

6 November 2019

Mr Ben Hiron  
Project Leader  
Australian Energy Market Commission

Dear Mr Hiron

**AEMC Ref: ERC0274 and ERC0263: Primary Frequency Response**

Intelligent Energy Systems (IES) wishes to respond to the Consultation Paper issued by the AEMC on the above proposed rule change.

IES is an Australian consulting and software company that has supported market reform in Australia since the mid-1980s. IES staff have advised on various aspects of market design in Australia and internationally. For example, IES designed the current ancillary service market arrangements and causer pays mechanisms in 1999-2000.

In the main part of the submission we have responded to each of the questions raised in the discussion paper. The key recommendations of the submission are summarised below:

1. Support AEMO's proposed requirement for compulsory PFR capability but only for units of 200MW or more.
2. Amend the rules as per AEMO to allow helpful frequency responsiveness away from schedule for generators and also for scheduled loads.
3. Do not proceed with AEMO's misguided proposal to exempt PFR providers from regulation causer pays costs, as this will reduce or even remove interest in containing the size of the regulation requirement. It will also reallocate costs to customers and increase them as well.
4. Instead, implement as soon as practicable a PFR market mechanism similar to a two-sided version of regulation causer pays, applicable to all scheduled units that have SCADA data. This should be applied to all SCADA metered units.
5. Begin development work immediately on a prototype meter and settlement logic that would support wider participation in the proposed PFC market by any party, as well support any longer-term deviation pricing arrangement (through enhancement of the firmware) as recommended below.
6. Begin research and development work immediately on the theory, prototyping and practical implementation of market-based pricing options, one of which should be deviation pricing.

I would be pleased to answer any further questions you may have.

Yours sincerely



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## 1 Formal Response to AEMC Questions

### QUESTION 1: ISSUES RAISED BY AEMO IN ITS RULE CHANGE REQUEST, *MANDATORY PRIMARY FREQUENCY RESPONSE*

In relation to AEMO's rule change request, *Mandatory primary frequency response*:

- What are stakeholders views on the issues raised by the AEMO in its rule change request, Mandatory primary frequency response?
- Do stakeholders agree with AEMO's assessment that regulatory change is required as a matter of urgency to restore effective frequency control in the NEM?
- What are stakeholders views on AEMO's definition of effective frequency control as requiring narrow band frequency response from as large a portion of the generation fleet as is practical?
- Are there any other related issues or concerns that stakeholder have in relation to frequency control during normal operation and following contingency events?

### QUESTION 1: RESPONSE

- The system does face an immediate challenge so a mandate down to 200 MW to deal with the immediate problem could be workable, as most such plant would already have the capability and costs would be minimal.
- Having made that point, mandating is a bad idea for the wider fleet because it imposes a bureaucratic approach with many arbitrary elements when a market approach can do a better job. Specifically, a mandated solution will inevitably be more costly than a market solution. AEMO's justification for the mandated approach seems to be the recommendation of Dr John Undrill, who likely had no basis other than common practice for making this recommendation. Common practice will not be adequate as Australia moves into a new paradigm for electricity system operation.
- IES agrees with the urgency but not the proposed approach in several respects. Note that a solution has been available to AEMO for 20 years; a recommendation for a two-sided 4 second market using SCADA data from the 1999-2000 Ancillary Services Review that established the current markets. AEMO initially accepted the recommendation as a long-term solution but later dropped the idea, apparently because the initial success of the other FCAS market arrangements made it seem unnecessary. However, the lack of reward and even penalty for maintaining governor action (PFC) has been evident for a long time – at least 5 years - so the current urgency for a mandated approach seems explicable.
- IES accepts the technical advice that such dispersion is desirable if done efficiently, noting that current FCAS market arrangements very explicitly do not require it unless there is a single contingency threatening separation.
- The demand-side is capable of much more proportional and nuanced response than current arrangements support.

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QUESTION 2: ISSUES RAISED BY DR SOKOLOWSKI IN HIS RULE CHANGE REQUEST, *PRIMARY FREQUENCY RESPONSE REQUIREMENT*

- What are stakeholders views on the issues raised by Dr Sokolowski in his rule change request, Primary frequency response requirement?
- Are there any other related issues or concerns that stakeholders have in relation to frequency control during normal operation and following contingency events?

