution around 50 Hz and only required primary frequency response from a few generators to achieve this performance.

scheduled and semi-scheduled plant. CS Energy however considers that this would have been an apt starting point. Too much proportional response may risk fast proportional oscillations, especially with delayed response from hydro plant (hydro plants suffer from an inverse response initially while accelerating their water column). There have been examples of this happening just outside the NOFB, which has been included in AEMO's FCAS working group presentations. Hence, even considering the changing generation mix and loss of inertia, the Rule change appears to be specifying much more response than is arguably required and does not appear to consider the different response characteristics of different types of generators.

The NEM power system event on 25 August 2018 was triggered by a non-credible contingency event, with several unexpected outcomes occurring including protection coordination issues on the Queensland-NSW interconnector and inappropriate operation of a protection scheme in Victoria (ironically triggered by primary frequency response from South Australian generation). Allocation of FCAS services by the AEMO NEMDE in regions and their subsequent 'stranding' immediately following the non-credible contingency event provided valuable learnings. It was disappointing that AEMO's operating incident report in respect of the 25 August 2018 event did not explicitly highlight and detail the performance of several Queensland generators wide deadband frequency response (ie response to the system frequency moving outside the 49.5 – 50.5Hz range and in this instance greater than 50.5Hz that was contained at around 50.9Hz) in containing the high frequency in Queensland electrical island following the non-credible contingency event. Generators providing wide deadband frequency response highlights the profound learning of its efficacy as a power system security 'safety net'. We provide further commentary on this in section 5 below.

Although CS Energy is not supportive of the Rule change as proposed, CS Energy has been working with and will continue to work with AEMO and the AEMC on the implementation of this Rule change and AEMO's remaining Rule change request, *Removal of disincentives to primary frequency response (PFR Rule Changes)*. CS Energy encourages the market bodies to take a strategic and holistic approach to the PFR Rule Changes. This includes an expectation that the process will incorporate strategic reviews on the delivery of expected and required outcomes and where required, changes and adjustments initiated to avoid the occurrence of unintended and adverse consequences.

2. Mandating narrowband primary frequency response

CS Energy does not support a mandated approach for the provision of narrowband PFC as this approach fails to recognise the critical value of the service. CS Energy considers mandating narrowband primary frequency response potentially disincentivises participants to provide the service and may in fact perversely allocate resources to seek an exemption.

CS Energy reiterates its view as set out in our submission on the Consultation Paper that the direct way to encourage narrowband primary frequency response is to provide appropriate compensation for its provision. CS Energy notes the AEMC's preference is also for a market-based approach for the provision of primary frequency response. CS Energy does acknowledge the challenges confronting the AEMC and its attempt to manage and prioritise the various components of the PFR Rule Changes and can appreciate the AEMC's initial priority is to address only the 'system security priority'. We are however disappointed in the delay in compensating and incentivising participants in the provision of narrowband PFC and welcome the three (3) year sunset on the mandatory primary frequency response. The imposition of a sunset provision that includes the removal of disincentives to primary frequency response will incentivise all

stakeholders to deliver an appropriate market and sustainable outcome. CS Energy is optimistic that the delivery of an appropriate market and sustainable outcome would not require the full three (3) year sunset provision, and if so, the proposed Rule should then lapse rather than expire after a period of three (3) years.

As discussed in our submission on the Consultation Paper, requiring generators to provide primary frequency response without also including a requirement to reserve capacity is a partial mandate only. The Draft Determination does not require generators to maintain head-room, foot-room or stored energy, other than providing that the Primary Frequency Response Requirements (**PFRR**) cannot require generators to maintain additional stored energy for the purposes of providing frequency response.

If the Rule is made, CS Energy encourages the AEMC to include in the Final Determination further clarification to ensure there is no ambiguity on the provision of primary frequency response when the participant is operating the generating units, particularly at defined upper or lower boundaries of operational capability. This would include generating unit safety and stability issues eg would the lifting of safety valves in the provision of primary frequency response be a legitimate reason to cease providing the response or to seek an exemption? It is also critical to remove any ambiguity or uncertainty on the requirements to ensure that contingency and regulation FCAS markets are not compromised.

3. Impact on FCAS markets

CS Energy is concerned there may be unintended consequences arising from the proposed Rule change on the current and future FCAS market. Stored energy utilised in providing the primary frequency response required by the Rule change will need to be accounted for by the same providers in their FCAS contingency offers to ensure the total enabled capability is delivered in response to a frequency excursion following a contingency event.

CS Energy also challenges the AEMC's view "*that mandatory provision of primary frequency response will not replace the need to procure market ancillary services*". Rule 4.7 of the draft Rule clearly requires the maximum possible range of response.

