Stakeholder Comments Template

Frequency Response Phase 2 Initiative Working Group

Submitted by	Company	Date Submitted
Mark Ahlstrom – 651-556-4262	*NextEra Energy Resources*	*March 17, 2017*

This template has been created for submission of stakeholder comments on the working group for the Frequency Response Phase 2 initiative held on February 9, 2017. Information related to this initiative may be found at:
http://www.caiso.com/informed/Pages/StakeholderProcesses/FrequencyResponsePhase2.aspx

Upon completion of this template, please submit it to initiativecomments@caiso.com. Submissions are requested by close of business on **March 17, 2017.**

The ISO includes a summary of the brainstormed options for potential solutions to reference while responding to Question 1 and its subparts. Seven potential options were brainstormed, they include:

1. Annual Forward Procurement - external BAAs
    a. Only procures incremental amount to cover expected shortfall
    b. Requires one contract type (TFR)
    c. Supports bid submission and settlement of that price if procured
    d. Does not require any day-ahead or real-time market co-optimized constraint
2. Annual Forward Procurement - external BAAs and internal resources
    a. Only procures incremental amount to cover expected shortfall
    b. Requires two contract types (TFR and frequency response awards)
    c. Supports bid submission and settlement of at least that price if procured
    d. Requires day-ahead and real-time co-optimized constraint
3. Day-ahead or Real-Time Market Product
    a. Procures amount to meet total requirement
    b. Requires one contract type (frequency response awards)
    c. Supports bid submission and settlement of at least that price if procured
    d. Requires day-ahead and real-time co-optimized constraint
4. Day-ahead and Real-Time Constraint
    a. Procures amount to meet total requirement
    b. Does not support bid submissions but would include some type of settlement for service
    c. Requires day-ahead and real-time co-optimized constraint
5. Combination Annual for externals and Day-ahead/Real-Time Product
    a. Procures incremental amount in annual forward procurement that would support bid submission and settlement of at least that price if procured

   b. Separately procures remainder of the amount to meet the total requirement that would support bid submission and settlement of at least that price if procured
   c. Requires day-ahead and real-time co-optimized constraint
6. Combination Annual for externals and Day-ahead/Real-Time Constraint
   a. Procures incremental amount in annual forward procurement that would support bid submission for TFRs and settlement of that price if procured
   b. Separately procures remainder of the amount to meet the total requirement that would not support bid submission for market constraint but would include some type of settlement
   c. Requires day-ahead and real-time co-optimized constraint
7. "Do nothing"
   a. Take no proactive action including procuring TFR from external BAAs

Questions:

1. The ISO seeks stakeholder input on the brainstormed options for a potential solution to the ISO need to take proactive action to ensure its frequency response is sufficient to support reliability in the event of a loss of two Palo Verde units (BAL-003-1 requirement). These include

   a. Provide description of view of advantages, disadvantages, or position on option 1 - Annual Forward Procurement - external BAAs.

   b. Provide description of view of advantages, disadvantages, or position on option 2 - Annual Forward Procurement - external BAAs and internal resources.

   c. Provide description of view of advantages, disadvantages, or position on option 3 - Day-ahead or Real-Time Market Product.

   d. Provide description of view of advantages, disadvantages, or position on option 4 - Day-ahead and Real-Time Constraint.

   e. Provide description of view of advantages, disadvantages, or position on option 5 - Combination Annual for externals and Day-ahead/Real-Time Product.

   f. Provide description of view of advantages, disadvantages, or position on option 6 - Combination Annual for externals and Day-ahead/Real-Time Constraint.

   g. Provide description of view of advantages, disadvantages, or position on option 7 - "Do nothing".

      In general, we support market products that procure system services from the most economic resources that are willing to provide such services. In the case of primary frequency response (PFR), however, we have come to believe that the nature of PFR is different from most other services. We further suggest that the actions of NERC and FERC are very likely to result in a future where all new resources will have the capability and requirement to provide PFR, thereby leading to an increasing amount

of PFR as the resource mix changes in future years. Since this will also lead to an ample supply of PFR for the interconnection, we suggest that a complex market product is not necessary and the revenues from such a new market product would be quite small, leading us to recommend a simpler approach such as option 6 (Combination of Annual for externals and Day-ahead/Real-Time Constraint).