QUESTION 2: RESPONSE

- Dr Sokolowski addresses most of the same issues as AEMO. AEMO's changes would seem to cover them off in most cases
- See response to Question1.

QUESTION 3: ISSUES RAISED BY AEMO IN ITS RULE CHANGE REQUEST, *REMOVAL OF DISINCENTIVES TO PRIMARY FREQUENCY RESPONSE*

- What are stakeholders views on the issues raised by the AEMO in its rule change request, *Removal of disincentives to primary frequency response?*
- Are there any other related issues or disincentives in the NER to the provision of PFR, that the AEMC should consider?

QUESTION 3: RESPONSE

- The removal of any perception in the rules that behaving in a manner that assists frequency control is non-compliant is long overdue. The change should apply to all market participants, not just generators.
- However, AEMO's proposal to remove the financial disincentives to operating in a frequency control mode (providing PFR) by exempting participants who do provide PFR from any regulation causer pays obligation is misguided. As AEMO itself argues, PFR and regulation are distinct functions, so it makes no sense to encourage one by giving discounts on the other. The outcome would be a degradation of the incentive to reduce the requirement for regulation (for example, through better self-forecasting or better plant control at the slower regulation time scale), which is the prime purpose of regulation causer pays. Further, and contrary to what AEMO appears to argue, regulation costs would then increasingly and indeed almost totally fall onto loads alone, which are only passive parties in the causer pays process. In short, causer pays would lose any of its practical purpose.

A much superior solution is to price the provision of PFR. Under this approach there would be no apparent financial or regulatory conflict between providing PFR and providing regulation. Indeed, the changes that AEMO has made to causer pays to remove periods where the regulation signal conflicts with the PFR signal would be unnecessary and are in fact misguided.

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In this submission IES foreshadows some work being carried out in association with CS Energy to demonstrate how PFR can be priced using a mechanism similar to regulation causer pays. We see this not as a long-term solution, but as an approach that could be implemented at the same time as the rest of this rule change, or very close thereafter. It could be a precursor to a more comprehensive consideration of how a deviation pricing mechanism could assist with the emerging frequency control challenges, as AEMC has strongly argued in the consultation paper as well as the earlier report of the Frequency Control Review.

QUESTION 4: CAPABILITY OF GENERATION PLANT AND THE IMPLEMENTATION PROCESS FOR AEMO'S PROPOSED MANDATORY PFR REQUIREMENT

In relation to AEMO's rule change request, *Mandatory primary frequency response*, and the draft PFRR:

- For stakeholders who own and operate scheduled or semi-scheduled generation plant: How easily can your plant meet the requirements of AEMO's draft PFRR? What, if any, adjustments or investments would need to be made and what are the expected costs?
- Do stakeholders agree with AEMO's proposed allocation of requirements between the NER and the PFRR under its proposed rule?
- Do stakeholders consider the implementation time frames suggested by AEMO in its draft PFRR to be appropriate? In relation to AEMO proposed self assessment process, is it appropriate for generators >200MW to provide AEMO with a self assessment within 60 business days and generators <200MW to provide AEMO with a self assessment within 120 business days?
- Do stakeholders consider there to be a more appropriate approach to coordinating the implementation of a PFR requirement across the generation fleet?

QUESTION 4: RESPONSE

- Asset owners will respond to this question, but a reasonable expectation is that plant over 200 MW (nearly all synchronous) will already have capability that can be activated at relatively low cost, whereas below 200 MW renewable technologies and batteries become dominant and changes become relatively more costly and problematic. For the immediate future, the 80-20 rule strongly applies
- No comment
- No additional comment, but see above
- If PFR capability is to be made compulsory, restrict it to over 200 MW. At (almost) the same time, a financial incentive for PFR could compensate the above 200 MW fleet and encourage appropriate (non-mandated) medium and long response from the less than 200 MW fleet.