Following the commencement of the Rule change, it is imperative that AEMO does not unilaterally change the FCAS requirements arising from the incorporation of the PFRR. Any changes must be conducted under a transparent consultation framework to ensure that the current FCAS market incentives are not distorted or undermined or uncertainty emerges for future investment decisions.

The proposed PFR Rule Changes and supporting arguments would certainly restore system security from its present marginal state. However, the potential loss of FCAS income and the expectation that generators will "price the cost of the mandated response into their market offers" would potentially further erode the commercial position of units that have participated in the FCAS market. This outcome may compromise the incentive for existing dispatchable units to remain in the market and lead to earlier retirement than currently planned. One of the justifications for the PFR Rule Changes appears to be driven by a lack of confidence in the capabilities of new inverter-based generators being able to achieve the frequency band ride-through capabilities specified in the automatic access standards. Accordingly, the PFR Rule Change, if not time bound, and if not appropriately compensated, may have the inverse effect to what is currently hoped.

4. Narrow deadband

CS Energy considers the proposed $\pm 0.015\text{Hz}$ deadband to be extremely onerous and unprecedented in the history of the NEM. CS Energy strongly supports a stepped approach in determining the appropriate PFC deadband with the proposed $\pm 0.015\text{Hz}$ deadband specified as an absolute minimum level and not the default level. CS Energy has concerns with plant being able to be operated to meet the proposed technical requirements of this deadband eg the proposed $\pm 0.015\text{Hz}$ deadband is just wide enough to cover the rotor angle oscillations between generators, as shown in Figure 6.2(c) of the AEMO consultant's report. CS Energy considers it essential that a governance process for the progressive changes to the PFC deadband levels is developed and overseen by the Reliability Panel. This will ensure an orderly transition process that will enable the identification of immediate and emerging technical and undesirable market impact issues.

CS Energy encourages the AEMC to consider implementing an incremental approach to establishing the appropriate deadband to address frequency control. CS Energy would support the PFC implementation for all eligible generating commencing with $\pm 0.1\text{Hz}$ deadband for a period of two (2) months. AEMO can assess the frequency control performance during this period. At the end of the period AEMO will be required to prepare a report including any recommendations and provide it to the Reliability Panel and NEM participants. If the Reliability Panel form the opinion that the frequency control performance is acceptable, then the process of reducing the deadband level would cease. If the Reliability Panel form the opinion that the frequency control performance is not acceptable, then the next decremental step in reducing the PFC deadband to $\pm 0.05\text{Hz}$ would be implemented including an assessment of the frequency control performance. This process provides a transparent and orderly process that is manageable by the participants and is likely to identify the PFC deadband to deliver the required frequency control performance.

CS Energy has considered the impact of the PFR Rule Changes on its generation portfolio coupled with its experience in the NEM. Set out in the Appendix are a number of statements that capture our observations, learnings and identification of technical considerations of plant that require further consideration in implementing the proposed Rule change.

5. Wide deadband

CS Energy has previously championed the benefits provided by wide deadband frequency response (response to the system frequency moving outside the 49.5 – 50.5Hz range). CS Energy remains concerned that this area continues to receive levels of attention that do not reflect the importance of the service (to provide system resilience to non-credible events) and the need to remove the current ambiguity on this subject.

CS Energy continues to be concerned that several generators in the NEM turn off their Partial Load Rejection capability specified in s5.2.5.7.

The "frequency response" capability specified in s5.2.5.11 can be turned off if the unit is not participating in the FCAS market, although AEMO has the power to direct generators to enable the capability in the event of a market failure. However, a number of issues remain unclear in respect of the exercise of this power: Is it assumed that unit operators can switch the frequency response influence back on at short notice through a selection switch on an operator's control system screen? Is it assumed that waiting hours for a call out technician to re-enable the frequency influence would not be satisfactory? Are generators that have switched off Partial Load Rejection capability required to provide

their operators with the ability to switch the wide range governor frequency response influence back on at short notice if directed by AEMO?

s5.2.5.7 “Partial Load Rejection” does not include a statement like that in s5.2.5.11(i)(4) “Frequency Response”, that generators are only required to operate in frequency response mode when enabled for a relevant market ancillary service. Hence the interpretation of s5.2.5.7 is ambiguous. Partial Load Rejection capability falls outside the scope of the FCAS market, as some generators have automatically limited the contingency governor response to the amount of 0.5 Hz deviation response dispatched, and the response measurement methodology in the MASS does not cover deviations beyond 0.5 Hz. An FCAS market for Partial Load Rejection capability would be impractical because the frequency band needs to be set inside individual generator’s maximum continuous operating frequency, creating fairness and co-ordination difficulties. A Partial Load Rejection capability market would also need to be distributed into regions covering potential islands. It would also be inefficient, because it would be rarely needed. Hence there appears to be a clear need for AEMO to direct enablement of Partial Load Rejection capability to maintain system security until the issue is resolved.

