

September 16, 2020

The Honorable Kimberly D. Bose  
Secretary  
Federal Energy Regulatory Commission  
888 First Street, NE  
Washington, D.C. 20246

**Re: California Independent System Operator Corporation  
Hybrid Resources Phase 1 Amendment  
Docket No. ER20-\_\_\_\_-000**

Dear Secretary Bose:

The California Independent System Operator Corporation (CAISO)<sup>1</sup> respectfully requests the Commission accept two sets of changes to its tariff. The first set of changes will permit the CAISO greater flexibility to model the aggregate capabilities of separate resources co-located at a single generating facility as part of its day-ahead and real-time markets. The CAISO will achieve this outcome by using an “aggregate capability constraint” in its market model. This constraint will model the maximum and minimum capability of co-located generating units at a generating facility for purposes of issuing day-ahead market and real-time market awards and dispatches. The second set of changes will ensure the CAISO can maintain visibility over intermittent resource production at hybrid resources that include a wind or solar generation component.<sup>2</sup> The two sets of tariff changes are independent of each other, and a decision regarding the justness and reasonableness of one set of tariff revisions will not affect the justness and reasonableness of the other set. The CAISO requests the Commission issue an order accepting these tariff changes effective December 1, 2020. The CAISO also requests such order within 61 days, or by November 16, 2020. Obtaining an order in advance of the CAISO’s implementation date will facilitate promoting the market software necessary to implement the aggregate capability constraint.

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<sup>1</sup> Capitalized terms not otherwise defined herein have the meanings set forth in the Master Definitions Supplement, Appendix A to the currently effective ISO tariff.

<sup>2</sup> The CAISO submits this filing pursuant to Section 205 of the Federal Power Act, 16 U.S.C. § 824d, Part 35 of the Commission’s regulations, 18 C.F.R. § 35, and in compliance with Order No. 714, *Electronic Tariff Filings*, FERC Stats. & Regs. ¶ 31,276 (2009).

## I. Background

Interest in energy storage development is significant and growing within the western United States. The Commission itself has promulgated rules to facilitate energy storage participation in organized electricity markets.<sup>3</sup> State policymakers and regulators are promoting energy storage development to increase reliability and fulfill state energy goals.<sup>4</sup> One of the key benefits of energy storage is its ability to reduce the intermittency and optimize the performance of variable energy resources. The CAISO interconnection queue currently has over 30,000 MW of storage projects paired with wind or solar resources in development.<sup>5</sup> The CAISO understands federal investment tax credits for energy storage located at the same site as solar resources is a significant driver of these projects. Many load-serving entities and developers also seek to pair energy storage with solar resources so the generating facilities can provide consistent power even as the sun sets and demand peaks. These combinations may develop as separate co-located resources or as single resources with multiple components using different fuel sources or technologies, *i.e.*, hybrid resources.

The distinction between co-located and hybrid resources is that co-located resources operate in the CAISO's markets as separate resources. Although co-located resources are located at the same generating facility from an interconnection perspective, they are treated as separate market entities. The co-located resources operating today are the same technology and fuel (*e.g.*, solar generating units paired with other solar generating units at a single generating facility), but that will change in the future).<sup>6</sup> In all cases, co-located resources are separate resources with separate Resource IDs.<sup>7</sup> Co-located resources submit separate bids and receive separate

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<sup>3</sup> *Electric Storage Participation in Markets Operated by Regional Transmission Organizations and Independent System Operators*, Order No. 841, 162 FERC ¶ 61,127 (2018), order on reh'g, Order No. 841-A, 167 FERC ¶ 61,154 (2019).

<sup>4</sup> See *e.g.* overview of energy storage activities in California at the following website: <https://www.cpuc.ca.gov/energystorage/>.

<sup>5</sup> The CAISO also has over 30,000 MW of stand-alone storage projects as well. <https://rimspub.caiso.com/rims5/logon.do>.

<sup>6</sup> Developers often elect to use separate Resource IDs for co-located generating units when different load-serving entities have procured different amounts of capacity from the same site. For example, a 100 MW generator could have one 50 MW contract with one load-serving entity, and one 50 MW contract with another. Bifurcating the resources allows the scheduling coordinators and load-serving entities to comply with their power purchase agreements more efficiently.

<sup>7</sup> A Resource ID is a set of “[i]dentification characters assigned by the CAISO to Generating Units, Loads, Participating Loads, Proxy Demand Resources, Reliability Demand Response Resources, System Units, System Resources, and Physical Scheduling Plants.” Master Definitions Supplement, Appendix A to the CAISO tariff. The CAISO uses Resource IDs to identify separate market resources.

market dispatches from other resources with which they are co-located. They submit separate outages and have separate meters.

In contrast, hybrid resources combine different components at a generating unit location and generally utilize different fuel types or technologies to operate as a single resource. The most prominent example is a resource with an energy storage component and a variable energy component, such as wind or solar, operating and modeled as one generator. A hybrid resource has one bid curve that applies to all of its component parts. A hybrid resource receives one dispatch instruction from the CAISO. The hybrid resource operator optimizes the various components of its resource to meet that dispatch instruction. Individual components of a hybrid resource are not individually metered for purposes of CAISO settlements.

In addition to the interconnection requests the CAISO is studying today, the CAISO expects many hybrid and co-located resources to commence commercial operation imminently by modifying existing generating facilities.<sup>8</sup> Developers can add energy storage to existing facilities through the modification process in their generator interconnection agreements rather than a new interconnection request so long as they do not require additional interconnection service capacity or substantially alter their electrical characteristics. This process ensures energy storage may safely and reliably interconnect without the need for the CAISO and participating transmission owners to restudy interconnection service for the entire facility.<sup>9</sup> The CAISO expects over 1,000 MW will interconnect to the CAISO grid by May 2021 in either a co-located or a hybrid configuration. Developers are adding storage to existing generating facilities because doing so can occur more quickly and at a lower cost than establishing new interconnections for the storage units. Leveraging existing infrastructure will reduce costs such as step-up transformer equipment that is already a part of an existing generating facility.

