Flexible Resource Adequacy Criteria and Must Offer Obligation – Phase 2

Straw Proposal

December 11, 2015

Contents

1. Executive Summary

Flexible Resource Adequacy Criteria and Must-Offer Obligation – Phase 2 (FRACMOO2) focuses on a variety of enhancements to the flexible resource adequacy capacity product. Specifically, the ISO will address six issues in FRACMOO2. These issues, along with a brief summary of the ISO's proposals, are:

- Review the flexible product definition and develop any additional flexible capacity needs – The ISO proposes to continue the current policy of limiting the flexible product definition to upward flexible capacity. The ISO proposes to address forecast oversupply conditions through 1) providing LSEs and LRAs information on forecast operational needs, including downward flexible capacity needs, to help guide capacity procurement, and 2) review of existing market rules to identify enhancements to provide clear economic signals to guide investment and market participant behavior to support operational needs. Market design enhancements will be addressed through new initiatives planned to start next year. Specifically, the ISO will undertake the following:

  I. Develop enhancements to upward flexible capacity requirements through FRACMOO2 initiative.

  II. Inform stakeholders about forecasted minimum net loads and potential oversupply and ramping speed needs through studies conducted annually by the ISO.

  III. Pursue enhancements to the ISO's market design to incentivize procurement of resources with the right attributes that can help mitigate operational challenges by:

    - Lowering the bid floor: The ISO will address this as part of the Stepped Constraints stakeholder initiative.
    - Reassessing current self-schedule priorities: Self-scheduling priorities establish a rank order for curtailing resource output in periods of oversupply. A reexamination of these self-scheduling priorities can inform whether additional priorities would be beneficial, determine the priorities are set properly, and if modifications can provide the ISO with additional tools to address oversupply. The ISO will address this as part of the Stepped Constraints stakeholder initiative.
    - Extending short-term unit (STUC) commitment horizon: The ISO will address this item as part of the Real-Time Market Enhancements stakeholder initiative (currently slated to start in June 2016).

- Provision of flexible capacity by import or export resources, including Effective Flexible Capacity calculation – The ISO proposes to allow 15-minute intertie resources to provide flexible resource adequacy capacity. The ISO believes a measured approach is warranted at this the time; therefore, the ISO proposes to cap allowable flexible capacity resources from qualified flexible capacity resources to no more than 50 percent of the total flexible capacity showing. Further, the ISO proposes that intertie resources meet the following criteria
    a. Must be resource specific
    b. LSE must have sufficient Maximum Import Capability (MIC) allocation for the resource
    c. Firm energy schedule

  The ISO is also considering allowing exports to provide flexible capacity and is seeking stakeholder input on the benefits of allowing exports to provide flexible capacity. If exports provide flexible capacity, the ISO seeks stakeholder input on whether it is appropriate to allocate measured demand charges to these resources and what other parameters should be considered.

- Flexible capacity from pumped-storage hydro model (*i.e*. storage resources not using the NGR model) – In the FRACMOO stakeholder initiative, the ISO committed to reassess the flexible capacity contribution of the pumped-storage hydro model as part of the current initiative. Two attributes are particularly relevant to the ISO's assessment: transition time and discrete, or blocky, dispatch volume. Because the ISO is able to account for transition time for other resources, the ISO proposes to allow pumped-storage hydro resources with transition times to be eligible to receive an Effective Flexible Capacity (EFC) value. The net change on the net load ramp created by the pumping load of discrete dispatch resources is zero because turning off of the pumping load returns the net load to the original net load. Thus, the resource does not provide any benefit to the upward net load ramp.[1] Therefore, the ISO proposes not to provide an EFC for pumping load that is subject to discrete dispatches to reduce pumping load. The ISO seeks additional stakeholder input of alternative options and demonstrations as to how such a resource can provide flexible under the currently defined product.

- Flexible capacity impacts of uncontracted/merchant Variable Energy Resources (VERs) (*i.e*. VERs where no LSE has procured its available capacity) – The ISO must submit an informational filing to FERC by the end of 2015 regarding the

[1] The ISO is not saying that pumped-hydro storage resources that have discrete curtailment provide no benefit. Those benefits are more clearly seen as downward flexible capacity to address oversupply. As noted section **Error! Reference source not found.** the ISO has outlined a plan of action to enhance opportunities for downward flexible capacity using day-ahead and real-time market tools.

impact and implications of merchant VERs on flexible capacity needs. The ISO estimates that the total current flexible capacity contribution of these merchant VERs is between -18.4 (*i.e*. resources are helping with the three hour net load ramp) and 23.3 MW. Allocating an RA requirement to a generating resource would constitute a significant departure from the existing RA construct. The ISO does not believe such a departure is warranted at this time given the impacts this would have on the current RA construct where RA requirements are assessed to load serving entities only.

- Allocating negative contributions to flexible capacity requirements – The ISO proposes to provide each LRA with its actual contribution to the calculated flexible capacity requirements, even if it is negative, and allow the LRA to allocate to LSEs, which may then sell those negative contributions as a credit towards another LSEs flexible RA showing.

- Resource adequacy showing requirements for small LSEs – The ISO proposes to allow load serving entities with a forecasted RA need of one MW or less in a given month to show zero MW of capacity on its monthly RA showing for that month. The one MW allowance would apply to each specific RA requirement – system, local (by TAC), or flexible. Allowing an LSE to show zero MW in a RA showing for a given month differs from an exemption from annual RA showings. The LSE will not be exempted from RA showings unless its metered peak demand for the previous year was less than one MW, as is the case today.

2. Stakeholder Comments and Changes to Proposal

Stakeholders submitted comments impacting the scope, scale, and direction of the FRACMOO2 stakeholder initiative in three forums: 1) comments on the Reliability Services Initiative – Phase 2 and Flexible Resource Adequacy Criteria and Must Offer Obligation – Phase 2: Issue Paper, 2) comments on the ISO working group process on FRACMOO2,[2] and 3) comments on the workshop to discuss import and export liquidity in the 15-minute market.[3] Given the diversity of comments and forums, the ISO attempted to capture the key overarching issues and concepts as they pertain to this initiative.

[2] Comments on the issue paper and the working group process can be found at http://www.caiso.com/informed/Pages/StakeholderProcesses/FlexibleResourceAdequacyCriteria-MustOfferObligations.aspx.
[3] Comments on the intertie liquidity workshop can be found at http://www.caiso.com/Pages/documentsbygroup.aspx?GroupID=F74BFA47-69BD-4DDB-A2CA-884DB879BE75.

2.1. Stakeholder comments

Recognizing the ISO would still need to develop details to a downward flexible capacity proposal, Calpine, CESA, WPTF, and Wellhead support continued development of such a product. Conversely, SDG&E believes "it is not productive to work further on the maximum inflexible generation concept" until numerous other questions are first addressed. CPUC staff, PG&E, SDG&E, Six Cities, and SCE assert that the ISO has not shown sufficient evidence to demonstrate a need for downward flexible capacity and that the interim product addresses the need for ramping speed. These parties encourage the ISO to rely on day-ahead and real-time market mechanisms to address downward flexibility needs. SDG&E suggests the ISO lower the bid floor to -$300. NGK asserts that resource adequacy needs to focus on moving many GWh of mostly solar generation from midday to the evening peaks as well as to respond to fast ramps up and down, while reducing greenhouse gas (GHG) emissions. Given these comments, the ISO proposes an initial plan of action focused on addressing downward flexibility needs in day-ahead and real-time markets, as well as conducting education and outreach. The ISO provides further details in section **Error! Reference source not found.**.