Just as FERC did for reactive voltage support last year in Order 827, FERC is very likely to require that all new generators must have the capability to provide PFR and keep these capabilities enabled. This will result in outcomes that are very different than those assumed by the ISO. Specifically:

- **If all new resources must have PFR capability as a condition of interconnection (including non-synchronous resources such as wind, solar and battery storage), there will be a very large amount of PFR capability in the future generation fleet. Ongoing transition of the generation fleet in both CAISO and WECC would therefore result in an increasing amount of PFR capability rather than a decrease.**
- **While capability does not guarantee headroom for provision of PFR in real time, the likely system conditions when the ISO would be concerned about having sufficient PFR should also be considered. The primary concern of the ISO is periods where most of the generation is from solar and wind (and conventional sources are not committed), but these will also tend to be the periods where there is some level of curtailment of the renewables. Because solar and wind can effectively be curtailed down to zero output while staying online, these plants can remain available to provide large amounts of PFR.**

Frequency is a property of the interconnection and not the balancing area (except for rare local stability issues that are not the concern here). Therefore, PFR is also a property of the interconnection, so while the NERC BAL-003-1 standard imposes a Frequency Response Obligation on each balancing area, this is more of a fairness issue than an issue of physics on the grid. In other words, the grid doesn't care which balancing area is providing the PFR. What matters is that there is enough PFR delivered quickly enough to prevent under frequency load shedding in the event of a major disturbance for the interconnection as a whole.

Based on the physics of the interconnection, CAISO's procurement of Transferred Frequency Response (TFR) from external BAAs is therefore quite reasonable. Looking forward, compensation for additional costs of adding PFR capability to new generators would be logical, but the incremental cost of PFR capability has become quite low for new generators (including non-synchronous resources). If FERC requires PFR capability as a condition of interconnection as we anticipate, it essentially becomes a standard feature of all new generators at even lower cost.

On the other hand, retrofitting of existing generators to add PFR capability makes little sense. Costs of retrofitting are much higher than the cost of including PFR

capability in new generators, so given that the interconnection currently has sufficient PFR and assuming that new generators will have PFR capability, there is not a logical argument for retrofits.

Compensation for provision is important, however, particularly to cover lost opportunity costs. Ideally, this would compensate those units that bear the burden of response and reflect the reality that fast frequency response (provided before the frequency nadir, or minimum frequency point) is more valuable to the system than slower frequency response. ERCOT has done some impressive analysis of these tradeoffs, showing that fast frequency response that is delivered in the arresting period prior to the nadir both supports a higher frequency nadir and reduces the overall amount of frequency response that is needed. ERCOT already requires all generators (including wind plants) to have PFR capability and is making impressive use of industrial loads for under frequency fast frequency response. For over frequency response, wind plants in ERCOT respond so quickly that conventional units seldom have time to detect and respond to such events.

Development of a new PFR market product may seem like a good idea, but it would be complicated (particularly when it comes to verifying performance and quality of response). Theoretically, a market product would procure the desired amount of PFR from the most cost effective resources, and it could allow renewables to provide such resources when they are the most cost effective source. The revenues from a PFR market product would likely be very low, however, because many resources can provide PFR at little cost.

The exception where costs of PFR would be high would be for rare situations where headroom would need to be intentionally retained specifically for providing PFR for under frequency events. This could be addressed through a market product, but it could also be handled (more simply) by a constraint and make whole payment to cover the lost opportunity cost. The lost opportunity cost is highly dependent on the marginal cost of the resource. For example, retaining headroom on a resource with a high marginal (fuel) cost has a lower lost opportunity cost, while retaining headroom on a resource with no fuel cost (such as solar and wind) has a very high lost opportunity cost. On the other hand, any resource that is already dispatched to a curtailed state (due to either economics or thermal transmission constraints) should be willing and able to provide PFR and the "headroom" already exists due to the curtailed state.