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QUESTION 5: AEMO'S EXPECTED COSTS AND BENEFITS FOR ITS PROPOSED RULE,  
*MANDATORY PRIMARY FREQUENCY RESPONSE*

In relation to AEMO's proposed rule, *Mandatory Primary frequency response* :

- Do stakeholders agree with AEMO's characterisation of the costs and benefits associated with its proposed rule?
- What do stakeholders consider to be the immediate and ongoing costs of providing PFR and being compliant with the proposed rules?
- Is AEMO's proposed compensation arrangements for plant upgrades necessary and appropriate?
- Do stakeholders consider the proposed rules to be a cost-effective solution to the frequency control issues identified by the proponents?

QUESTION 5: RESPONSE

- The benefits of improved frequency control are well set out by AEMO. However, the costs are blurred over to the point of being misleading. For example, spreading the requirement around to a large portion of the fleet may be a good idea, but it is unlikely to reduce costs – rather to increase them. Similarly, the cost-benefit of mandating responses now for the under 200 MW fleet are far different to that for the over 200 MW fleet. The two should be separated when applying any mandatory requirement.
- No comment
- No comment
- AEMO's approach is not cost-effective. Any mandate should be restricted to plant over 200 MW. Even in the immediate future, an initial market-based solution is far preferable for all scheduled participants, even if some have PFC capability mandated.

QUESTION 6: DR SOKOLOWSKI'S EXPECTED COSTS AND BENEFITS FOR HIS PROPOSED RULE,  
*PRIMARY FREQUENCY RESPONSE REQUIREMENT*

In relation to Dr Sokolowski's proposed rule, *Primary frequency response requirement*:

- Do stakeholders agree with Dr Sokolowski's characterisation of the costs and benefits associated with his proposed rule?
- What do stakeholders consider to be the immediate and ongoing costs of providing PFR and being compliant with the proposed rules?
- Do stakeholders consider the proposed rules to be a cost-effective solution to the frequency control issues identified by the proponent?

QUESTION 6: RESPONSE

- Dr Sokolowski's proposals overlap with AEMO's. IES has no comment as to whether his proposals to tweak the wording in the rules have merit

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QUESTION 7: AEMO'S PROPOSED RULE, *REMOVAL OF DISINCENTIVES TO PRIMARY FREQUENCY RESPONSE*

**Allocation of regulation service costs — causer pays**

- Does AEMO's proposed rule adequately address stakeholder concerns in relation to the risks and rewards associated with the voluntary provision of PFR?
- Do stakeholders envisage any unintended consequences as a result of the proposed rule change?
- Does the causer pays procedure contain any other potential barriers to the provision of PFR under normal operating conditions?

**Frequency response and compliance with dispatch instructions**

- What are stakeholders views on AEMO's proposed changes to clauses 4.9.4 and 4.9.8 of the NER to address disincentives to PFR relating to compliance with dispatch instructions?

**Operating in a frequency response mode**

- What are stakeholders views on AEMO's proposed rule to address disincentives to PFR related to the requirements for FCAS provision?
- Do stakeholders identify there to be any other sections of the NER that may restrict generators from operating in a frequency responsive mode and providing PFR.

QUESTION 7: RESPONSE

**Allocation of regulation service costs — causer pays**

- They are inadequate in that they distort the relative cost and reward structure for causing and providing PFR and regulation.
- Yes; many parties will lose interest in reducing the need for regulation because they can get exemption by providing some (but how much?) PFR.
- The causer pays procedure, although imperfect in many ways, has NEVER been a barrier to the provision of PFR. The barrier has ALWAYS been the failure to implement a pricing mechanism for PFR, despite a mechanism being recommended and initially accepted by AEMO nearly 20 years ago,

**Frequency response and compliance with dispatch instructions**

- These changes are sound. Dispatch instructions including scheduled regulation cannot provide the full suite of tools necessary for frequency control.

**Operating in a frequency response mode**

- Even in the short term, some sort of pricing is possible and much to be preferred.
- Lack of a comprehensive deviation pricing or similar mechanism. Pricing PFR could be a small but important demonstration of the power of this approach

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QUESTION 8: AEMO'S EXPECTED COSTS AND BENEFITS ASSOCIATED WITH THE PROPOSED RULE, *REMOVAL OF DISINCENTIVES TO PRIMARY FREQUENCY RESPONSE*

In relation to AEMO's proposed rule, *Removal of disincentives to primary frequency response*:

- What are stakeholders' views on AEMO's estimate of the associated costs and benefits?