AEMO have previously advised CS Energy that it was of the opinion that it would not be allowed to direct enablement of Partial Load Rejection capability at present, even after the separation event on 25 August 2018. CS Energy considers the Rules should clarify the circumstances in which AEMO can direct re-enablement of Partial Load Rejection capabilities eg would threats to an inter-connector as reflected in constraints due to lightning in the vicinity of the line, be sufficient cause? If not, AEMO is unlikely to be able to direct enablement before incidents occur, because system separation events are by nature rare and unexpected, as the result of a “non-credible contingency”. In which case, specifying a Partial Load Rejection capability would appear to be of no benefit to AEMO in managing system security.

CS Energy questions how AEMO can realistically determine system stability constraints when the system response to large disturbances is dependent on how many generators have their Partial Load Rejection capability enabled. There has been a lot of criticism of poor narrow range frequency control compromising system stability constraint calculations, because a disturbance could start with frequency already near the edge of the NOFB. However, a lack of Partial Load Rejection capability is much more serious, and it is wrong to conflate this with the raise/lower regulation FCAS problem within the NOFB. While both require increased fast proportional governor response to provide adequate control, they apply to different frequency bands with very different needs. Partial Load Rejection capability is rarely needed but needs to be distributed throughout the NEM, while raise/lower regulation FCAS is continuously required, and can be sourced anywhere in the NEM.

Given a high percentage of new solar and wind inverters are providing high frequency response, as required under revised Australian Standards and NEM rules, it is incongruous to allow large thermal generators to disable Partial Load Rejection capability. Generators that have disabled Partial Load Rejection capability are free-loading on others who provide the fast re-balancing of generation with load after separation events; this protects the freeloader’s plant from stresses and risks associated with fast load reductions, and avoids a reduction of generation into the energy market, while exacerbating these conditions for the others who delivered the load rejection. However, if the system collapses as a result, every-one is much worse off, hence it is a common good, and it would be appropriate for Partial Load Rejection capability to be mandatory under the NEM rules.

CS Energy considers that the evidence is overwhelming in support of mandating a wide deadband frequency response performance. As stated in our submission on the Consultation Paper, CS Energy does not consider mandating a wideband response is likely to impose an economic cost as, in this case, the incentive is already present (with the cost of responding to major deviations likely to be less than the cost of failing to do so).

6. Exemptions framework

CS Energy supports the proposed exemptions framework and broadly supports the five listed criteria. The need for a clear exemptions framework, including explicit recognition of the costs of conversion, is particularly essential since the Commission has proposed to delete any compensation for conversion or ongoing service provision.

As previously stated, under certain circumstances a generating unit may be capable of operating in “frequency response mode” but may not be able to provide the required rate of response under certain operating conditions. It is not evident under the proposed criteria how this would be managed. In considering the proposed exemptions framework, the framework should facilitate both total and partial exemption from the proposed primary frequency response obligations.

While CS Energy supports a structured exemptions framework, we consider that it should be operated by the Australian Energy Regulator (**AER**) rather than AEMO. This would be consistent with the AER’s technical compliance enforcement responsibilities across the Rules. CS Energy considers a framework where AEMO solely determines exemptions would be unfair upon a generator, as its only recourse to reverse an AEMO decision is to trigger a lengthy and costly Chapter 8 dispute. In contrast, a framework governed by an AER process would have a more transparent and cost-efficient dispute mechanism, requiring that all parties present robust justifications for their positions before an independent third-party, such as the AER.

7. Staged approach to generating unit inclusion

CS Energy supports AEMO’s proposed staged approach to requiring participation of generating units in the provision of primary frequency response, with generating units above 200 MW capacity required to initially participate with lower capacity units to follow at a later date. We are however concerned that a “blanket” inclusion approach may not provide the least cost approach of provision of the mandated service and result in unnecessary increased costs to consumers. This is particularly the case as the mandatory provision of primary frequency response is for a three (3) year period. We believe this proposed staged approach should be further modified and included in the Final Determination.

CS Energy proposes that following implementation of stage 1, stage 2 should consist of those units in the 30 to 200 MW capacity range that currently have capability to provide regulation and fast contingency FCAS. Following implementation of stage 2, the Reliability Panel will be required to conduct a review of power system frequency outcomes. Where the Reliability Panel determines that observed power system frequency outcomes remain unsatisfactory, implementation will proceed to a third stage where the remainder of the generation fleet is required to implement mandatory primary frequency response requirements.

This proposed change to the staged approach will ensure that costly modifications to generating unit control systems are only implemented on a demonstrated technical

requirement as opposed to a “blanket” inclusion resulting in an orderly needs-based transition without incurring unnecessary costs.

