



Memorandum

To: ISO Board of Governors

From: Anna McKenna, Vice President, Market Policy and Performance

Date: July 7, 2021

Re: **Decision on Hybrid Resource Aggregate Capability Constraint**

This memorandum requires Board action

EXECUTIVE SUMMARY

In July 2020, the Board of Governors approved Management's phase 1 hybrid resource functionality, followed by the Board's approval of phase 2 hybrid resource functionality in December 2020. Hybrid resources refers to multiple resources behind a single point of interconnection. The most common hybrid resource configuration is a solar resource located with a storage resource behind a single interconnection point. Phase 1 included the authority to specify an aggregate capability constraint in the ISO market that could limit dispatch instructions issued to a set of co-located resources, whose physical generating capability exceeds the ISO studied and approved injection limits at the point of interconnection for the resources. Phase 2 included an expanded definition of the aggregate capability constraint, allowing co-located resources with this constraint to also provide ancillary services, in addition to energy, to the market. The approved policy also included requirements for high sustainable limit data from solar and wind co-located resources and hybrid components, as well as the dynamic limit tool that allows hybrid resources to convey real-time availability changes to the ISO market software.

Stakeholders recently raised concerns that the aggregate capability constraint functionality, approved through phase 1 and phase 2 of the hybrid resources initiative, would be insufficient to manage co-located projects coming on-line in the next few years due to certain contractual provisions that provide off-takes with rights to separately schedule shares of the hybrid resource. Specific contractual provisions prohibit resources from generating above their contractual share of the approved interconnection capacity. To accommodate these contracts, Management proposes a new constraint to enforce these individual contractual restrictions that can also be relaxed by the market software when reliability is threatened.

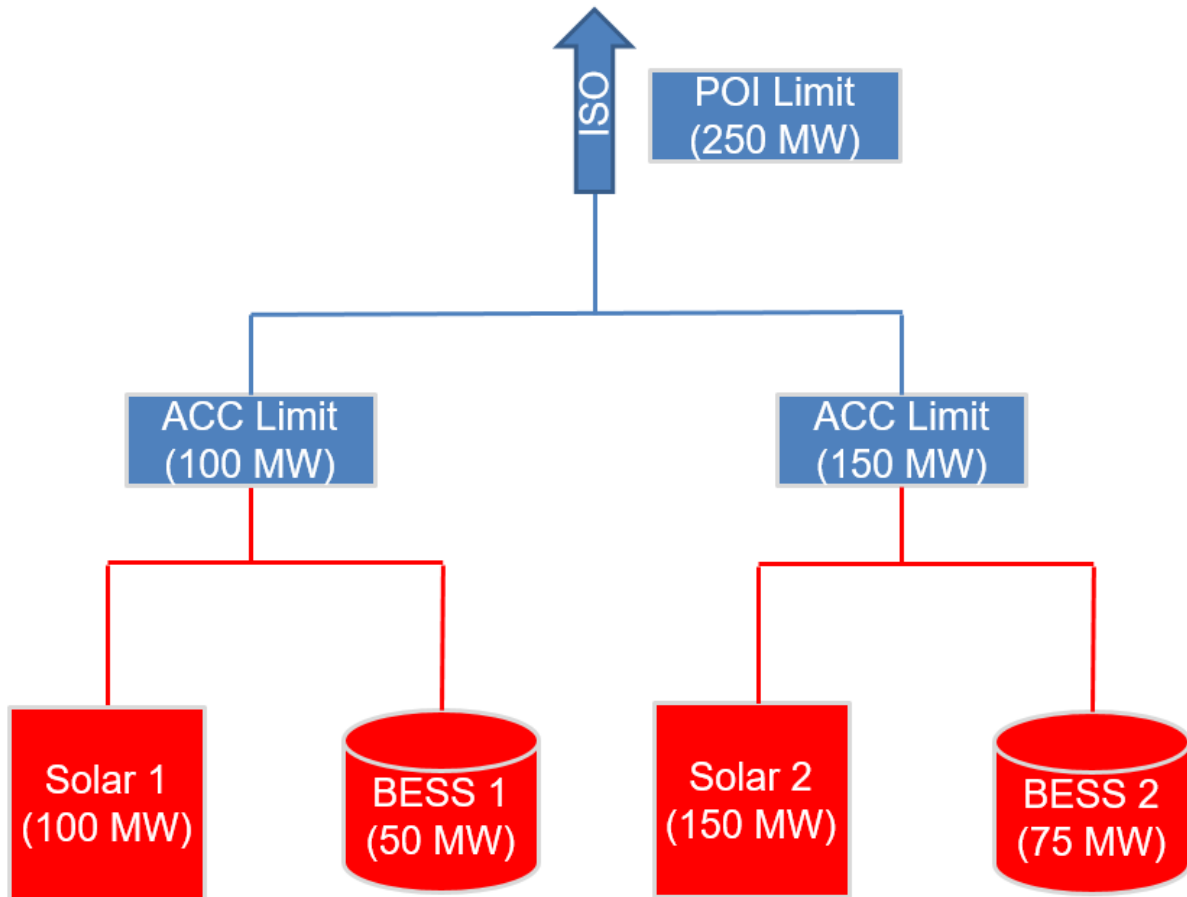
Moved, that the ISO Board of Governors approves the tariff revisions necessary to enhance the hybrid co-located resources model to