Facilitating the efficient and reliable integration of additional energy storage capacity in the form of co-located and hybrid resource configurations into operation of the CAISO's day-ahead and real-time markets is important and necessary. These resources are coming online quickly and in great numbers, and the CAISO expects this trend will continue. This filing takes initial but important steps to integrate these resources and optimize their performance. For example, the CAISO's proposed aggregate capability constraint provides a tool for the CAISO to access additional

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<sup>8</sup> See CAISO Board of Governors briefing on renewable and energy storage in the CAISO generator interconnection queue dated July 22, 2020 at slide 3-4. <http://www.caiso.com/Documents/Briefing-Renewables-EnergyStorage-Generator-Interconnection-Queue-Presentation-July2020.pdf>. This presentation does not draw a distinction between energy storage seeking to use a co-located versus a hybrid configuration.

<sup>9</sup> CAISO tariff section 25.1 and Article 5.19 of Appendix EE to the CAISO tariff.

capacity, which would otherwise remain stranded and unavailable to serve energy requirements.

The CAISO continues to work with stakeholders and policymakers through its stakeholder processes to explore additional enhancements to integrate co-located and hybrid resources.<sup>10</sup> This effort will benefit from the CAISO's initial experience integrating co-located and hybrid resources and the experience of other transmission providers.

## **II. Proposed Tariff Modifications**

The CAISO proposes two sets of tariff revisions. The first set establishes market rules for using an aggregate capability constraint for co-located resources at a single generating facility. The second set establishes data requirements for hybrid resources with a wind generation or solar generation component. The CAISO will allow developers to elect whether to be co-located resources or hybrid resources.

The CAISO's proposed definition of a co-located resource recognizes a co-located resource operates as a separate generating unit that is part of a generating facility with other generating units. The CAISO's proposed definition is:

A Generating Unit with a unique Resource ID that is part of a Generating Facility with other Generating Units. An EIM Participating Resource with a unique Resource ID that is part of a single resource with other EIM Participating Resources.<sup>11</sup>

In contrast, the CAISO proposes to define a hybrid resource as:

A Generating Unit, with a unique Resource ID at a single Point of Interconnection, with components that use different fuel sources or technologies.<sup>12</sup>

As explained below, these proposed definitions adequately distinguish between those generating units that will operate individually or in concert with other generating technologies at their generating facility, sharing a single interconnection. The key distinction is how the resources are modeled and dispatched in the CAISO markets.

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<sup>10</sup> More information on the status of the CAISO's hybrid resource stakeholder process is available at the following website: <https://stakeholdercenter.caiso.com/StakeholderInitiatives/Hybrid-resources>

<sup>11</sup> See proposed addition to Appendix A to the CAISO tariff, definition of Co-located Resource.

<sup>12</sup> See proposed definition of Hybrid Resource in Appendix A to the CAISO tariff.

### **A. Aggregate capability constraint for co-located resources**

The CAISO proposes to allow an interconnection customer electing to have co-located resources to request an aggregate capability constraint. This constraint will model the maximum and minimum capabilities of co-located generating units at a generating facility for purposes of issuing day-ahead market and real-time market awards and dispatches.<sup>13</sup> The CAISO will apply only one aggregate capability constraint to an entire generating facility. With the use of an aggregate capability constraint, the combined PMaxes of generating units at a generating facility may exceed the generating facility's interconnection service capacity. This constraint will ensure market awards of those generating units will not exceed the generating facility's interconnection service capacity.

In some cases, developers of co-located resources will seek to interconnect capacity that would otherwise exceed the interconnection customer's interconnection service rights at the generating facility. Consistent with Order No. 845,<sup>14</sup> the CAISO permits this practice today to allow developers to build redundancy into their generating facilities and maximize performance. For example, developers frequently install extra solar cells to account for outages or to take advantage of irradiance variability. Developers also install additional inverters so they can maximize production during shoulder hours. Currently, however, the CAISO limits the maximum capability a scheduling coordinator can register in its Master File for co-located generating unit(s), so the aggregate maximum capability does not exceed the generating facility's interconnection service capacity at the point of interconnection.<sup>15</sup> Using an aggregate capability constraint will allow the CAISO to relax this rule while ensuring the CAISO's market issues awards that respect the generating facility's interconnection service capacity.

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<sup>13</sup> See proposed addition of CAISO section 27.13. See also proposed definition for Aggregate Capability Constraint in Appendix A to the CAISO tariff:

A constraint that reflects the combined maximum and the combined minimum capability of Generating Units that comprise a single Generating Facility so that the capability does not exceed the Generating Facility's Interconnection Service Capacity or charging capacity specified in its Generator Interconnection Agreement. In the case of EIM Participating Resources, a constraint that reflects the combined maximum and the combined minimum capability of individual EIM Participating Resources or non-participating resources that comprise a single resource.

<sup>14</sup> *Reform of Generator Interconnection Procedures and Agreements*, Order No. 845, 163 FERC ¶ 61,043 at PP 367 *et seq.* (2018).

<sup>15</sup> Consistent with Order No. 845, the aggregate generating facility also must install control technologies to ensure it cannot produce more energy than was requested and studied. See Section 3.1 of Appendix DD to the CAISO tariff.

The aggregate capability constraint will allow scheduling coordinators for co-located generating units to register the maximum generating capability of their units so the combined capability may exceed the generating facility's interconnection service capacity at its point of interconnection. The constraint, however, will ensure that market awards and dispatches at those generating units do not exceed the generating facility's interconnection service capacity. For energy storage paired with a wind or solar resource, this constraint can maximize the use of interconnection facilities so the output from the co-located generating units complement each other and allow production from the generating facility to occur at times when the wind or solar fuel is not available. Consistent with the CAISO's current practice, if an interconnection customer elects to forego using an aggregate capability constraint, the combined PMax of the co-located resources registered in the CAISO's Master File for that generating facility may not exceed the generating facility's interconnection service capacity.