8. Reporting requirements

CS Energy considers AEMO’s reporting requirements under Rule 4.8.16 should be updated to require AEMO to produce reports during the transition period to include the following:

- (a) the level of primary frequency response activity for each dispatch interval;
- (b) histograms of the frequency control performance in the NOFB;
- (c) identification and analysis of observed outcomes such as oscillations and hunting indicative of undesirable interactions; and
- (d) AEMO’s opinion on the effectiveness of the primary frequency response obligation, in particular with regards to informing future work on the appropriate minimum quantities of primary frequency response, the size of the primary frequency response deadband and stored energy that should be acquired by a future market arrangement.

Any recommendations by AEMO arising from the reporting requirements should be submitted to the Reliability Panel for their review prior to the implementation of any recommendations.

9. Future workplan

CS Energy acknowledges the work undertaken by the AEMC to review and amend the Frequency Control Frameworks Review workplan as set out in Table 3.1 in the Draft Determination.

CS Energy supports the inclusion of a detailed work plan in the Final Determination with aligned provisions in the Rules which require AEMO and other stakeholders to demonstrate ongoing commitment to achieving the stated objectives. However, the future work plan in the Draft Determination appears to be only a combination of broad research and matters associated with implementation of the PFR Rule Changes. There appears to be no set timetable towards the achievement of a market-based solution to replace the sunset mandated primary frequency response requirement.

CS Energy’s preference is to achieve the implementation of a market-based solution as soon as practically possible but not later than the three (3) year sunset. The most appropriate platform for its development would be the Primary Frequency Response Technical Working Group, led by the AEMC with appropriate interaction with the Reliability Panel. The workplan should identify specific deliverables, allocated to specific parties, by specific dates with the AER required to monitor and report on the achievements of the stated objectives or the reasons for non-achievement.

CS Energy has concerns with statements as set out in the Draft Determination that even if a market based solution is developed, AEMO will seek to continue the proposed temporary requirement for the provision of mandatory primary frequency response from all scheduled and semi-scheduled generators in parallel with the market based solutions. This approach will undermine the development of market based solutions and require an extension of this Rule change beyond the current sunset date. Only by including additional defined outcomes and dates for the interim steps to achieve a long-term

market-based solution and requiring all parties to collaborate and work to meet these dates in the Final Determination, stakeholders will have confidence that a market based solution will be implemented.

APPENDIX

Technical Considerations

All generating plant that are capable should have the following capability - 5% droop and 0.015Hz symmetrical deadband that would provide a 5.4% load response inside the NOFB between 0.015 and 0.15 Hz, and up to 19.4% load change at 0.5 Hz. NOFB is defined in the PFRR but there is no further mention of it, so presumably it remains at ± 0.15 Hz.

CS Energy believes that there is not a universal understanding of the technical challenges required to deliver the requirements specified in the PFRR that include the following:

- (a) A speed of response of 10 seconds for 5% change in MW output is a very fast response. The characteristics of one of the generators in the CS Energy portfolio reflect the Rules requirements applicable at the time of commissioning of the unit. The unit can achieve +5%/-10% in 60 seconds, which is on the slow side. Hence the unit has a 15 second lag applied to the frequency error, to slow its response to the required 60 seconds and minimise the disturbance to unit controls (particularly the steam feed pump turbine control of feedwater flow). Note that unit does not use governor speed control to provide the initial fast response because it was only required to be achieved in 60 seconds with the response achieved through the DCS load controller. If PFRR comes into force, the 15 second lag on unit frequency error will have to be removed, and the governor will need to be reconfigured to provide the initial fast speed controller response.
- (b) The reheater volume imposes a 10 second lag on the unit, on about 73% of the generator load which comes from the IP/LP turbines, and a proportional action step response that takes over 3 times the lag time constant to stabilise; that is over 30 seconds on the unit. Hence it is impossible to achieve the response in 10 seconds, even if strong derivative action was added to make the fast HP turbine response as large as possible while waiting for the IP/LP response to come through. However, the slower response than the PFRR should be acceptable under the provision "Unless limited by stability or inherent plant capability". There will be high level of discussion around plant capability and how far is it reasonable to push them without causing additional damage and life consumption, especially for mature plant.
- (c) In order to sustain the required response, the following challenges are detailed as follows:
 - mill grinding lags are much too slow to sustain a +5% change after 10 seconds;
 - the initial +5% can be supplied by stored energy with governor valve throttle margin, but sustaining it would require a significant retuning effort, and possibly mill modifications as well, such as actuated classifier vanes and variable grinding pressure. The unit has a 40 second lag on mill Primary Air (PA) flow demand from the boiler master where PA flow delivers the fuel to the furnace, so it is fundamental to short term firing response;
 - to sustain a +5% change after 10 seconds would require derivative lead action on the PA flow demand instead of the lag, and derivative lead action on the coal feeder demand to maintain coal inventory in the mill.