include subordinate aggregate capability constraints as described in the memorandum dated July 7, 2021; and

Moved, that the ISO Board of Governors authorizes Management to make all necessary and appropriate filings with the Federal Energy Regulatory Commission to implement the proposal, including any filings that implement the overarching initiative policy but contain discrete revisions to incorporate Commission guidance in any initial ruling on the proposed tariff amendment.

DISCUSSION AND ANALYSIS

Management proposes an enhancement to the hybrid co-located resource model to allow for the use of multiple aggregate capability constraints at a single generating facility. Management proposes to introduce subordinate aggregate capability constraints, which are nested constraints that are subordinate to the master aggregate capability constraint that observes the generating facility's total interconnection service capacity limit. This proposal would allow multiple resources and off-takers at a generating facility comprised of co-located resources. The use of subordinate constraints will allow the ISO to model each set of co-located resources to their maximum contractual operating levels, but limit the awards and dispatch instructions to the portion of the interconnection service capacity represented by the subordinate aggregate capability constraint. Using these market constraints prevents off-takers from exceeding specified contractual limits under normal operating conditions. The following example illustrates how this proposal would work.



The figure above shows a scenario with four co-located resources at a single generating facility and two subordinate aggregate capability constraints. This example reflects a scenario where two physical resources, a 250 MW solar and a 125 MW storage resource, are constructed and the developer enters into contracts with two off-takers. The first off-taker, represented on the left, receives contractual rights to 100 MW of the solar resource and 50 MW of the storage resource. Those components are also contractually obligated to never generate more than 100 MW from a combination of the two underlying resource shares at any time. Similarly, a second off-taker, represented on the right, contracts for a 150 MW share of the solar facility and a 75 MW share of the storage resource. The second off-taker is also contractually obligated to never generate more than 150 MW from a combination of the two underlying resource shares at any time.

This proposal includes a methodology to model this generating facility configuration. Each of the four resource shares, two solar shares and two storage shares, are

represented as four independent resources, each with a resource ID, metering and bidding requirements, and dispatch instructions from the ISO market software. These four resources are related using the methodology established for modeling co-located resources. Additionally, the market will enforce a master aggregate capability constraint to ensure that the market does not issue instructions to a combination of the four resources that would exceed the studied interconnection limit of 250 MW. Further, the market would enforce a subordinate aggregate capability constraint on the two resources contracted to the first off-taker to limit dispatch to not exceed the contractual operating limit of 100 MW. A similar subordinate aggregate capability constraint would be placed on the resources contracted to the second off-taker constraint that would limit dispatch to be below the 150 MW contracted limit.

Management proposes that the master and subordinate aggregate capability constraints be treated differently because these constraints serve different functions. The master aggregate capability constraint serves the function of limiting combined dispatch from all co-located resources at a generating facility to no more than the studied interconnection capacity. This is similar to other physical constraints already enforced on the grid and is often modeled as maximum generating (Pmax) limits for resources. These constraints are firm and cannot be relaxed by the market software. The subordinate constraints are different and represent contractual limitations on the output of co-located resources. These constraints exist as limitations on output and may be based on a share of the interconnection to which an off-taker is contractually entitled. These limitations can be modeled in the market, but Management argues that they should not jeopardize either system or local reliability. Therefore, Management proposes allowing the market software to relax subordinate aggregate capability constraints during instances when grid reliability is threatened and the supply demand balance cannot be achieved without relaxing the constraint. Simply, these constraints would be relaxed slightly before the market software relaxes the power balance constraint. By allowing this relaxation, no megawatts are artificially stranded behind a subordinate aggregate capability constraint during stressed system conditions when reliability could be jeopardized.

