Stakeholder Comments Template

Submitted by	Company	Date Submitted
Jimmy Nelson, Ph.D. Energy Modeler Union of Concerned Scientists 500 12th Street, Suite 340 Oakland, CA 94607 (510)-809-1570 jnelson@ucsusa.org	Union of Concerned Scientists	November 2, 2015

Please use this template to provide your comments on the presentation and discussion from the stakeholder web conference held on October 19, 2015.

Submit comments to InitiativeComments@caiso.com

Comments are due November 2, 2015 by 5:00pm

The presentation discussed during the October 19, 2015 stakeholder web conference may be found on the Frequency Response Initiative webpage.

Please provide your comments on the ISO's straw proposal for each of the eight issues listed below along with the ISO's straw proposal. The ISO welcomes comments in addition to these issues as well.

The Union of Concerned Scientists (UCS) appreciates the opportunity to provide comments on the ISO's frequency response straw proposal. Our comments are summarized here:

Frequency Response Standard

The ISO believes the straw proposal and its accompanying technical appendix covers the standard's requirements for compliance purposes. The ISO is endeavoring to provide sufficient information to stakeholders for effective evaluation of the ISO's proposal. The ISO seeks comments on whether any unresolved questions on the standard and the ISO's obligation still exist.

Comments: No Comment

Frequency Response Drivers

Several factors contribute to the primary frequency response performance of participating generators having governors. The ISO discusses some of the main drivers of PFR performance in Section 4.2 of its straw proposal. These factors include (1) magnitude of frequency deviation, (2) amount of synchronous on-line capacity providing sustained PFR, and (3) headroom available from that connected on-line capacity.

The ISO is evaluating what additional data points would need to be included in its Masterfile or through other mechanisms to facilitate a market tool or product to be designed. The ISO seeks comments on what factors influence a generators ability to provide PFR in the event of a frequency disturbance and the pieces of information necessary to estimate expected PFR.

Comments:

Data should be collected from asynchronous resources and incorporated into the look-ahead tool

In developing the "look-ahead" tool, the ISO should include contributions to primary frequency response (PFR) from asynchronous resources such as electricity storage, solar photovoltaics, wind, and demand response. Not including asynchronous resources when calculating the ability of online resources to meet PFR needs could result in the commitment of more conventional resources than necessary via increased spinning reserves. This could in turn increase greenhouse gas emissions, production costs, and curtailment of renewable generators.

To include asynchronous resources in the look-ahead tool, the ISO will need adequate data from these resources. The ISO's straw proposal would benefit from additional specificity on data collection from asynchronous resources. Collection of PFR data from these resources can also help set the stage for Phase 2 of the frequency response initiative, in which much data from asynchronous resources will be needed.

UCS proposes a few pieces of data in the bulleted list below that the ISO could collect from asynchronous resources that would be helpful in determining their contribution to PFR. This list is not meant to be final – rather it is a starting point on which to build via the stakeholder process. In Phase 1, this data could be collected from asynchronous resources qualified to provide spinning reserves. UCS notes that the same information would be useful to collect from synchronous resources as well.

- A flag that tells whether the resource is on droop control.
- If the resource is providing droop, what percent droop setting is used.
- What deadband is used.
- Compliance with BAL-003-1 is measured as the average response 20 to 52 seconds after an event.[1] This suggests that the expected response at 20 or perhaps 30 seconds after a frequency deviation would be useful. The data could be collected as a percent of rated capacity or a percent of capacity committed to provide spinning reserve.
- By reducing the magnitude of the frequency nadir (the lowest frequency after an event), quick response to frequency deviations can be more valuable than slower response. The one second response of a resource would be useful to estimate the amount a resource could contribute to lowering the initial rate of change of frequency (RoCoF). The five second response would be useful to estimate the amount a resource could contribute to reducing the magnitude of the frequency nadir.
- Any information about situations in which the resource could provide more or less response than specified by the above metrics.

Phase 1, addressing real-time deficiencies

Section 6.2 of the straw proposal discusses Phase 1 of the initiative which will enact the five steps to ensure it is capable of meeting the requirement at that time. The first step discussed in section 6.2.1 is to develop "look-ahead" tools to assess the PFR capability of the system at various time horizons in the future based on current system conditions. If the look ahead indicates an anticipated deficiency of PFR the ISO can take actions to address the deficiency.

The ISO seeks comments on its proposal for addressing real-time PFR deficiencies for 2017 compliance period.