• QUESTION 8: RESPONSE

- As noted earlier, the benefits in system security are clearly stated, but the costs are unquantified. AEMO's arguments appear to suggest that its approach doesn't cost much, in an apparent bid to contrast it with an approach where the costs are explicit.

QUESTION 9: DR SOKOLOWSKI'S PROPOSED CHANGES TO ADDRESS DISINCENTIVES TO THE PROVISION OF PRIMARY FREQUENCY RESPONSE

In relation to Dr Sokolowski's proposed rule, *Primary frequency response requirement*:

- What are stakeholders' views on Dr Sokolowski's proposed changes to the NER to address disincentives to PFR?
- Do stakeholders envisage any unintended consequences as a result of the proposed rule change?

QUESTION 9: RESPONSE

- No comment
- No comment

QUESTION 10: AEMO'S RESPONSIBILITY TO MAINTAIN AND IMPROVE POWER SYSTEM SECURITY

In relation to Dr Sokolowski's proposed rule, *Primary frequency response requirement*:

- Do stakeholders consider there to be value in amending cl 4.3.1 to explicitly refer to AEMO's responsibility to improve, in addition to maintain, power system security?

QUESTION 10: RESPONSE

- IES sees it as AEMC's role to oversee those improvements, as AEMO may tend to be more focussed on mandated solutions rather than market ones, as with this proposal.

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#### QUESTION 11: INERTIA AND INERTIA SUPPORT ARRANGEMENTS IN THE NER

In relation to Dr Sokolowski's proposed rule, *Primary frequency response requirement*:

- Is the current chapter 10 definition of Inertia appropriate and fit for purpose?
- Do the current arrangements for Inertia support activities adequately allow for Inertia support by way of fast frequency response from inverter connected plant?
- How could the arrangements for Inertia and inertia support activities in the NER be improved to better utilise the capabilities of inverter connected plant?

#### QUESTION 11: RESPONSE

- Inertia is accurately defined as the property that resists acceleration and deceleration of the system. In fact, this property should include any form of stored energy delivered in proportion to system acceleration (to include synthetic inertia).
- Generally, no.
- A deviation pricing mechanism supported by suitable (high resolution) metering could support responses with time constants ranging from, say 100ms (inertia-type response) to, say, 0.5 seconds (FFR) and time constants corresponding to the current 6 and 60 second and 5-minute services as well as regulation.

#### QUESTION 12: ASSESSMENT FRAMEWORK

In relation to the AEMC's proposed assessment framework for the PFR rule changes:

- Do stakeholders consider that the assessment framework is adequate for considering the PFR rule change requests from AEMO and Dr Sokolowski?
- Are there any other relevant considerations that should be included in the assessment framework for the PFR rule changes?

#### QUESTION 12: RESPONSE

- Yes
- It would be helpful to define short- and long-term time frames as far as implementation is concerned. IES believes that an interim market-based solution (operating in a trial mode) could be ready within months, while a focused RD&D program could have a market-based mechanism (deviation pricing) ready for deployment in the order of year, if the will were there. If experience is any guide, long term is regarded as 6 years away (2025 as per ESB programme), which is unacceptable given the challenges the system faces in the coming few years.

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#### QUESTION 13: TECHNICAL REQUIREMENTS OF EFFECTIVE PRIMARY FREQUENCY RESPONSE

In relation to the discussion of the technical requirements for effective frequency control and the policy options described in section 4.4:

- How do stakeholders view the ability of market or regulatory approaches to provide the necessary broad-based frequency response from participants?
- What issues are likely to arise with market or regulatory approaches in achieving the objective of a broad-based frequency response?