Management anticipates that subordinate aggregate capability constraints will be relaxed very infrequently. Power balance constraint relaxations may serve as a proxy for an upper bound of how often a subordinate aggregate capability constraint will be relaxed. In its most recent annual report, from 2019, the Department of Market Monitoring reported that power balance relaxations occurred in .08% of 15-minute market intervals and .2% of 5-minute intervals.¹ In addition to tight system conditions, there must be conditions that allow for the relaxation of the subordinate aggregate capability constraint at the facility. This means that at a co-located facility there would need to be an inability for generation to produce up to one subordinate aggregate

¹ 2019 Annual Report on Market Issues and Performance, Department of Market Monitoring, pp 121:
<http://www.caiso.com/Documents/2019AnnualReportonMarketIssuesandPerformance.pdf>.

capability constraint and the ability to generate above another subordinate constraint. This scenario may occur when one co-located resource is on outage or otherwise unavailable, which could be uncommon, as contracts may have rights to proportional ratios of the same underlying physical resources. This could also occur when storage resources for one off-taker are out of state of charge, while other storage resources have significant state of charge remaining.

POSITIONS OF THE PARTIES

Stakeholders support this proposal, and many asked that it be implemented as quickly as possible. Stakeholders also reiterated how these constraints could help smaller load serving entities contract for small quantities of existing or new resources. They also emphasized how this could help with procurement of storage resources in the coming years.

Stakeholders asked some clarifying questions in their comments. Most common was a request for additional clarity on how the aggregate capability constraints would be implemented. Management has committed to posting additional information on how the new functionality would work. These constraints will be enforced, just like other constraints – such as the power balance constraint or transmission limitations – in the market optimization software. The market software attempts to solve a constrained optimization problem with an objective of serving all load from available resources at the lowest possible cost. To solve this problem, the market may elect to relax some of the imposed constraints at an additional, typically very high, cost. When the market is operating under normal conditions these constraints are never relaxed because the model is able to match demand with supply without needing the additional flexibility of relaxing the constraint. Some constraints, like transmission constraints or the proposed master aggregate capability constraint, have such a high penalty price that the market software will likely never relax them. This is intentional. These constraints represent physical hardware limitations that, if exceeded, could cause damage to the asset. Other constraints, like the subordinate aggregate capability constraint or the power balance constraint, represent constraints that the market would prefer to maintain, but can be relaxed under extreme circumstances. As noted above, in practice these constraints are relaxed very infrequently by the market software.

Several stakeholders expressed concern regarding Management's proposal to relax the subordinate aggregate capability constraints when reliability is threatened. They suggest that the plant could have physical or logical mechanisms set up to enforce off-takers' ability to provide energy above the limits specified in contracts and model by subordinate aggregate capability constraints. The ISO reviews all models for interconnecting resources and additions or changes to existing resources and may not approve specifications that that will not allow for accurate modeling. The ISO notes that each resource configuration is different and each is reviewed independently.

One stakeholder asked how specific constraints could be updated over time. Management understands that the system is not static and is often changing and offers

robust methods to update how resources are modeled in the market today. As market participants change and update contracts, they may change how resources and constraints are modeled by requesting these changes from the ISO's master file team, via the normal procedures that are already in place today.

Finally, one stakeholder requested that master and subordinate constraint relaxations be reported. The ISO is not planning to release any special report outlining when these constraints are relaxed today. There are several outlets, including reports from the Department of Market Monitoring and the market analysis team, that currently report on the relaxation of existing constraints. These reports may include summarized relaxations of aggregate capability constraints in the future.

CONCLUSION

Management requests that the Board of Governors approve the proposed enhancements to the hybrid co-located model to allow for subordinate aggregate capability constraints. This new functionality will facilitate contracting by load serving entities for fractional shares of hybrid co-located projects.