All stakeholders that commented on the issue of allowing flexible capacity from interties, including SDG&E, Powerex, PG&E, support expanding flexible capacity to 15 minute import resources. The ISO has also identified a potential opportunity to allow exports to provide flexible RA capacity. The ISO is exploring whether such an option should also include reductions or waivers of ISO measured demand charges. Stakeholders like SMUD and Powerex believe the ISO should more fully explore this option. Other parties, like SCE and Six Cities do not believe such a waiver is warranted or justified. SCE argues "waiving transmission charges or uplifts for FMM exports as it violates the principle that those using the transmission grid should contribute to the cost recovery." PG&E urges the ISO to focus on other means of enabling flexible capacity such as allowing imports to provide flexible capacity from intertie resource. The ISO provides a detailed description of its analysis and proposal on these issues in section 5.1.

PG&E requests that the ISO alter its flexible capacity counting rules for storage resources that do not fit into the CAISO's non-generator resources (NGR) model to be consistent with the California Public Utilities Commission (CPUC) rules. Currently, the ISO utilizes the pumped storage hydro model for such resources. The ISO remains committed to reexamining the benefits that the pumped storage hydro model can provide towards meeting the flexible capacity needs as currently defined as part of the current initiative. The ISO provides its assessment in section 5.2.

PG&E and the CPUC staff agree that the ISO should continue assessing the impact of uncontracted, or merchant VERs on the flexible capacity requirement. The ISO has conducted an initial assessment for this straw proposal in preparation for its informational filing with FERC at the end of the year. The ISO provides its assessment in section 5.3.

CPUC staff, CDWR, and WPTF recommend that the ISO include the issue of allocating the negative flexible capacity contribution (*i.e*. net load contribution that helps mitigate upward net load ramping needs) to the scope of this initiative. The ISO agrees and discusses this item in section 5.4.

As part of the RSI2 stakeholder comments, the Small POU Coalition asked the ISO to further clarify RA exemptions for small LSEs. The ISO currently provides an exemption for annual system RA showings if an LSE's peak measured demand was less than one MW. However, the ISO agrees that it can provide additional clarity on this matter for monthly showings as well local and flexible showings. This item has been added to the scope of the current initiative in section 5.5

The CPUC staff further recommends that the ISO expand the scope of this initiative to consider the error term adopted in FRACMOO. FERC approved the error term as part of the ISO FRACMOO tariff filing. If the ISO adjusts the flexible capacity needs based on the error term, it will provide a detailed description of how and why this adjustment was made as part of the annual flexible capacity technical study process.

The CPUC staff also requests that the ISO consider EFCs from VERs. The ISO's existing EFC counting rules do not prohibit VERs from providing flexible capacity. As such, there does not appear to be any need to explore this matter further in this initiative.

2.2. Changes made based on stakeholder comments

The ISO has made the following changes to its proposal based on stakeholder comments:

- The ISO proposes to continue the current policy of limiting the flexible product definition to upward flexible capacity. The ISO proposes to address forecast oversupply conditions through 1) providing LSEs and LRAs information on forecast operational needs, including downward flexible capacity needs, to help guide capacity procurement, and 2) review of existing market rules to identify enhancements to provide clear economic signals to guide investment and market participant behavior to support operational needs. Market design enhancements will be addressed through new initiatives planned to start next year. Specifically, the ISO will undertake the following:

I. Develop enhancements to upward flexible capacity requirements through FRACMOO2 initiative.

II. Inform stakeholders about forecasted minimum net loads and potential oversupply and ramping speed needs through studies conducted annually by the ISO.

III. Pursue enhancements to the ISO's market design to incentivize procurement of resources with the right attributes that can help mitigate operational challenges by:

- Lowering the bid floor: The ISO will address this as part of the Stepped Constraints stakeholder initiative.
- Reassessing current self-schedule priorities: Self-scheduling priorities establish a rank order for curtailing resource output in periods of oversupply. A reexamination of these self-scheduling priorities can inform whether additional priorities would be beneficial, determine the priorities are set properly, and if modifications can provide the ISO with additional tools to address oversupply.[4] The ISO will address this as part of the Stepped Constraints stakeholder initiative.
- Extending short-term unit (STUC) commitment horizon: The ISO will address this item as part of the Real-Time Market Enhancements stakeholder initiative (currently slated to start in June 2016).

- Beyond the elements identified in the issue paper, the ISO has added the following items to the scope of this stakeholder initiative:
  - Consideration of flexible RA capacity for exports and assessment of the measured demand charges for those resources
  - Allocation of negative contributions to the flexible capacity need
  - RA capacity requirement showing exemptions

3. Plan for Stakeholder Engagement

The current schedule for this initiative is shown below.

Milestone	Date
Straw proposal posted	December 11, 2015

[4] Appendix A includes a table of the self-scheduling priorities when there is oversupply on the system (*i.e.*, negative parameters).

Milestone	Date
Stakeholder call	December 21, 2015
Stakeholder comments on revised straw proposal due	January 6, 2016
Revised straw proposal posted	February 11, 2016
Stakeholder call	February 25, 2016
Stakeholder comments on revised straw proposal due	March 10, 2016
Draft final proposal posted	April 14, 2016
Stakeholder call on draft final proposal	April 28, 2016
Stakeholder comments on draft final proposal due	May 12, 2016
Board of Governors Meeting	June 28-29, 2016

4. Background

As noted in the joint issue paper, the FRACMOO2 stakeholder initiative focuses on the need to enhance the existing flexible capacity product by (1) reviewing the need for downward flexible capacity to address oversupply, as well as fast upward and downward ramping, (2) allowing intertie resources to provide flexible capacity, and (3) assessing flexible capacity capability of storage resources such as pumped-storage hydro resources that do not align with the ISO's NGR market design. Based on stakeholder comments, the ISO also has expanded the original list of issues contained in the issue paper. Below is a list of topics the ISO proposes to cover in the FRACMOO2 initiative:

1) Review the flexible product definition and develop any additional flexible capacity needs
2) Imports and exports providing flexible capacity, including any modifications to the EFC calculation to incorporate flexible capacity
3) Flexible capacity from storage resources not using the NGR model
4) Flexible capacity impacts of uncontracted/merchant VERs
5) Allocating the negative contributions of flexible capacity requirements
6) Resource adequacy showing requirements for small LSEs