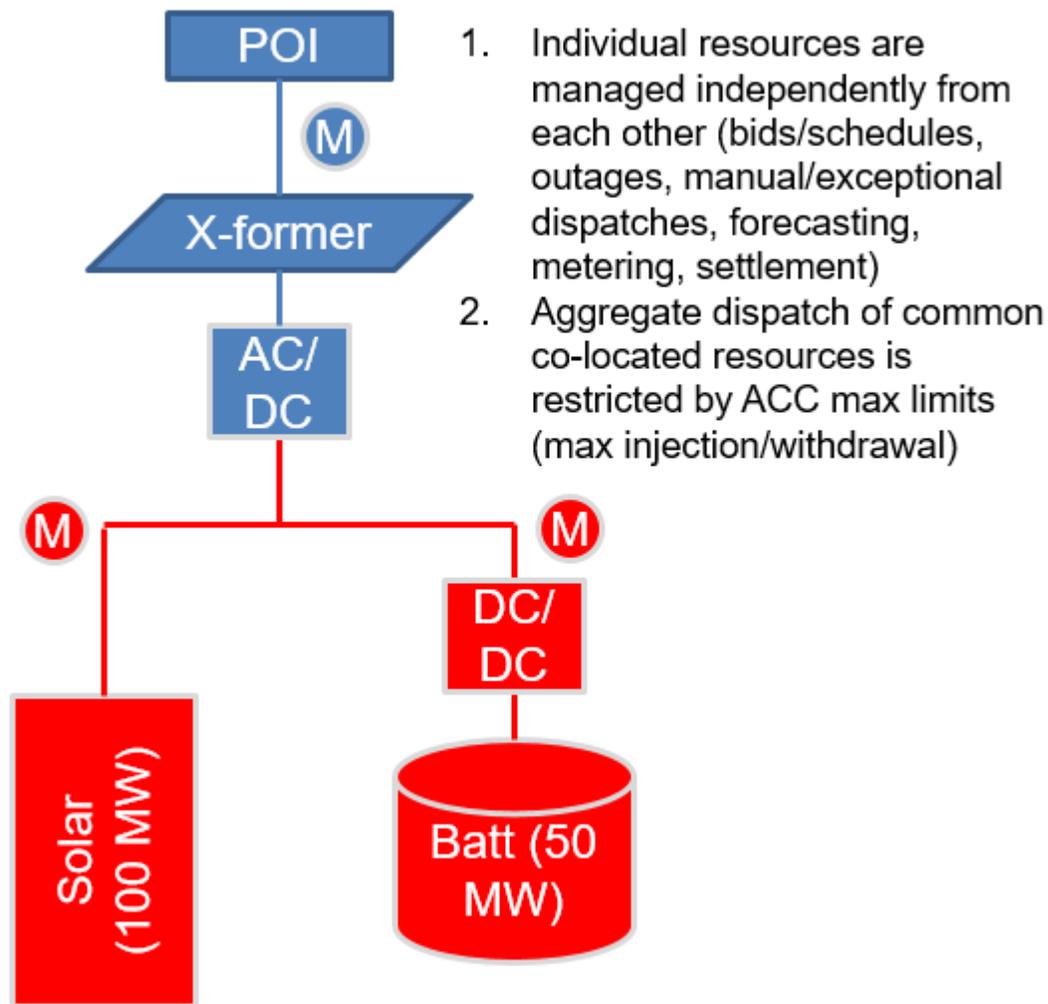
The CAISO's proposed tariff revisions also extend the election to use the aggregate capability constraint to participating resource scheduling coordinators in the western Energy Imbalance Market (EIM).<sup>16</sup> In the case of the EIM, the EIM Entity balancing authority will remain responsible for processing any interconnection requests for co-located resources that may exceed a generating facility's interconnection rights at its point of interconnection to the EIM Entity's transmission facilities. Any use of the aggregate capability constraint within an EIM Entity's balancing authority area will be subject to the EIM Entity's prior approval. Similar to the CAISO, interconnection rules for these EIM Entities should include proper control technologies to ensure the generating facility does not inject energy above its level of interconnection service.<sup>17</sup>

The following reflects a simple example of a co-located resource that could take advantage of the aggregate capability constraint. The diagrams reflects two co-located resources at a single generating facility, a 100 MW solar resource and a 50 MW battery resource that use a common step-up transformer. The interconnection service capacity at the generating facility's point of interconnection is 100 MW.

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<sup>16</sup> As part of this filing, the CAISO has expanded its definition of the point of interconnection to include the following language: "For Generating Facilities connected to the Distribution System, the point of interconnection is the point at which the Generating Facility connects to the CAISO Controlled Grid. For an EIM Participating Resource or non-participating resource, the point of interconnection is the point at which the EIM Participating Resource or non-participating resource connects to an EIM Entity's transmission facilities." See proposed changes to definition of Point of Interconnection in Appendix A to the CAISO tariff.

<sup>17</sup> Order No. 845, 163 FERC ¶ 61,043 at PP 367 *et seq.*



In this example, the aggregate capability of co-located resources at the generating facility exceeds the generating facility's interconnection service capability. Under today's practices, the CAISO would require the co-located resources to limit the generating units' combined PMax registered in the Master File so that together they do not exceed 100 MW. However, by using the aggregate capability constraint proposed herein, the CAISO would allow each co-located resource to register its maximum capability in the Master File. The CAISO would utilize the aggregate capability constraint to ensure market awards and dispatches to both co-located resources do not exceed 100 MW—the generating facility's interconnection service rights at its point of interconnection. The CAISO would also model the minimum generating output (- 50 MW) representing the charging capacity of the battery using the aggregate capability constraint.