In summary, we would recommend that the ISO consider the next steps from FERC's NOPR on Primary Frequency Response prior to undertaking a complex and expensive new effort. Conceptually, we would like to see a market product, but a constraint may be more practical in the near term (and compensation for lost opportunity cost is obviously required). In practice, we question whether PFR will

actually be in short supply in the future, so the concern (and the compensation that some seek) may be insignificant.

8. ISO seeks stakeholder input on the proposed frequency response service specifications for fast frequency response, primary frequency response and fast regulation attached separately in the draft frequency control product specifications document found here.

9. ISO seeks stakeholder input on the proposed scope of services for which a procurement mechanism would be designed. The proposed scope shown in the product specification handout is that the ISO only needs to evaluate procurement of primary frequency response whether from external BAAs or internal resource and does not need to procure fast frequency response or fast regulation capable of providing the secondary response shown on slide 47 in the appendices to the working group presentation. If any stakeholders believe that the scope should include the fast frequency response or fast regulation services under its evaluation of a procurement mechanism please provide an explanation.

10. ISO seeks stakeholder input on whether load responsive devices can perform with a proportional response or does it require shedding load at a specific trigger point? Also, whether there has been any exploration of the concept of stopping non-critical processes for short periods has been evaluated?

11. ISO seeks stakeholder input on whether pump storage hydro is pumping rather than generating would frequency control device perform with a proportional response or require shedding load at specific trigger points?

12. ISO seeks stakeholder input on the statement made on Slide 15 of the ISO presentation, "Frequency control services require reserves above operating reserves that are not procured for RA". The ISO stated that it believes that resource adequacy or flexible resource adequacy capacity procured to ensure RA to ensure energy deliverability cannot be awarded frequency responsive reserves since these reserves cannot be released by ISO dispatch to ensure deliverability during peak or ramping needs. If any stakeholders hold a different belief, the ISO asks that additional information and explanation be provided to continue to move the dialogue forward.

The purpose of Primary Frequency Response (PFR) is to provide the interconnection with the ability to respond to disturbance event and stabilize frequency above automatic Under Frequency Load Shedding settings. By design, PFR is obtained from a large population of resources in an automated way for a very short period of time, and given the seconds and few minutes of this automated response prior to the secondary response from units under AGC and dispatch control, this PFR response is essentially constrained only by the ability of a resource to quickly and automatically change its output level in the appropriate direction.

While some may find it to be surprising, this response should intentionally ignore maximum interconnection limits, curtailments for transmission deliverability,

dispatch set points and other limitations that would apply for the normal deliverability of energy and other reserves. This is because PFR is designed to be the highest priority of automated response for the benefit of the system, but PFR is intended to deploy for just a few minutes and sustain that response until the ISO's AGC and dispatch instructions can begin to be effective. To exclude the automated PFR action from any resource, even if that resource will soon be released by the ISO, would be contrary to the best interests of the power system.

We therefore disagree with the ISO's statement on Slide 15 because the ISO is inappropriately confusing the automatic operation of PFR with the controlled dispatch of resources. To protect the interconnection, the automated PFR response must take precedence over other actions. All resources with the current capability and headroom to respond should do so. The interconnection has no expectation that this response will always come from the same resources, nor that known resources will be specifically backed down to provide headroom at any given time, but only requires that there is sufficient PFR in the interconnection as a whole. (As previously discussed, the ISO may elect to deliberately provide headroom through a dispatch constraint or market product, such as for reducing its chance of incurring penalties under BAL-003, but this is largely for the ISO's other desires and not directly for the physical needs of the interconnection.)

Because all resources with the capability should have an inherent obligation to support the interconnection with PFR upon a disturbance, it is illogical to suggest that any resources (even resources that are fully procured for resource adequacy) either should not or would not respond with PFR to the full extent of their capability at the time of a disturbance event. Even if the PFR response is directly converted to a dispatched release by the ISO as part of the secondary frequency reserves process, the resource is doing the right thing to support the interconnection. Setting aside the frequency responsive reserve separately from other resource adequacy or reserve products simple removes additional flexibility and PFR range from the system during the automated PFR time period when the interconnection needs it the most, so this is illogical and counterproductive to the core objectives of frequency response.