4.1. Working group process: an overview of oversupply

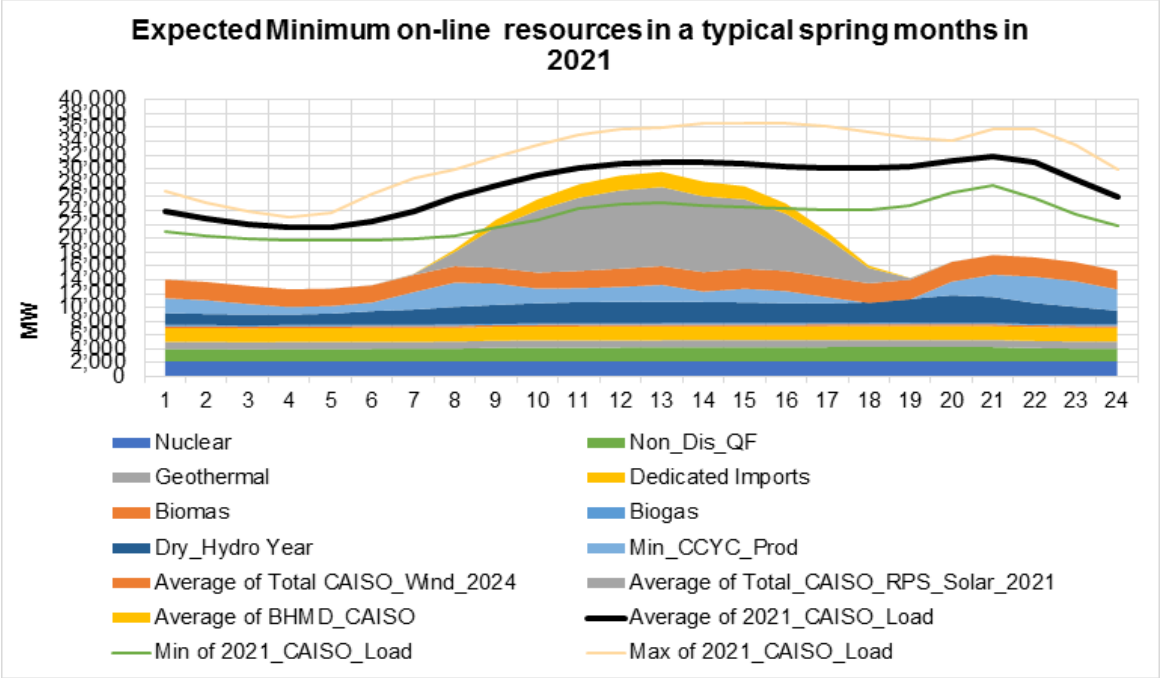
As an initial step in the FRACMOO2 stakeholder process, the ISO hosted two working group meetings. These working group meetings offered stakeholders an opportunity to discuss several issues identified in the joint RSI2-FRACMOO2 issue paper, including the need for downward flexible capacity to address oversupply.[5] The primary point of discussion in the working group meeting was the ISO's expressed need to continue improving ways to capture additional downward flexible capacity to address oversupply. When the ISO developed the FRACMOO tariff, the primary focus was addressing upward flexible capacity needs. However, the ISO also expressed a need to address downward flexibility in the FRACMOO stakeholder initiative.[6] The existing FRACMOO framework provide some downward flexible capacity when flexible capacity resources receive day-ahead energy awards and are required to rebid that capacity into real-time markets. Based on the data submitted in the ISO's Flexible Capacity Technical Study, the ISO expects the net-load continue to drop even lower on low-load days, thus increasing the number of potential oversupply days.

In times of low net load there may be limited ability to adjust non-dispatchable resources downward to maintain supply-demand balance. As an example, Figure 1 shows forecasted low, average, and low load for a spring day in 2021.

Figure 1

[5] In the context of the working group process, the ISO materials referred to Overgeneration. However, after review of the ISO tariff, Business Practice Manuals, Operating procedures, the ISO determined that the use of the term Overgeneration conflated the problem the ISO was examining. For details on the basis for including downward flexible capacity requirements, see appendix B. For specific details on the ISO's working group proposal, see http://www.caiso.com/Documents/PresentationProposal-FlexibleRACriteriaMustOfferObligation.pdf.

[6] http://www.caiso.com/Documents/RevisedDraftFinalProposal-FlexibleRACriteriaMustOfferObligation-Clean.pdf at p. 30 footnote 26.



The purpose of Figure 1 is to demonstrate the potential for oversupply, not to identify a specific quantity of downward flexible capacity need. The graph in Figure 1 generally depict the challenges identified in the ISO's duck chart: The increased potential for energy supply to exceed energy demand.[7] This load is plotted against the forecasted non-dispatchable resources and average levels of wind and solar output.[8] As a conservative estimate, the ISO assumed a low hydro year output. The figure shows the average wind and solar output for spring months and shows that even with average wind and solar output, combined with the remaining inflexible capacity in the ISO, could create the potential for oversupply on the ISO system. This potential for oversupply increases during high wind and solar output.

There are other critical factors that play into the portfolio of resources actually online and potentially exacerbating oversupply. For example, this assessment does not fully account for the minimum operating levels needed to ensure sufficient ramping capabilities to meet evening load and net load ramps.[9] Further, it does not account for

[7] The duck chart reflect low net-load (load minus wind and solar output). Figure 1 plots generating resources against gross load.

[8] The data points provided by this initial assessment are consistent with joint planning assumptions between the ISO, CPUC, and CEC. The ISO developed the wind and solar portfolios using the CPUC's RPS calculator. The load wind and solar forecasts have been built out based on the 2014 LTPP assumptions based on the CPUC RPS calculator and reduced to reflect expected on-line wind and solar resources for 2021. The RPS calculator is currently be redesigned and may not accurately capture current RPS procurement practices. However, in an effort to stay consistent with joint planning assumptions, the ISO elected to use this as an initial data point.

[9] Including minimum operating levels of rampable resources may increase the likelihood that energy supply exceeds demand.

forecast error in load or wind and solar output.[10] In short, the type of load and resource assessment done in Figure 1 offers a "best case" scenario. Additional system needs and forecast error likely increase the potential for oversupply.

Although the ISO believes that ensuring flexible capacity is available to the ISO day-ahead and real-time markets through RA procurement will help mitigate the frequency and magnitude of, or even avoid, oversupply events, proper incentives in the day-ahead and real-time markets will also help the ISO manage oversupply. Out-of-market dispatches and curtailing self-scheduled resources will remain potential solutions to address oversupply situations. However, deferring large quantities of oversupply to day-ahead and real-time markets may lead to reliability challenges and non-market based solutions in the long run.

5. Straw Proposal

5.1. Allowing flexible capacity from import and export resources

In the FRACMOO stakeholder initiative, the ISO committed to assessing the ability for 15-minute intertie resources to provide flexible capacity resources. FERC, in its October 16, 2014 order accepting the ISO's tariff amendments, instructed the ISO to submit an informational report that, *inter alia,* "assess[es] the feasibility of permitting static import resources to provide flexible resource adequacy capacity."[11] The ISO has completed a preliminary assessment of flexible ramping needs and the differences between five minute dispatch and 15-minute dispatch timing. Because flexible capacity needs are forward looking, the ISO's assessment relied on the forecasted load, wind, and solar profiles used for the 2016 Flexible Capacity Technical Needs study.