Using the aggregate capability constraint will not change CAISO rules for resources to follow dispatch instructions, including rules that allow co-located resources that are Eligible Intermittent Resources<sup>18</sup> to produce as capable when their dispatch operating targets equal their forecast.<sup>19</sup> The CAISO proposes to clarify in its tariff that a generating facility whose co-located resources do not comply with dispatch instructions will be ineligible to use the aggregate capability constraint.<sup>20</sup> Practically, this should not occur because the CAISO requires a generating facility with generation capability exceeding its interconnection service capacity to install generator limiter controls to ensure the output from the generating facility does not exceed the interconnection service capacity at the point of interconnection.<sup>21</sup> Consistent with Commission Order No. 845 and good utility practices, these same controls should exist under EIM Entities' interconnection rules. EIM Participating Resource Scheduling Coordinators will need to obtain written pre-approval from EIM Entities that co-located resources do not pose a reliability or safety concern prior to applying the aggregate capability constraint to co-located resources. The CAISO will establish a process for submitting this written pre-approval through its business practice manuals.

For the first year of implementation, the CAISO proposes to apply this constraint only to energy awards and dispatches. Accordingly, co-located resources electing to use this constraint will be ineligible to offer ancillary services or receive uncertainty awards for flexible ramping capability during this time.<sup>22</sup> This interim period will allow the CAISO to monitor the performance of the aggregate capability constraint to ensure it effectively and reliably clears energy awards and provides energy dispatches in a

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<sup>18</sup> See "Eligible Intermittent Resource," Appendix A to the CAISO tariff: "A Variable Energy Resource that is a Generating Unit or Dynamic System Resource subject to a Participating Generator Agreement, Net Scheduled PGA, Dynamic Scheduling Agreement for Scheduling Coordinators, or Pseudo-Tie Participating Generator Agreement."

<sup>19</sup> CAISO tariff section 34.13.

<sup>20</sup> The CAISO proposes that if this were to occur, the CAISO will adjust those co-located resources' PMaxes proportionate to each generating unit's capacity such that the sum of the PMaxes equals the interconnection service capacity of the generating facility. The interconnection customer could request an alternative allocation so long as the total value does not exceed the interconnection service capacity of the Generating Facility. See proposed addition of CAISO section 27.13.

<sup>21</sup> The CAISO tariff requires control technologies in cases where a generating facility's capacity exceeds its interconnection service capacity, including for co-located generating units. See Section 3.1 of Appendix DD to the CAISO tariff.

<sup>22</sup> See proposed tariff section 27.13, which states in part: "Scheduling Coordinators may not offer or self-provide Ancillary Services into the CAISO's Markets or receive Uncertainty Awards from Generating Units that are subject to Aggregate Capability Constraints until the CAISO issues a Market Notice stating this restriction will no longer apply." Once the CAISO has issued the Market Notice, it intends to remove the tariff provision under Section 205 of the Federal Power Act as soon as practical thereafter.

manner that respects the generating facility's interconnection service rights. Expanding the aggregate capability constraint to apply to ancillary services requires additional functional testing and market simulation. However, applying the aggregate capability constraint only to energy awards will provide benefits in its own right, while allowing the CAISO to assess expanding the concept. Interconnection customers seeking to use the aggregate capability constraint during this interim period will need to assess the value of increasing co-located generating units' maximum generating capability in the CAISO's Master File with the tradeoff of not offering ancillary services or receiving uncertainty awards. Again, resources are not required to use the aggregate capability constraint, but it can help the CAISO and resource owners unlock additional capability at co-located resources, which are likely to have different operating profiles during the trading day.

As explained above, the CAISO anticipates that using the aggregate capability constraint within the CAISO will initially involve generating facilities in which at least one of the co-located resources uses energy storage and non-generator resource modeling functionality.<sup>23</sup> For resources using other modeling constraints it may be problematic to apply an aggregate capability constraint that could conflict with existing constraints for purposes of issuing market awards or dispatch instructions. For this reason, and out of an abundance of caution, the CAISO has proposed that the following resource types will be ineligible to use the aggregate capability constraint: Multi-Stage Generators, Pseudo-Tie Resources, Proxy Demand Response, Pumped Storage Hydro Units, Metered Sub-Systems, and Use-Limited Resources. These resource types have yet to express an interest in using an aggregate capability constraint in the CAISO's stakeholder initiative, and there are very few, if any, of each type in the CAISO interconnection queue.<sup>24</sup> Expanding the aggregate capability constraint to these resource types would create significant additional complexity in implementing the constraint this year. Until the CAISO has sufficient operational experience with the aggregate capability constraint, the CAISO believes good utility practice supports the proposed incremental implementation approach.

For purposes of pricing energy dispatches, the CAISO will price co-located resources at their point of delivery to the CAISO controlled grid. This pricing node is appropriate – as opposed to the co-located generator location – because the CAISO market model prices congestion on the CAISO controlled grid. When the combined maximum generator capability of co-located resources exceeds the generating facility's interconnection service rights, the generating facility could experience congestion on its interconnection facilities, creating the potential for pricing disparity between co-located resources. However, the CAISO's market model does not model congestion on interconnection facilities. The CAISO is not proposing to change this. Instead, the

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<sup>23</sup> See proposed tariff section 27.13.

<sup>24</sup> Even if there were, they would need to co-locate with an additional resource *and* request less interconnection service capacity than generating capability. As such, it is unlikely this approach would affect any potential project.

CAISO is simply proposing is to accommodate interconnection customers with co-located resources that exceed a generating facility's interconnection service rights. By using the aggregate capability constraint, the CAISO allows these resources to manage their PMax constraints without the need for additional interconnection upgrades. This outcome can benefit electricity consumers in the CAISO balancing authority and EIM Entity balancing authority areas who will obtain access to additional supply capability to serve electric demand without needing costly interconnection upgrades.