Comments:

[1] California ISO, Primary Frequency Response, Draft Technical Appendix, October 20, 2015, p.10. Available at http://www.caiso.com/Documents/DraftTechnicalAppendixFrequencyResponse.pdf

To the greatest extent possible, the look-ahead tool and results should be made publicly available

While the ISO will likely need to preserve some level of confidentiality in developing the look-ahead tool, UCS encourages the ISO to provide as detailed of documentation as possible on the calculations performed by the look-ahead tool, as well as data inputs and outputs. Doing so will provide transparency, allow for better stakeholder input on the tool itself, and will prepare stakeholders for Phase 2 of the frequency response initiative.

Phase 1, tariff and interconnection revisions

Section 6.2 of the straw proposal discusses Phase 1 of the initiative which will enact five steps to ensure it is capable of meeting the requirement at that time. The first step discussed in section 6.2.2 is to revise the tariff to include requirements for all participating synchronous generators with governors, not just those providing spinning reserves, to set governors to specified droop settings and deadbands, and to not override governor response through outer-loop controls or other mechanisms.

The ISO seeks comments on the tariff revisions it is proposing to help the ISO ensure sufficient frequency responsive headroom and whether other revisions should be considered.

Comments: No Comment.

Phase 1, ISO's practice of preserving operating reserve headroom

Section 6.2 of the straw proposal discusses Phase 1 of the initiative which will enact five steps to ensure it is capable of meeting the requirement at that time. The first step discussed in section 6.2.3 is to revise the tariff to clarify the authority of the ISO to designate any reserve not previously identified as Contingency Only by a Scheduling Coordinator (SC) as Contingency Only reserves.

Comments: No Comment.

Phase 1, performance requirements

Section 6.2 of the straw proposal discusses Phase 1 of the initiative which will enact five steps to ensure it is capable of meeting the requirement at that time. The first step discussed in section 6.2.4 is to include frequency response performance requirements for resources with governor control and frequency responsive capacity available.

The ISO will continue to develop the details of a proposed performance requirement and seeks comments from stakeholders on an appropriate performance requirement.

Comments: See the subsequent section about incentives vs. requirements.

Phase 1, allocation of BAL-003-1 non-compliance penalties

Section 6.2 of the straw proposal discusses Phase 1 of the initiative which will enact five steps to ensure it is capable of meeting the requirement at that time. The first step discussed in section 6.2.5 is considering provisions for allocating any non-compliance penalties associated with BAL-003-1, should they be imposed on the ISO, to resources that should have provided more PFR than they actually delivered during frequency events.

The process discussed in ISO tariff section 14.7 applies to an allocation of any reliability-based penalty. The ISO seeks comment on how it could apply these tariff provisions to BAL-003-1 compliance and whether it should explore additional tariff provisions beyond those set forth in section 14.7 to impose responsibility for penalties on any resource that fails to provide primary frequency response for which it has an obligation to provide.

Comments:

Incentives should be provided for resources to improve frequency response performance

While UCS has no comments on the allocation of penalty costs, we note that incentives should be put in place to encourage better PFR performance.

The current proposal of obtaining frequency response through additional spinning reserve requirement does not provide resources a clear financial signal to improve their frequency performance beyond the minimum requirements. The ISO has clarified that resources will be able to include costs relating to providing frequency response in their spinning reserve bids.[2] However, including costs to provide PFR in a resource's spinning reserve bid could be a *disincentive* to improve frequency performance, as the resource will be less likely to be chosen to provide spinning reserve when it puts in a higher bid.

UCS supports the concept that different resources could have different droop settings depending on their ability to provide PFR. For example, the Bay Area Municipal Transmission group (BAMx) suggested that "response settings of 5% for hydroelectric, 4% for other synchronous generation and 3% for batteries" could be adopted.[3] However, providing an

[2] California ISO, Primary Frequency Response, Summary of Stakeholder Comments Appendix, October 20, 2015, p. 4, 9, and 15. Available at http://www.caiso.com/Documents/StakeholderCommentSummaryAppendixFrequencyResponse.pdf

[3] Bay Area Municipal Transmission group, BAMX Comments on the CAISO Frequency Response Issue Paper and August 13 Stakeholder Call, August 27, 2015, p.2. Available at http://www.caiso.com/Documents/BAMxComments_FrequencyReponseIssuePaper.pdf

incentive for different resources to choose droop settings would likely be more efficient than mandating requirements for different technologies.

Phase 2, long-term approaches

Phase 2 of the initiative will evaluate if a market constraint or product is better suited to competition for frequency response capability (Section 6.3 of straw proposal). Such market-based mechanisms could not be designed, approved and implemented by December 1, 2016, and therefore the ISO will need to consider them in a second phase of this initiative.