Although the ISO initial commitment was to assess opportunities for imports to provide flexible capacity, with the ISO has identified an opportunity for imports to provide flexible capacity, as well. For example, cleared export bids can help increase the net load in the middle of the day (just like charging a NGR storage resource). Therefore, the ISO is exploring the potential for exports to provide flexible capacity.

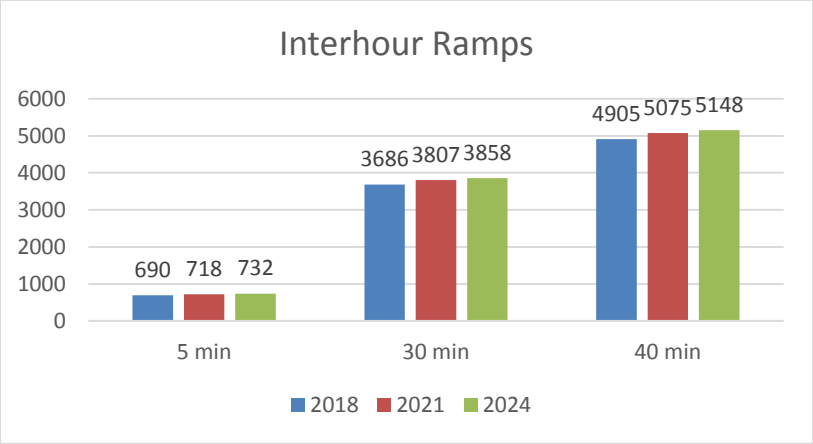
5.1.1. Imports

Based on the ISO's initial assessment, the ISO proposes to allow qualified 15-minute intertie resources (qualifications are described below) to provide flexible capacity. As shown in Figure 2, the largest changes between real-time dispatch and the time at which 15 minute intertie resources are issues is almost 5,000 MW. This does

[10] If day-ahead load forecast is higher than real-time load, unit commitments made in the day-ahead market may increase the amount of minimum operating levels online, increasing the potential oversupply
[11] *California Independent System Operator Corporation,* 149 FERC ¶61,042 (2014). .

not account for five-minute variability, which can be around 700 MW. All five minute variability between dispatch intervals must be managed using internal ISO resources. Further, all variation between the 15-minute intertie dispatch intervals and real-time must also be handled by internal ISO resources.

Figure 2: Largest net load ramps between dispatch intervals (in MWs)



This implies that 15-minute intertie resources can provide reliability benefits, however, because there is still significant variability after dispatches instructions for 15-minute intertie resources these benefits are not comparable to 5-minute dispatchable capacity. As such, the ISO believes a measured approach is warranted at this the time. Accordingly, the ISO proposes to cap allowable flexible capacity resources from qualified flexible capacity resources to no more than 50 percent of the total flexible capacity showing. The ISO can reassess the benefits of raising this limit at that time.

5.1.1.1. Eligibility

In order for an import to provide flexible resource adequacy capacity, 15-minute intertie resources must first meet following four basic criteria:

1) Must be resource specific
2) LSE must have sufficient Maximum Import Capability (MIC) allocation for the resource

3) Firm energy schedule

The ISO provides the basis for each of these initial criteria below. However, the ISO is still examining these criteria and assessing the need for any further criteria. **The ISO seeks stakeholder input on these criteria and any other criteria that should be considered for 15-minute imports.**

The ISO assessed the possibility of allowing non-resource specific resources to provide flexible capacity, but identified two primary shortcomings with such an approach. First, the goal of forward procurement is to ensure the ISO has sufficient resources committed to the ISO market. Further, as part of EIM, the ISO conducts a ramp sufficiency test to ensure that one EIM entity is not leaning on the flexible capacity of another. If the ISO allows non-resource specific imports to provide flexible capacity, it is possible such resource could count towards meeting the flexible capacity requirement of two BAs: one as a resource specific flexible capacity resource; and the other as the resource backing a non-resource specific flexible capacity resource. This, would result in a double counting of the same resource. **The ISO seeks stakeholder feedback on whether the resource specific criteria is necessary for non-EIM capacity.** The second shortcoming is associated with determining the quality of the flexible capacity and the amount of capacity the resource can provide. As the resources backing a non-resource specific flexible capacity resource change, the "operational attributes" of the import might also change day-to-day or even hour-to-hour. Thus, an import that was capable of providing flexible capacity during one time period might be unable to provide it in a different period. Therefore, at this time the ISO proposes that import flexible capacity resources be resource specific.

Any LSE using an import resource for flexible capacity must demonstrate that it has sufficient Maximum Import Capability (MIC) capacity. The MIC allocation process is described in section 40.4.6.2 of the ISO tariff. The MIC capacity is how LSEs demonstrate that the resource's output, and therefore flexibility, is deliverable to the ISO. The ISO is not proposing changes to this process. However, having sufficient MIC is a requirement for any import resources to provide RA capacity. It is equally important that flexible capacity be deliverable into the ISO and therefore appropriate to maintain this standard for flexible capacity.

The flexible capacity resource must commit to providing firm energy to the ISO. The ISO is relying on the output of the resource to meet flexibility needs. Allowing other BAAs or even the SC for the resource to adjust the output from the resource for external reasons may comprise the ISO's ability to meet a ramping need. For example, if the ISO is relying on a resource to meet a ramp, but the resource is pulled from the ISO to provide energy to the external BA, the ISO would be the BA that has to deal with the reliability implications.

5.1.1.2. Calculating resources effective flexible capacity

Because the import resource must be resource specific, the ISO will calculate EFC the same way it calculates EFC for an internal resource. Specifically the ISO would apply the following formula to determine EFC for an import flexible capacity resource:

If start-up time of a resource is greater than 90 minutes:

EFC is limited to the MW range between Pmin and Net Qualifying Capacity (NQC) as limited by ramp rate

EFC = minimum of (NQC-Pmin) or (180 min * RRavg)

If start-up time of a resource is less than or equal to 90 minutes:

EFC is limited to the MW range between zero and NQC as limited by start-up time and ramp rate

EFC = minimum of (NQC) or (Pmin + (180 min – SUT) * RRavg)

Where: SUT = Longest (cold) RDT start-up time in minutes

RRavg = average MW/min ramp rate between Pmin and NQC

5.1.1.3. Must offer obligation

All import flexible capacity resources will be held to the same must-offer obligation as internal resources providing the same category of flexible capacity. Specifically, the resource must submit economic bids into both the day-ahead and real-time markets for the total amount of flexible capacity that has been provided. The only difference is that the import resource must submit economic bids into both the day-ahead and 15-minute markets (which is the shortest time interval on which they can be dispatched as opposed to five-minute market used for internal resources).

5.1.1.4. Application of RAAIM

The ISO will apply RAAIM to all import flexible capacity resources in a manner comparably to how the ISO applies RAAIM to internal flexible capacity resources. More specifically, the ISO will hold an import flexible capacity resource to the must offer obligation of the highest quality of flexible capacity for which it is shown. For example, if an import flexible capacity resource is shown as both a category one and category two flexible capacity resource, the ISO will assess the entire resource as a category one flexible capacity resource. If an intertie flexible capacity resource goes on outage, then the resource must provide substitute capacity from either an internal flexible capacity resource or another qualified import resource that is able to provide the same level of flexible capacity for the duration of the outage. Internal resources must still meet

bidding requirements for other internal resources (*i.e*. economic bids for five minute dispatches).