## **B. Meteorological and other information requirements for hybrid resources**

The CAISO continues to work with stakeholders on market rules to facilitate hybrid resource participation.<sup>25</sup> This is a complex task; however, at this time the CAISO is prepared to implement some initial rules for hybrid resources that are narrow in scope. The CAISO proposes that hybrid resources that contain a wind or solar generation element must provide the same meteorological data that a wind or solar resource would have to provide the CAISO if it were a standalone resource in the CAISO market systems. These revisions are not dependent on hybrid resource participation rules the CAISO may develop in the future.

The CAISO's existing tariff requires Eligible Intermittent Resources to provide the CAISO with meteorological and other data.<sup>26</sup> An Eligible Intermittent Resource is a variable energy resource that has executed a participating generator agreement with the CAISO. Consistent with Order No. 764,<sup>27</sup> the CAISO tariff defines a variable energy resource as a resource that is characterized by an energy source that: (1) is renewable; (2) cannot be stored by the facility owner or operator; and (3) has variability that is beyond the control of the facility owner or operator.<sup>28</sup> A hybrid resource composed of both a solar or wind element and another generation technology, such as storage, does not meet the definition of a variable energy resource or an Eligible Intermittent Resource. As a result, few hybrid resources will qualify as Eligible Intermittent Resources. Notwithstanding this fact, the CAISO still needs data

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<sup>25</sup> See CAISO stakeholder initiative on hybrid resources (<https://stakeholdercenter.caiso.com/StakeholderInitiatives/Hybrid-resources>) and resource adequacy enhancements (<https://stakeholdercenter.caiso.com/StakeholderInitiatives/Resource-adequacy-enhancements>).

<sup>26</sup> See section 4.8.2 of the CAISO tariff; Appendix Q to the CASIO tariff.

<sup>27</sup> *Integration of Variable Energy Resources*, Order No. 764, 77 F.R. 41482 (July 13, 2012), FERC Stats. & Regs. ¶ 31,331 (2012).

<sup>28</sup> See Appendix A to CAISO tariff, "Variable Energy Resource."

associated with hybrid resources that include a wind or solar generation component so it can forecast likely production at these facilities.

Consistent with its policies for variable energy resources, the CAISO proposes that Scheduling Coordinators for hybrid resources that include a wind or solar generation component capable of separately registering as an Eligible Intermittent Resource under the CAISO tariff provide data as required by Appendix Q.<sup>29</sup> Practically, this means if the wind or solar generation component of a hybrid resource is 1 MW or greater, it must provide the CAISO with meteorological data and other related information.<sup>30</sup> This information includes data to support accurate power generation forecasting and the communication of such forecast and meteorological data. Similar to Eligible Intermittent Resources, hybrid resources can receive schedules on a 15-minute basis and receive five-minute real-time dispatches. The meteorological information will inform the forecast production of wind and solar generation components, thereby providing the CAISO with information relevant to reliability, and assisting the scheduling coordinators for hybrid resources to develop their bids.

The CAISO proposes to allow such hybrid resources to receive an informational production forecast based on their meteorological conditions. The CAISO proposes to charge scheduling coordinators electing to use the forecast developed by the CAISO a forecast fee, similar to the forecast fee all other Eligible Intermittent Resources pay when they elect to use the CAISO's forecast.<sup>31</sup> These forecast services will be optional, and resource owners can elect not to receive and pay for this CAISO service. If a resource owner does not elect to have the CAISO generate a forecast for the wind or solar component of a hybrid resource, the resource owner will still be required to provide the CASIO with meteorological information as specified in Appendix Q as well as forecast production information for any wind or solar component of its hybrid resource.

The CAISO will use the meteorological data to predict renewable generation capabilities at specific electrical locations. The data will enhance the CAISO's operational awareness, inform risk assessments associated with output from wind or solar, and support *ex post* analysis of market performance. In addition, the CAISO will use the forecasted output from these components of hybrid resources to understand their operation and inform the CAISO's overall renewable production supply forecast, which, in turn, informs the CAISO's various market processes. This information can help the CAISO improve its forecasts of energy production from wind and solar generation within the CAISO balancing authority even if some of this production is not delivered to the CAISO controlled grid. The information will also inform the ability of

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<sup>29</sup> See proposed changes to CAISO section 4.8.2.

<sup>30</sup> See Appendix A to the CAISO tariff, "Participating Generator."

<sup>31</sup> Section 4.8.2.2 of the CAISO tariff.

hybrid resources to offer products like regulation, flexible ramping, and, in the future, imbalance reserves.

Finally, the CAISO has included a clarifying change to section 4.8.2 of its tariff to delete the reference to Appendix Q as requiring Eligible Intermittent Resources to provide outage data to the CAISO. Eligible Intermittent Resources provide outage data to the CAISO consistent with section 9 of the CAISO tariff; not Appendix Q.

### **III. The Commission should accept the CAISO's tariff revisions**

The CAISO's tariff revisions are responsive to commercial interest in pairing energy storage with solar or wind generation. They are an initial step toward developing more robust rules and models for co-located resources and hybrid resources to participate in the day-ahead and real-time energy markets. The aggregate capability constraint will help advance energy storage development within the CAISO balancing authority and EIM Entity balancing authority areas consistent with market efficiency and grid reliability. The data requirements for hybrid resources will also promote a more efficient and reliable market solution by providing the CAISO and resource operators with production forecast and other data to support modeling output from the wind or solar generation components of a hybrid resource.