Comments:

When exploring constraints and/or a market product, the ISO should draw on existing literature

In comments on the issue paper, many stakeholders including UCS supported the creation of a market product for PFR, and the addition of constraints to the market optimization to ensure that enough PFR is committed.[4] The ISO can build upon work in the scientific literature[5] and at Electric Reliability Council of Texas (ERCOT).[6] The paper by Ela *et al.* includes PFR constraints that could be implemented using the data collected in Phase 1 of this initiative. ERCOT has been performing a study on the benefits of revising the provision of ancillary services – including but not limited to PFR – and will present results on November 9.[7]

Frequency response performance incentives and/or requirements for asynchronous resources should be explored in Phase 2

The ISO and stakeholders should suggest frequency response performance requirements for asynchronous resources in addition to those in Appendix K, Part B 1.2 to the ISO tariff.[8] For example, do asynchronous resources need to follow a droop curve when responding to frequency excursions, or can their response be non-proportional to the size of the frequency deviation? If asynchronous resources must follow a droop curve, what droop setting or range of settings is required?

The question of proportionality in frequency response is important for asynchronous resources because these resources may be able to ramp more quickly than conventional resources on the

[4] California ISO, Primary Frequency Response, Summary of Stakeholder Comments Appendix, October 20, 2015. Available at http://www.caiso.com/Documents/StakeholderCommentSummaryAppendixFrequencyResponse.pdf
[5] Ela, E., et al. "Market designs for the primary frequency response ancillary service—Part I: Motivation and design." *Power Systems, IEEE Transactions on* 29.1 (2014): 421-431.
[6] http://www.ercot.com/committees/other/fast
[7] http://www.ercot.com/calendar/2015/11/9/73769-FAST
[8] California ISO, Frequency Response - Straw Proposal, October 12, 2015, p.7-8. Available at http://www.caiso.com/Documents/StrawProposal_FrequencyResponse.pdf

PFR timescale of 20-52 seconds. For example, if a hypothetical resource were able to ramp through its entire capacity in 20 seconds but also needed to conform to a 5% droop curve, this could limit its response to a large frequency deviation (say 0.3 Hz) to (0.3 Hz / 60 Hz) / 5% = 10% of the resource's capacity. For simplicity the above example excludes the deadband of the resource. A balance of quick response and system stability needs to be maintained when setting standards for frequency response from fast ramping resources.

Solar facilities can be particularly effective at providing PFR if they have headroom available

As the amount of renewable electricity generation in the ISO footprint increases, there will be more pressure to reduce conventional generation during times of abundant renewable production. Some level of renewable curtailment will be a reality going forward, and frequency response may be a good way to use the headroom created by renewable curtailment to support grid reliability. This will be especially true if the binding constraint holding conventional generators online during times of renewable curtailment is a PFR requirement. Renewables should therefore be incentivized to offer frequency response.

The ISO's frequency response straw proposal does not adequately characterize the potential for solar power facilities to provide PFR. In a discussion on generator headroom, the straw proposal states that "while solar facilities can cause the depletion of headroom, wind facilities are an untapped source of headroom. Wind manufacturers have shown that wind turbine generators can provide headroom up to 5% margin between its power output and capacity of the turbine given wind conditions."[9] It is unclear why solar and wind resources are characterized differently in the straw proposal, as both wind and solar resources can be operated below their maximum power output. Doing so enables them to provide upward flexibility and PFR,[10] albeit at the cost of forgone energy production. The ability of wind to provide frequency response is already well known, so we focus on solar photovoltaics (PV) here. Solar PFR will be especially important in the California context because the state is likely to meet much of its renewables portfolio standard (RPS) obligation with solar resources.

To demonstrate how solar facilities could be operated to provide droop and upward flexibility, UCS has received permission from Mahesh Morjaria of First Solar to include recent research from the "PV Controls Demonstration Project" in these comments.[11] The National Renewable Energy Laboratory, First Solar, and the Electric Reliability Council of Texas recently tested a 30

[9] California ISO, Frequency Response - Straw Proposal, October 12, 2015, p.12. Available at http://www.caiso.com/Documents/StrawProposal_FrequencyResponse.pdf