A unique challenge with flexible capacity from imports is ensuring the resource is, in fact, providing flexible capacity and is not simply providing a wheeling schedule through the ISO. The ISO is considering how it can ensure that the flexible capacity sold by 15-minute intertie resource is actually made available for use by the ISO. For example, could the ISO apply in the RAAIM calculation for import schedule to ensure it does not also have an associated export schedule? Therefore, **the ISO seeks stakeholder input about any other special considerations that are needed to properly apply RAAIM to import resources. Further, the ISO requests whether stakeholders have any other concerns regarding the RAAIM, or any other aspect of allowing flexible capacity from intertie resources**.

5.1.2. Exports

The ISO is currently exploring the potential for exports to provide flexible capacity. This is a new area of exploration and the ISO has not completed a full assessment comparable to the one done for imports provided above. As such, the ISO is not, at this time, proposing specific eligibility criteria, must-offer obligations, or other guidelines and/or limits as part of this straw proposal. It should be noted that exports would not help address peak load needs. Therefore, just as is the case for the charging portion of an NGR resource, an export resource would only be permitted to sell flexible capacity, not system RA capacity. However, **the ISO is seeking stakeholder input on the potential benefits of pursuing such a products (including the likelihood that such a product would be procured and/or needed), qualifying criteria for providing the product or any other considerations the ISO should consider. The ISO is also seeking stakeholder input on whether exports providing flexible Resource Adequacy capacity should subject to any exemption from or reduction to measured demand charges, including wheeling access charges.** The ISO is considering whether adjustments to measured demand charges (1) are needed to help facilitate exports ability to provide flexible capacity and (2) are applicable since the export is providing a grid service.

5.2. Enhancements to flexible capacity treatment for pumped-hydro storage resources

The ISO has identified two issues regarding the ability of pumped-hydro storage resources to provide flexible capacity. These issues are (1) the ability to use the charging portion of storage resources that use the pumped-hydro storage model, and (2) assessing the quantity of flexible capacity that storage resources that are charging in

local capacity areas can provide. This section addresses these two issues in greater detail.

5.2.1. Pumped-storage hydro unit model

In the FRACMOO stakeholder initiative, the ISO established a model for NGRs to provide flexible capacity from the charging portion of the resource. The policy was based on the idea the NGRs could increase net load at the start of the ramp and transition smoothly into the net load curve, thereby reducing the total net load ramp. However, the ISO did not establish similar provisions for storage or charging resources that did not fit into the NGR model. The primary model used by the ISO for non-NGR resources is the pumped-storage hydro unit model. The ISO committed to reassess this model as part of the current initiative.

The ISO's assessment of non-NGR storage or charging resources is focused on two attributes of pumped-hydro storage resource: transition time and discrete, or blocky, dispatch volumes both on and off. The ISO will assess both of these attributes in determining whether (1) it is reasonable to allow pumped-storage hydro resources to count pumping load as flexible capacity in the same way as an NGR resource and, whether it is reasonable to provide an EFC for the pumping load, and (2) if it is appropriate to determine the EFC for the resource, how the quantity is determined.

5.2.2. Transition time

NGRs do not have a transition time and can switch smoothly from charge to discharge. This makes for a very clear, continuous change towards meeting the ISO's ramping need. The ISO has continued to assess whether the impact of transition time creates a reliability basis for disqualifying pumped-storage hydro resources from providing flexible capacity from their pumping load. The answer, in short, is no.

Transition times are not unique to the pumped-storage hydro model. Multi-stage generating (MSG) resources also have transition times. Currently, the ISO allows MSG resources to provide flexible capacity. The ISO accounts for the transition time for MSG resources in determining how many MWs the resource can ramp over three hours. Further, the ISO's STUC outlook looks out over four and half hours and can determine when the pumping load is not needed, turn off this load, leave it idle for a transition period (while other resources in the flexible capacity fleet ramp), and then commit the discharge capabilities of the resource.

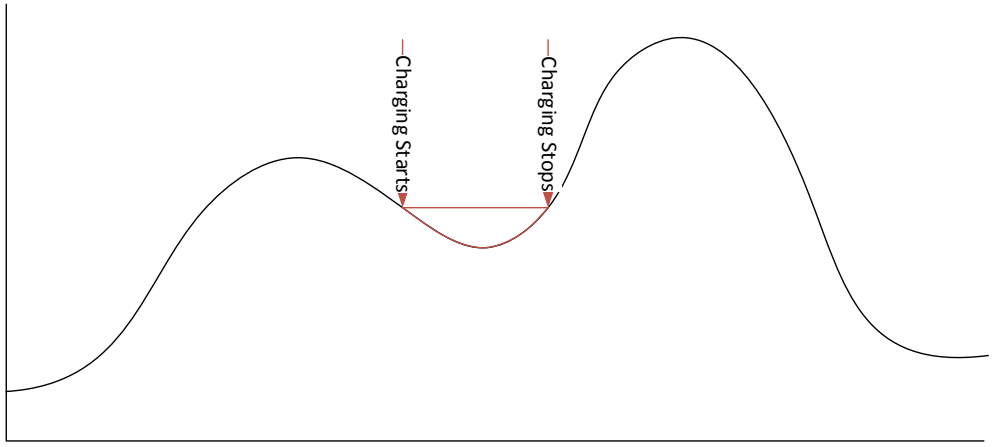
Because the ISO is able to account for transition time for other resources and because the STUC process should be able to determine when the pumped-storage resource should transition, the ISO will not disallow pumped-storage hydro resources with transition times to be eligible to receive an EFC. The calculated EFC for the

charging portion of the resource would be subject to any other counting rules or prohibitions established herein.

5.2.3. Discrete dispatch level

The ISO determines EFC based on a resource's ability to address the ISO's three hour net load ramp, *not simply lifting the net load*. As an example, the basis of providing NGRs an EFC for the charging capability is not based on their ability to impact net load, but their impact on the net load ramp.[12] As noted above, NGRs transition smoothly from charge to discharge. This smooth transition from the charging to a zero output state allows NGRs to reduce the net load ramp. Figure 3 shows this transition. Note that this smooth transition ensures there is no regression back down towards the net load curve (*i.e*. the new net load curve does not decrease). In fact, the old net load curve approaches the new net load curve.