The CAISO will employ the aggregate capability constraint to ensure efficient and reliable dispatch of co-located resources at a generating facility. Referring to the example in section II, the CAISO will allow each co-located generating unit to submit economic bids or self-schedules up to its respective PMax. The CAISO will limit any awards or self-schedules for energy in the day-ahead and real-time markets to the generating facility's interconnection service capacity. In addition, the CAISO will limit any real-time dispatch of these co-located resources so the combined dispatch does not exceed the generating facility's interconnection service capacity. For example, if the 100 MW solar generating unit has a dispatch operating target of 80 MW based on its production forecast, then the maximum dispatch of the energy storage resource will be 20 MW. If, however, the solar resource production exceeds its dispatch operating target, the aggregate capability constraint would correspondingly limit the maximum real-time dispatch of the energy storage resource. Separately, the CAISO will require the generating facility to deploy generator limiter controls so the combined output of the generating units does not exceed the generating facility's interconnection service capacity.

In the case of EIM participating resources, the CAISO expects the transmission provider in the EIM Entity balancing authority area would require similar controls. Any use of the aggregate capability constraint within an EIM Entity's balancing authority area will be subject to the EIM Entity's prior approval. The Commission has recognized system protection requirements to control generator output in order to allow interconnection customers to request interconnection service that is lower than full

generating facility capacity.<sup>32</sup> As a practical matter, however, co-located resources that include solar generation and energy storage are unlikely to operate at their maximum PMax at the same time because these two technologies generally are intended to complement each other. Solar operates during daylight hours and, as a general matter, the CAISO's markets incentivize storage resources to provide energy to the market when energy prices are the highest, which usually occurs during the evening net-load ramp and the evening net-load peak.

The constraint will not limit or affect the bid amount (MW) or bid price (\$/MWh) of the co-located resources. Instead, the constraint will merely limit the respective market awards of co-located resources so the aggregate dispatch does not exceed the interconnection service capacity at the generating facility. The aggregate capability constraint is not a transmission constraint or a resource constraint the CAISO normally would model in clearing economic bids of resources. However, the aggregate capability constraint will promote market efficiency by securing additional energy from co-located resources throughout the operating day based on increased PMaxes. Without this tool, the CAISO rules will continue to limit the PMax of co-located resources in the Master File so they do not exceed their aggregate interconnection service capacity. As a result, the CAISO will be unable to reach capacity above those levels because it will remain stranded behind the co-located resources point of interconnection. The constraint also will promote reliability by ensuring the combined dispatch of the co-located generating units does not exceed the generating interconnection service capacity in any one operating interval.

Regarding data requirements for hybrid resources, the data the CAISO will receive from scheduling coordinators is necessary for forecasting production at the wind or solar generation component of the hybrid resource. Although hybrid resources may not deliver all of this output to the CAISO controlled grid at the time of production, this information will help improve the CAISO's forecasting model and ensure a feasible market solution. Currently, the CAISO uses production forecasts from Eligible Intermittent Resources to inform its day-ahead and real-time market processes. Production forecast information also provides greater flexibility for Eligible Intermittent Resources to bid into the CAISO markets, particularly in real-time. For example, an Eligible Intermittent Resource may have varying production during three consecutive five-minute real-time dispatches or between fifteen-minute market intervals and can submit an offer curve that reflects the potential for increased capability over the operating hour. By using a production forecast, the CAISO can limit its dispatch of Eligible Intermittent Resources to the upper range of their production forecast, thereby ensuring a feasible dispatch and minimizing the resource's exposure to deviation charges, which are calculated based on the difference between what was produced and the dispatch instruction.

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<sup>32</sup> Order No. 845, 163 FERC ¶ 61,043 at PP 367-374.

Similar to the service it provides Eligible Intermittent Resources, the CAISO will offer forecasting services for the wind or solar components of the hybrid resources. This proposal is consistent with the CAISO's current tariff rules and practices associated with forecasting wind and solar generation production.<sup>33</sup> These forecasts will only apply to the wind or solar generation component of the hybrid resource, not the entire output of the hybrid resource. These forecast services will be optional, and hybrid resource owners can elect not to receive and pay for this CAISO forecasting service. If, however, scheduling coordinators for hybrid resource owners do not elect to have the CAISO generate a forecast for the wind or solar generation component of the hybrid resource, they must still provide meteorological information and forecast data for the wind and solar generation components to the CAISO. This data will ensure the CAISO can predict wind and solar generation at a hybrid resource as well as variability of output at a specific electrical location. The information will improve the predictive functions of the CAISO's forecast model and inform the CAISO's real-time market and reliability commitment decisions. The information will also assist scheduling coordinators for hybrid resources to structure their real-time bids based on the operating profile of the wind or solar generation component of their resources. Finally, this data will help ensure scheduling coordinators for hybrid resources submit bids or self-schedules that result in feasible awards, minimizing their exposure to deviation charges.

#### **IV. Stakeholder Process**

The CAISO initiated a process to obtain stakeholder input concerning the proposed tariff changes included in this filing in 2019. The CAISO published several proposals, accepted written comments and held public workshops to discuss the elements included in this filing.<sup>34</sup> The CAISO appreciates the ongoing efforts of stakeholders to provide input to this process and help develop these rules. The stakeholder process resulted in a number of changes to the CAISO's proposal and helped clarify the parameters of the proposed aggregate capability constraint for co-located resources. By way of example, the stakeholder process addressed several issues described below.

##### **A. The pricing node for the generating units or EIM participating resources subject to an aggregate capability constraint will be their point of delivery**

During the CAISO's stakeholder initiative, various stakeholders raised concerns with establishing the pricing node for co-located resources using the aggregate capacity constraint at the generating facility's point of interconnection as opposed to

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<sup>33</sup> CAISO tariff section 4.8.2 and Appendix Q to the CAISO tariff.