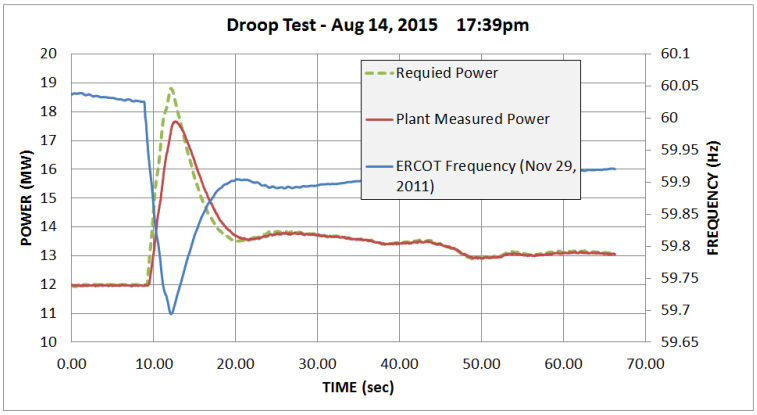
[10] Miller, N. W. *et al.* Western Wind and Solar Integration Study Phase 3 – Frequency Response and Transient Stability, National Renewable Energy Laboratory, NREL/SR-5D00-62906, December 2014, p.112-120. Available at http://www.nrel.gov/docs/fy15osti/62906.pdf

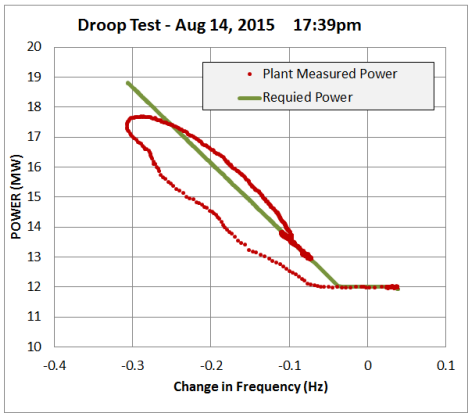
[11] Morjaria, M. PV Controls Demonstration Project. Presented to the Utiltity Varible-Generation Integration Group, Fall Technical Workshop, October 15, 2015, Slides 11-12.

MW (AC) solar plant in west Texas by simulating loss of generation and subsequent drop in grid frequency. As shown in the slide below, the solar plant was put on droop control, and responded very quickly to the drop in frequency. Further documentation from this study is forthcoming.

ERCOT Frequency Event Simulation Test

Simulation Event: Loss of 1.365 MW of generation during 30.07 GW load





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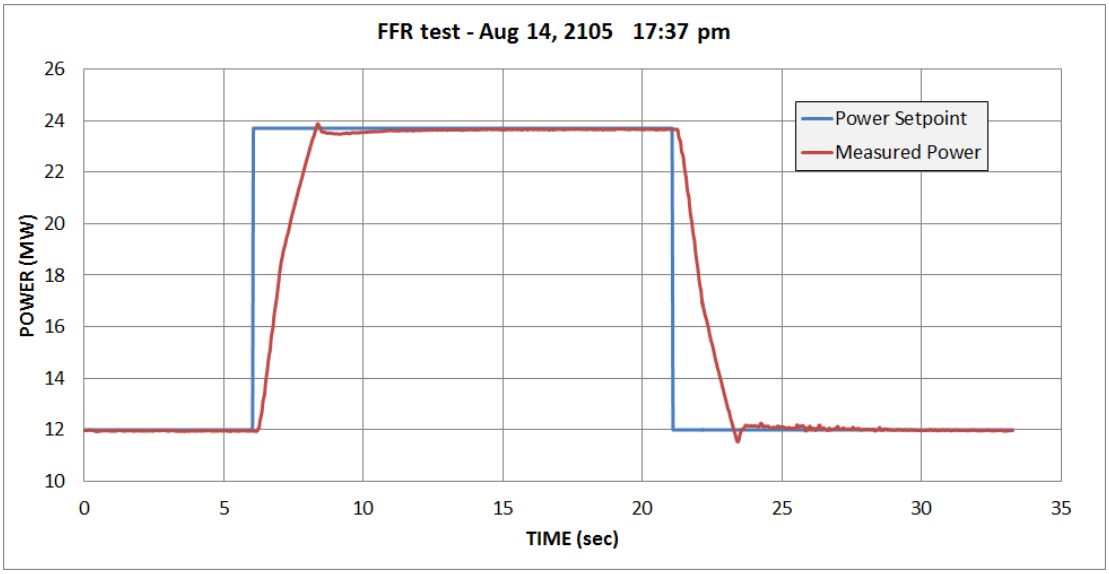
Note: this should be a loss of 1.365 GW of generation, not 1.365 MW. "Required power" is the amount commanded by the controller.

As shown in the subsequent slide, the plant was also tested to provide fast frequency response. It was able to ramp up ~40% of its rated capacity in less than three seconds. The speed of the response of the PV plant shows that it can provide upward flexibility on a timescale that could be called synthetic inertia – even faster than the PFR response discussed in the CAISO's frequency response initiative. Solar PV plants could therefore aid in reducing the magnitude of the frequency nadir. Phase 2 of the ISO frequency response initiative should design incentives to extract this type of response from capable resources when such response is needed.

Fast Frequency Response Test



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