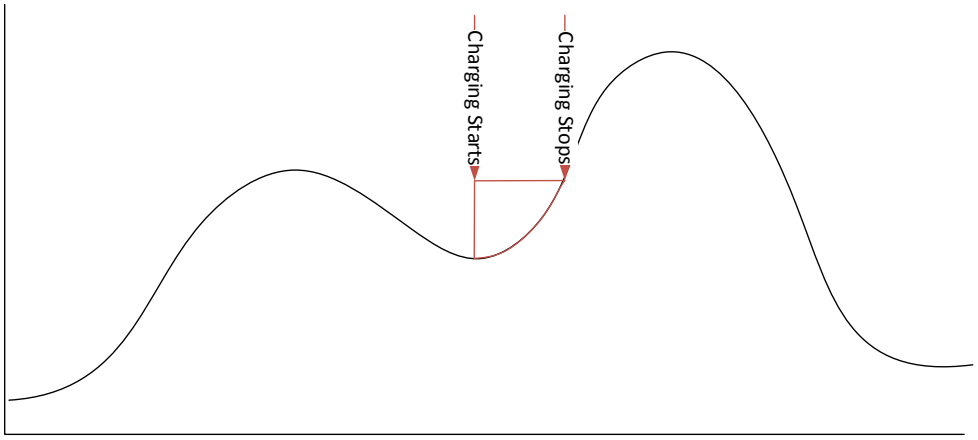
Figure 3: Example of NGR resource's impact on net load ramp with continuous charging capabilities



Further, as shown in Figure 4, the important feature is the smooth transition off, not on. In this figure, the storage resource turns on discretely, but because it is able to decrease its charge continuously, it is able to reduce the net load ramp for all of its charging portion. Therefore, at this time, the ISO does not believe there is a need to set any rules limiting the output of a storage resource that has a discrete start-up dispatch.

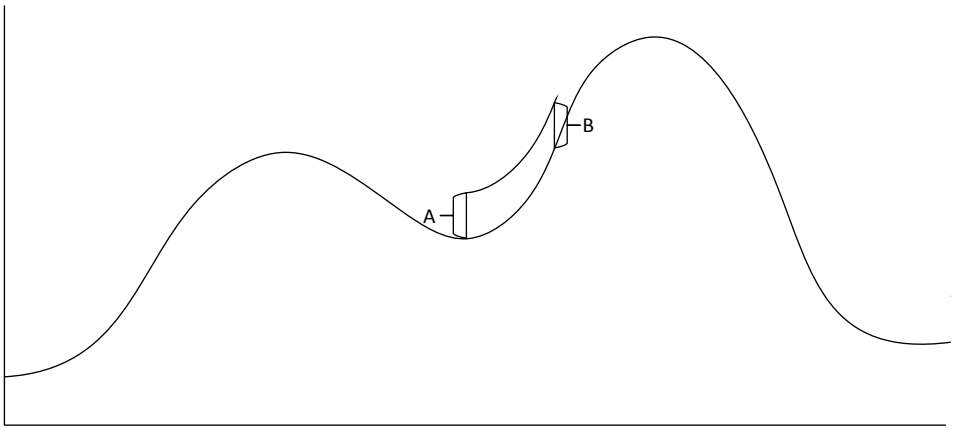
Figure 4: Example of NGR resource's impact on net load ramp with discrete start but continuous charging capabilities

[12] It is important to note that EFC is a measure of ramping capabilities, not a measure of impact on net load.



Discrete transitions out of pumping mode, however, may not provide a comparable benefit in terms of contribution to net load ramps. See Figure 5 as an example of such a resource.

Figure 4: Example of resource's impact on net load ramp with discrete start and discrete stop charging capabilities



In this figure, the resource turns on discretely at a quantity of A MWs (which, as noted, above is acceptable). However, the resource then stops pumping, dropping B MWs of load. This load drop means that new net load *drops* immediately back to the old net load curve. Because the starts and stops are both discrete, the figure shows that the ramps from the old and new net load curves are the same. In short, the actual ramp, in terms of MW, between A and B is the same on both curves. The net change created by the pumping load on the net load ramp is zero. The resource turns on A MWs and the off B MWs, where A equals B. Thus, the resource does not provide any benefit to the upward net load ramp. Therefore, the ISO proposes not to provide an EFC for pumping load that is subject to discrete dispatches to reduce pumping load.

However, **the ISO remains open to considering alternative options and demonstrations as to how such a resource can provide flexible capacity benefits. The ISO seeks additional stakeholder input on this matter**.

5.2.4. Assessing the ability to charge storage resources

The flexible capacity requirement is currently a system capacity requirement. There is no obligation or limitations based on the location of the resource because the ISO assumes that a resource can provide ramping capabilities to the system without specific congestion concerns. The ISO has identified a need to further explore this assumption. Specifically, the ISO has explored whether the charging portion of storage resources can lift the net load without turning on additional generation internal to the load pocket, thus helping address the net load ramp as described above. Stated differently, the ISO will assess whether a storage resource can absorb excess system energy when physically located in a local capacity area or whether it will simply require additional local generation to charge. If additional local generation is needed, then the charging load has not absorbed excess system energy.

Based on this assessment, the ISO has determined that additional studies are needed. It is necessary to conduct an off-peak study of transfer capability into load pocket to ensure there is sufficient transfer capability for storage resource to charge using system energy and effectively lift net load without committing any generating resources located in the load pocket. As is done for the ISO's local RA studies, all relevant input assumptions will be determined as part of the ISO's annual stakeholder process. Based on these study results, the ISO will determine the maximum allowable charging EFC that can be provided in any given local area.

5.3. Merchant Variable Energy Resources

FERC, in approving the FRACMOO tariff amendments, instructed the ISO to file an informational report to FERC regarding the impact of merchant VERs (*i.e*. VERs not under contract to an ISO based LSE but located in the ISO BA) on flexible capacity requirements by December 31, 2015. In preparation of this filing, the ISO has conducted an assessment of the impact of merchant VERs on flexible capacity requirements and to determine whether the contribution of merchant VERs to the flexible capacity need and whether the contribution is large enough to warrant redesigning the flexible RA product to allocate a flexible capacity requirement to these VERs. It should be noted, that currently only LSEs have RA forward procurement obligations. Although generators can provide RA capacity, they are not required to procure any.

As an initial matter, the ISO began its assessment by reviewing merchant VERs contribution to the 2016 flexible capacity technical needs study. The ISO has identified

200 MW of merchant wind resources and zero MW of merchant solar. This accounts for 4.48 percent of all wind capacity included in the 2016 flexible capacity technical needs study. The forecasted total three-hour net load ramp for 2016 for non-summer months is between 8,850 MW and 11,662 MW. During these months, which are the months of greatest flexible capacity need, the ISO study showed that wind resources' forecasted contribution to the three hour net load ramp is about 1-2 percent.[13] Table 2, below, shows:

1) The forecasted three hour net load ramps
2) The average wind contribution to that ramp as percentage
3) The quantity of MWs that all wind contributes based on the three hour net load ramp and the percent wind contributes
4) The percent of all wind resources that are merchant
5) The estimated contribution of merchant VERs for all months.

To determine the quantity of flexible capacity requirements caused by merchant VERs, the ISO multiplied the maximum three hour net load ramp times the contribution by all wind resources times the percent of wind resources that are merchant VERs. Given the total three hour net load ramps, and the expected contribution of wind to these ramps, the ISO estimates that the total flexible capacity contribution of these merchant VERs in non-summer months would be between -7.93 (*i.e*. wind resources are helping with the three hour net load ramp) and 23.3 MW.

Table 2: Results of 2016 flexible capacity technical needs study and estimated contribution of merchant VERs to overall flexible capacity needs.