<sup>34</sup> A record of the ISO's stakeholder process and comments received is available at the following website: <https://stakeholdercenter.caiso.com/StakeholderInitiatives/Hybrid-resources>.

the co-located resource location. Their concerns included that pricing these resources at the point of interconnection could incentivize resources to deviate from dispatch if the price at the point of interconnection did not reflect congestion behind the aggregate capability constraint. Other stakeholders asked whether, as a matter of nodal pricing design, locational marginal prices for co-located generating units should reflect congestion behind the point of interconnection, *i.e.*, should each co-located resource have a pricing node at this Resource ID location?

The CAISO discussed these concerns and questions with stakeholders. Based on these discussions, the CAISO proposes that the pricing node for the generating units or EIM participating resources subject to an aggregate capability constraint will be their point of delivery. The CAISO tariff requires resources to follow dispatch instructions.<sup>35</sup> If co-located resources deviate from those dispatch instructions, the aggregate output of the co-located resources remains subject to generation limiting controls so the sum of the resources' output will not exceed the interconnection service capability at their point of interconnection. When an interconnection customer elects to use the aggregate capability constraint, co-located resources at the interconnection customer's generating facility are accepting this paradigm. Co-located resources will need to coordinate any financial impacts of these generation limiter controls through co-tenancy or other agreements.

The facilities between co-located resources and their mutual point of interconnection do not constitute part of the CAISO controlled grid. The CAISO's market model only prices congestion on the CAISO controlled grid, not interconnection facilities.<sup>36</sup> Establishing a pricing node for co-located resources at the location of a co-located resource, as opposed to the point of interconnection, would treat co-located resources differently from other resources. Although the CAISO's market processes will recognize the aggregate capability constraints for co-located resources when the interconnection customer elects to use the constraint, the purpose of this constraint is to assist co-located resources to manage their maximum and minimum capabilities so their awards and dispatches do not exceed their interconnection service capacity. The purpose for pricing congestion on the ISO controlled grid is to facilitate the efficient use of the transmission system. Making the cost of congestion on the transmission system transparent does not apply to interconnection facilities behind a resource's point of interconnection.

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<sup>35</sup> CAISO tariff section 34.13.

<sup>36</sup> *Cal. Indep. Sys. Operator Corp.*, 116 FERC ¶ 61,274 (2006) at P 62. (Nor distribution facilities.)

The CAISO tariff defines congestion to mean "A characteristic of the transmission system produced by a binding Transmission Constraint to the optimum economic dispatch to meet Demand such that the LMP, exclusive of Marginal Cost of Losses, at different Locations of the transmission system is not equal." See Appendix A to the CAISO tariff. The marginal cost of congestion reflects transmission constraints. See Appendix C to the CAISO tariff.

**B. The CAISO will apply one aggregate capability constraint to an entire generating facility**

Stakeholders asked whether the CAISO will permit interconnection customers to establish multiple aggregate capability constraints for co-located resources at a single generating facility. Conceivably, this request could ease the burden for different owners or scheduling coordinators of co-located resources to coordinate. However, this approach would require the CAISO to modify the design of the aggregate capability constraint to include both a total aggregate capability constraint, mapped to a specific point of interconnection limit, as well as sub-constraints, which would be a fraction of the interconnection limit. At this time, the CAISO's design cannot accommodate this request because it increases the technology requirements associated with the aggregate capability constraint design. The CAISO will consider this proposal as it gains experience with these resources and the aggregate capability constraint.

**C. The CAISO will permit co-located resources using the aggregate capability constraint to provide ancillary services and receive uncertainty awards after the CAISO has gained experience managing energy schedules**

As explained above, the CAISO's initial implementation of the aggregate capability constraint will only permit co-located resources to offer energy bids and receive energy awards. Until the CAISO has sufficient experience with the aggregate capability constraint for this purpose, good utility practice does not support extending the constraint to ancillary services or uncertainty awards for flexible ramping. Applying the constraint to these additional capacity schedules would require increased testing to ensure a feasible market design based on additional information from its market systems, including ramp rates, certified ancillary service capacity ranges, and outages. Stakeholders expressed concern that addressing these issues would unduly delay the timeframe to deploy the aggregate capacity constraint for energy schedules until the fall of 2021.

The CAISO initially proposed to file a subsequent tariff filing when the CAISO has adequately tested the aggregate capability constraint, but stakeholders recommended the CAISO instead identify the restriction and then issue a market notice once it was ready to lift the restriction. The CAISO proposes to adopt this recommended approach as part of the tariff language it has submitted with this filing.<sup>37</sup> This approach will allow the CAISO to lift this restriction without the need to undertake a subsequent stakeholder initiative process and tariff filing. The CAISO expects to lift the restriction associated with applying the aggregate capability constraint to ancillary services and uncertainty awards in the fall of 2021.

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<sup>37</sup> See proposed tariff section 27.13, which states in part: "Scheduling Coordinators may not offer or self-provide Ancillary Services into the CAISO's Markets or receive Uncertainty Awards from Generating Units that are subject to Aggregate Capability Constraints until the CAISO issues a Market Notice stating this restriction will no longer apply."

#### **D. The CAISO will make the aggregate capability constraint available to EIM Resources**

The aggregate capability constraint will allow the CAISO to model the maximum and minimum capability of co-located generating units at a generating facility for purposes of issuing day-ahead market and real-time market awards and dispatches. Some stakeholders recommended the CAISO delay extending this modeling constraint to the EIM until additional stakeholder discussions have occurred. But it is unclear from stakeholder comments what additional issues those discussions would address. Based on the protections proposed in its tariff, the CAISO sees no reason not to offer the aggregate capability constraint to the EIM Entities and EIM Participating Resource Scheduling Coordinators as part of the real-time market.