#### QUESTION 13: RESPONSE

- Regulatory approaches are likely to be less efficient than well designed market-based approaches for the reasons AEMC itself outlines. Even a requirement that PFC be geographically distributed between many providers does not support a mandated approach. The core arguments that AEMO mounts for the approach is that everybody else does it that way and that something needs to be done quickly.
- Australia's electricity system is more advanced than most others in its transition to new technologies so that aping what everybody else has always done is not necessarily the best approach. An initial market-based approach is feasible. A workable approach would be to mandate the capability where it is already provided (say for units 200 MW and under) to deal with the immediate problem and to implement a causer-pays type approach for all participants based on SCADA metering immediately (within months) after that. Work on research, development and demonstration (RD&D) of a longer-term market-based mechanism should also begin immediately.

#### QUESTION 14: RESPONSE

##### QUESTION 14: TEMPORAL CONSIDERATIONS

In relation to the discussion of the temporal requirements for the development and implementation of a solution to deliver effective frequency control:

- How do stakeholders reconcile the need to address system security with the objective of minimising the long-term costs to consumers?
  - Do stakeholders consider the need to address system security in a timely manner as influencing the mechanism adopted to address the issue?
  - Do stakeholders consider the process of implementing physical changes to generator governor controls as influencing the choice of mechanism?
- The two are not in conflict. As suggested above
    - Mandate PFC capability for units of 200 MW and under;
    - Simultaneously or shortly after implement a causer pays type mechanism for PFC for all parties on SCADA metering;
    - Begin RD&D immediately on a longer-term market-based solution.

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- Only to a small degree. See above. It would be ideal not to require any mandating, but AEMO needs some immediate comfort that enough units have the capability to fix the problem.
  - Because technologies differ so widely, any mandated procedure will be more costly than it needs to be. However, this cost is least for plant (mostly existing synchronous plant over 200 MW) that already has the capability. Bringing such plant into a state ready for PFC service, together with a properly designed additional incentive to provide the service, should be enough to deal with the immediate problem.

**QUESTION 15: CONSIDERING THE COST BENEFIT TRADE-OFF FOR THE PROVISION OF PFR**

In assessing the proposed rules for mandatory PFR, the Commission seeks stakeholder input on the following questions:

- What is the existing capability of the generation fleet to provide narrow band PFR?
- What is the scale and cost of plant upgrades that would be required to meet different PFR performance requirements, including the performance specifications set out in AEMO's draft PFRR?
- How much of the fleet must provide narrow band PFR in order to be confident that the immediate system security needs are satisfied?

**QUESTION 15: RESPONSE**

- For asset operators to answer
- For asset operators to answer
- The over 200 MW fleet provides good geographic dispersion and, if made available for PFC, would greatly improve the current PFC capability. Even if mandated PFC capability were to be implemented now for the under 200 MW fleet, it is unlikely that much of it could be ready for the current summer. There should be time to implement a market-based mechanism for this part of the fleet without any additional risk to the system.

## **2 Recommendations**

IES recommends the following proposed approach

1. Support AEMO's requirement for compulsory PFR capability but only down to 200MW.
2. Amend the rules as per AEMO to allow helpful frequency responsiveness away from schedule for generators AND also for scheduled loads.
3. Do not proceed with AEMO's misguided proposal to exempt PFR providers from regulation causer pays costs, as this will reduce or even remove interest in

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containing the size of the regulation requirement. It will also reallocate costs to customers and increase them as well.

4. Instead, implement as soon as practicable an initial PFR market mechanism similar to a two-sided version of regulation causer pays, applicable to all scheduled units that have SCADA data.
  - a. IES working with CS Energy has a prototype system under development and will have initial results based on current PFR performance published on the web within weeks.
  - b. Design choices (easily implemented) could include:
    - i. whether to emphasise least cost or geographic diversity
    - ii. whether to separate or combine raise and lower PFR services
5. Begin development work immediately on a prototype meter and settlement logic that would support wider participation in the proposed PFC market by any party, as well support any longer-term deviation pricing arrangement (through enhancement of the firmware) as recommended below.
6. Begin research and development work immediately on:
  - a. documenting the theoretical control system and pricing basis for a deviation pricing mechanism in order to clarify the nature of such pricing including its ability to support services provided at different timescales such as 6, 60 and 300 second contingency, regulation, PFR, Fast Frequency Response (FFR) and Inertia.
  - b. prototyping and ultimately testing the deviation pricing mechanism for both generators and for loads who are willing to participate subject to support by the rules.