Month	Three hour net load ramp	Average of Wind contribution 2016	Estimated MW of total wind contribution	Percent of wind resources that are merchant VERs	Flexible RA contribution
January	9,974	-1%	99.74	4.48%	4.47
February	9,421	-2%	188.42	4.48%	8.44
March	9,284	-2%	185.68	4.48%	8.32
April	8,850	2%	-177	4.48%	-7.93
May	6,498	-8%	519.84	4.48%	23.30
June	5,876	7%	-411.32	4.48%	-18.44
July	6,392	6%	-383.52	4.48%	-17.19
August	6,412	6%	-384.72	4.48%	-17.24
September	7,784	1%	-77.84	4.48%	-3.49
October	9,066	-2%	181.32	4.48%	8.13

[13] The details regarding all calculations and forecasted contributions from load, wind, and solar resources can be found in the 2016 flexible capacity technical needs study at http://www.caiso.com/Documents/FinalFlexibleCapacityNeedsAssessmentFor2016.pdf.

November	10,858	-1%	108.58	4.48%	4.87
December	11,662	-2%	233.24	4.48%	10.45

As noted above, allocating an RA requirement to a generating resource constitutes a significant departure from the existing RA construct. Given the *de minmis* contribution to the three hour ramp needs caused by merchant VERs, the ISO does not believe there is sufficient evidence to change the existing RA construct. Therefore, the ISO will not pursue an additional requirements for merchant VERs at this time. However, based on the annual data submitted by LSEs used in the ISO's flexible capacity technical needs assessment, the number of merchant VERs may increase over time as existing contracts expire. Increased state RPS targets may reduce the likelihood that resources under expiring contracts remain merchant VERs (*i.e*. these resources may receive new contracts to help meet higher RPS targets). The ISO will monitor these changes to determine whether expiring contracts remain merchant and whether there are sufficient quantities of merchant VERs to warrant further action.

5.4. Allocating negative contributions to flexible capacity requirements

The ISO currently calculates an LRA's contribution to the three hour net load ramp using three factors:

1) Change in load
2) Change in wind output from contracted wind resources
3) Change in solar output from contracted solar resources

An LRA's contribution is currently limited to a minimum of zero. However, based on the above factors, it is possible that an LRA may actually have a beneficial impact on the three hour net load ramp. In particular, LRA that has load drop with little wind or solar output change may actually help mitigate the three hour net load ramp. For example, suppose an LRA's expected contribution to the three hour net load ramp is -100 MW load, -10 MW of wind, and -20 MW of solar. In total, the LRA would be mitigating the three hour net load ramp by 70 MW.[14] Under the current flexible capacity counting rules this LRA would receive an allocation of zero instead of -70.

The ISO proposes to provide each LRA with its actual contribution, even if it is negative and allow the LRA to allocate those MW it its jurisdictional LSEs, who could, in turn, sell those negative contributions as a credit towards meeting another LSE's flexible RA showing. This results in a more equitable treatment for LRAs that can help reduce

[14] The formula for determining an LRA's contribution to the net load ramp can be found at http://www.caiso.com/Documents/RevisedDraftFinalProposal-FlexibleRACriteriaMustOfferObligation-Clean.pdf, at p. 18.

the net load ramps, provides for a low cost solution to meet flexible capacity needs, and provides further incentives to LSEs and LRAs to reduce their contributions to the three hour net load ramp.

5.5. Resource adequacy showing requirements for small LSEs

The ISO tariff provides an exemption from RA showings for small LSEs if measured demand for the previous year was less than one MW. This exemption was based on the challenge and cost associated with trying to procure less than a MW of capacity. Although this waiver provides some relief for small LSEs, it still leaves many LSEs with many off-peak monthly RA requirements of less than one MW. Currently, the tariff is less clear about the showing requirements during those months. Further, there is currently no discussion about local and flexible capacity requirements of less than one MW. As such, the ISO proposes to clarify the RA showing requirements for these instances.

The ISO proposes to allow an LSE with a measured peak demand of greater than one MW but with a monthly RA requirement for a specific month and a specific RA product (*i.e.* system, local, or flexible capacity) less than one MW to show zero MW for the monthly RA showing for that RA product. To be clear, the ISO is not saying the LSE would not have an RA showing requirement. For example, a small LSE may have a peak load of 2.5 MW in June, but only .75 in January through May. This LSE could show zero MW for RA for January through May but would have to provide a showing of 2.5 MW for June.[15]

RA showings for local and flexible capacity require additional clarity. In RSI2 the ISO is proposing that each LSE specific designate the capacity it will use for meeting its local capacity requirement. As part of this FRACMOO2 proposal, the ISO proposes to allow an LSE to show zero MW for its local capacity requirement if the LSE's local requirement is less than one MW in a TAC. This means the LSE would not be required to designate local capacity in that TAC area. As an example, if an LSE has a local requirement in PG&E TAC of 0.75 MW and a 1.25 MW in SCE TAC, then the LSE would be required to designate 1.25 MW of local in SCE TAC, but would not be required to designate any local RA in PG&E TAC. Further, for flexible RA, the ISO proposes that an LSE be permitted to show zero MW for flexible RA only if the *total* flexible RA requirement for the LSE is less than one MW. The LSE may not show zero if only a specific category of flexible capacity is less than one MW. As another example, a small

[15] The LSE may submit these values as part of its annual RA showings and, as proposed in RSI2, have those values automatically roll through into the monthly showings. For the ISO's current proposal on this matter, see http://www.caiso.com/Documents/SecondRevisedStrawProposal-ReliabilityServicesPhase2.pdf at p. 33.

LSE in May with a peak load forecast of 6 MW but a flexible capacity requirement of 0.75 MW would have to provide a system RA showing for the 6 MW, but would not be required to provide a flexible capacity showing for that month.

6. Next Steps

The ISO will discuss this straw proposal with stakeholders during a call on December 21. The ISO requests that stakeholders submit written comments on the straw proposal by January 6, 2016 to initiativecomments@caiso.com. Please use the template at the following link to submit your comments: http://www.caiso.com/informed/Pages/StakeholderProcesses/FlexibleResourceAdequacyCriteria-MustOfferObligations.aspx.

Appendix A: Self-scheduling priorities

Current BPM priorities when there is oversupply on the system (*i.e.*, negative parameters)

Penalty Price Description	Day-Ahead		Real-Time		Comment
	Scheduling Run Value	Pricing Run Value	Scheduling Run Value	Pricing Run Value	
Qualified Load Following self-provision Up or Down	[redacted]		-8500	0	Scheduling run penalty price reflects the highest priority among all categories of AS self-provision. AS bid floor is used as the pricing parameter for any type of AS self-provision.
Day ahead conditionally qualified Reg Up or Down Award			-7750	0	Scheduling run penalty price is higher than the penalty price for energy balance constraint to reflect higher in priority over energy. AS bid floor is pricing parameter for any type of AS self-provision.
Day ahead conditionally qualified Spin Award			-7700	0	Scheduling run penalty price is lower than the one for Reg-up. AS bid floor is pricing parameter for any type of AS self-provision.
Day ahead conditionally qualified Non-spin Award			-7650	0	Scheduling run penalty price is lower than the one for Spin. AS bid floor is pricing parameter for any type of AS self-provision.

Penalty Price Description	Day-Ahead		Real-Time		Comment
	Scheduling Run Value	Pricing Run Value	Scheduling Run Value	Pricing Run Value	
Reliability Must-Run (RMR) pre-dispatch curtailment (supply)	-6000	-150	-6000	-150	The ISO considers transmission constraints when determining RMR scheduling requirements. After the ISO has determined the RMR scheduling requirements, the market optimization ensures that the designated capacity is scheduled in the market.
Pseudo-tie layoff energy	-6000	-150	-6000	-150	Pseudo-tie layoff energy is scheduled under contractual arrangements with the Balancing Authority in whose area a pseudo-tie generator is located.
Transmission Ownership Right (TOR) self schedule	-5900	-150	-5900	-150	A TOR Self-Schedule will be honored in the market scheduling in preference to enforcing transmission constraints.
Existing Transmission Contract (ETC) self schedule	-5100 to -5900	-150	-5100 to -5900	-150	An ETC Self-Schedule will be honored in the market scheduling in preference to enforcing transmission constraints. The typical value is set at $5500, but different values from $5100 to $5900 are possible if the instructions to the ISO establish differential priorities among ETC rights. For some ETC rights the ISO

Penalty Price Description	Day-Ahead		Real-Time		Comment
	Scheduling Run Value	Pricing Run Value	Scheduling Run Value	Pricing Run Value	
					may use values below the stated scheduling run range if that is required for consistency with the instructions provided to the ISO by the PTO.
Converted Right (CVR) self schedule	-5500	-150			A CVR Self-Schedule is assigned the same priority as the typical value for ETC Self-Schedules.
Regulatory Must-Run and Must Take supply curtailment	-1350	-150	-1300	-150	Regulatory must-run and must-take supply receive priority over generic self-schedules for supply resources.
Price-taker supply bids	-1100	-150	-1100	-150	Generic self-schedules for supply receive higher priority than Economic Bids at the bid cap.
Final IFM Supply Schedule			-1000	-150	Scheduling run penalty price is much higher in magnitude than supply generic self-schedule but lower than ETCs. Energy bid floor is the pricing parameter for all energy supply self-schedules.

Penalty Price Description	Day-Ahead		Real-Time		Comment
	Scheduling Run Value	Pricing Run Value	Scheduling Run Value	Pricing Run Value	
Power Balance constraint for individual PACE and PACW areas.	[redacted]		-750	-150	Subject to the FERC order granting waiver of tariff sections 27.4.3.2.and 27.4.3.4, and consistent with Section 10.1.6 of the BPM for Energy Imbalance Market, which implement the price discovery mechanism overriding the pricing parameters and yielding the last economic signal under constraint relaxation. The scheduling run parameter is set to -750 for the individual EIM areas to coordinate the relaxation of the EIM power balance constraint during over-generation conditions relative to congestion on non-EIM constraints.
Conditionally qualified Regulation Up or Down self-provision	-405	NA	-405	0	Conversion of AS self-schedules to Energy pursuant to section 31.3.1.3 received higher priority to maintaining the availability of regulation, over spinning and non-spinning reserve.
Conditionally qualified Spin self-provision	-400	NA	-400	0	Conversion of AS self-schedules to Energy pursuant to section 31.3.1.3 receives higher priority to maintaining the availability of spinning reserve, over non-spinning reserve.

Penalty Price Description	Day-Ahead		Real-Time		Comment
	Scheduling Run Value	Pricing Run Value	Scheduling Run Value	Pricing Run Value	
Conditionally qualified Non-Spin self-provision	-395	NA	-395	0	This penalty price for conversion of self-provided non-spinning reserves balances the maintenance of AS self-schedules with ensuring that the conversion to energy occurs before transmission constraints are relaxed.
Conditionally unqualified Reg Up or Down self-provision	-195	NA	-170	0	In instances where AS self-provision is not qualified pursuant to the MRTU tariff, the capacity can still be considered as an AS bid, along with regular AS bids. The price used for considering unqualified AS self-provision is lower than the AS bid cap, to allow it to be considered as an Economic Bid.
Conditionally unqualified Spin self-provision	-170	NA	-155	0	Same as above.
Conditionally unqualified Non-Spin self-provision	-155	NA	-155	-155	Same as above.
System power balance constraint	[redacted]		-155	-155	To reflect the role regulation plays in balancing the system when economic bids are exhausted, the ISO allows the system

Penalty Price Description	Day-Ahead		Real-Time		Comment
	Scheduling Run Value	Pricing Run Value	Scheduling Run Value	Pricing Run Value	
	[redacted]				power balance constraint to relax by as much as +/-350MW in the real-time dispatch process. The prices are selected to allow for coordinated dispatch of bids that may exist at or near the bid cap, or at or near the bid floor.

Appendix B: Summary of basis for ISO's working group proposal

The basis for a forward, flexible capacity procurement solution to downward flexible capacity needs is essentially the same as the need for the RA program in general. Forward procurement and capacity payments typically exist in markets in which prices are capped for two reasons:

1) Forward capacity procurement ensures that adequate capacity is available to clear the day-ahead and real-time markets efficiently while maintaining reliability (*i.e*., it ensures the ISO can maintain supply-demand balance in nearly all circumstances without out-of-market dispatches or shedding firm load);
2) Capacity payments enable resources that provide energy to recover costs that are not recoverable through energy markets (i.e., the "missing money" concern)

The logic for including upward ramping capabilities in forward procurement is the same as for capacity generally. If the ISO is ramp constrained, prices for additional ramping capacity may not fully reflect the benefits of incremental ramping because of the ISO's bid cap. Additionally, if there is insufficient ramping capacity, no matter how well real-time market tools like the ISO's flexible ramping product are designed, the ISO will not be able to maintain reliability with market based solutions.

This same logic can be applied to the need for downward flexible capacity needs. Just as the ISO has a bid cap at $1000, it also has a bid floor. Currently, the ISO's bid floor is negative $150. As the probability of oversupply on the ISO system increases, it is reasonable to ask whether there is a need to include downward flexibility in forward procurement. Because of bid floors, the costs caused by inflexible resources during periods of oversupply may not be fully reflected on the energy prices. For example, if there is oversupply on the system, a negative $150 price may not provide sufficient incentive for a resource to back down energy output. This is essentially the same as a resource not capturing scarcity rents do to bid caps. Further, without sufficient downward flexible capacity, the ISO would still experience downward constraints and would, once again, have to pro-rata curtail resources using administratively determined penalty parameters and possibly out-of-market solutions to maintain reliability. This could include manual curtailments and exceptional dispatches.

In non-summer months, however, LSEs may procure excess inflexible capacity that participates in the market but is not included on RA showings. Thus, RA showings may demonstrate compliance with the limited inflexible capacity and/or the provision of downward flexible capacity, but non-RA resource may mean this capacity or forward procurement does not fully resolve the downward flexible capacity need without additional market enhancements. If the non-RA capacity is inflexible, then it could add to potential oversupply in the day-ahead or real-time markets by displacing flexible RA capacity with self-schedule.