The CAISO presented this proposal to the EIM Governing Body, which advised the CAISO Board of Governors of their support for extending the aggregate capability constraint to the EIM. The CAISO expects EIM Entity balancing authority areas will require the same protective controls as the CAISO to ensure output from co-located resources does not exceed their interconnection service capacity. However, the CAISO will require written pre-approval from EIM Entities that co-located resources do not pose a reliability or safety concern prior to applying the aggregate capability constraint to co-located resources in their balancing authority areas. The CAISO will establish a process for submitting this pre-approval through its business practice manuals. This process also should address any concerns that may exist involving EIM resources deviating from dispatch instructions because the resources' pricing node will occur at their point of interconnection as opposed to their resource location. In the event that co-located resources in an EIM Entity balancing authority area do not comply with dispatch instructions such that their output would exceed the interconnection service for those resources, the CAISO will ask the applicable EIM Entity balancing authority whether it will revoke its prior approval to enforce the aggregate capability constraint.

#### **E. Co-located resources at a generating facility may use different scheduling coordinators**

As part of the CAISO's draft final proposal regarding the aggregate capability constraint for co-located resources, the CAISO proposed that all co-located resources at a single generating facility must use the same scheduling coordinator. The CAISO proposed this requirement because there may be a need to coordinate the exceptional dispatch of co-located resources. Specifically, the CAISO raised concerns that exceptional dispatch controls for co-located resources would reflect their respective PMaxes but would not reflect the interconnection service limits in the aggregate capability constraint. This concern would make exceptional dispatch more challenging and impose additional manual steps for operators. To help mitigate this concern, the CAISO proposed to require co-located resources at a generating facility utilizing an

aggregate capability constraint to have the same scheduling coordinator. With this proposed rule, the CAISO would only need to contact a single scheduling coordinator, who could then manage the output of the co-located resources behind the aggregate capability constraint.

Stakeholders expressed significant concern with this limitation based on (1) existing commercial arrangements at generating facilities in which different scheduling coordinators represent individual generating units and (2) efforts underway to contract for additional capacity that would operate in a co-located resource configuration utilizing the aggregate capability constraint. Based on these comments, the CAISO revisited the proposed requirement and determined that generation limiting controls at the generating facility will help mitigate the operational concerns it identified. In addition, the CAISO agreed to explore enhancing its exceptional dispatch controls to recognize the maximum output limits of co-located resources at a generating facility utilizing the aggregate capability constraint. Accordingly, the CAISO eliminated the proposed requirement that co-located resources at a single generating facility must use the same scheduling coordinator.

## **V. Effective Date**

The CAISO requests the Commission issue an order accepting these tariff changes effective December 1, 2020. The CAISO requests such order within 61 days, or by November 16, 2020. Obtaining an order in advance of the CAISO's implementation date will facilitate promoting the market software necessary to implement the aggregate capability constraint. In addition, such an order will promote regulatory certainty for those market participants seeking to deploy energy storage in a co-located or hybrid resource configuration in the near future.

## **VI. Communications**

Please address communications regarding this filing to the following individuals, whose names the CAISO requests the Commission place on the official service list established with respect to this submittal:

William H. Weaver\*  
Senior Counsel  
California Independent System  
Operator Corporation  
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Tel: (916) 608-1225  
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Andrew Ulmer\*  
Director, Federal Regulatory Affairs  
California Independent System  
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250 Outcropping Way  
Folsom, CA 95630  
Tel: (916) 608-7209  
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[aulmer@caiso.com](mailto:aulmer@caiso.com)

\*Individuals designated for service pursuant to Rule 203(b)(3).<sup>38</sup>

## VII. Service

The CAISO has served copies of this transmittal letter, and all attachments, on the California Public Utilities Commission, the California Energy Commission, and parties with effective scheduling coordinator service agreements under the CAISO tariff. In addition, the CAISO is posting this transmittal letter and all attachments on the CAISO Web site.

## VIII. Materials Provided In This Filing

The following documents, in addition to this transmittal letter, support this filing:

Attachment A	Clean tariff sheets incorporating the revisions described in this filing
Attachment B	Sheets showing, in redline format, the changes to the currently effective tariff described in this filing
Attachment C:	EIM Governing Body presentation materials dated June 30, 2020
Attachment D	CAISO Board of Governors memorandum dated July 15, 2020, presentation materials dated July 22, 2020

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<sup>38</sup> 18 C.F.R. § 385.203(b)(3).

## **IX. Conclusion**

In this filing, the CAISO proposes initial tariff revisions to help facilitate development interest in co-locating separate renewable and energy storage resources at a single generating facility as well as hybrid resources, *i.e.*, a generating unit with components that use different fuel sources or technologies. The CAISO's tariff revisions will provide it with greater flexibility to model the aggregate capabilities of separate resources co-located at a single generating facility as part of its day ahead and real-time markets. This flexibility will allow market participants and the CAISO to more efficiently utilize the capacity of generating units co-located at a single generating facility. The tariff revisions also will ensure the CAISO can maintain visibility for purposes of forecasting resource production at hybrid resources that include a wind or solar generation component. These revisions will support more accurate forecasting of renewable production of hybrid resources. The CAISO requests that the Commission accept these tariff amendments.

Please do not hesitate to contact the undersigned if you have any questions.

Respectfully submitted,

**By: /s/ Andrew Ulmer**

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General Counsel

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Counsel for the California Independent  
System Operator Corporation

Dated: September 16, 2020

**Attachment A – Clean Tariff**

**Hybrid Resources Initiative - Phase 1**

**California Independent System Operator Corporation**

**September 16, 2020**

## **Section 4**

\* \* \* \* \*

### **4.8.2 Forecasting**

All Scheduling Coordinators for Eligible Intermittent Resources are subject to the forecasting requirements and the Forecast Fee as described below. All Eligible Intermittent Resources must provide the CAISO meteorological data as specified in Appendix Q. Scheduling Coordinators for Variable Energy Resources not located in the CAISO Balancing Authority Area that elect to use the forecast provided by the CAISO are also subject to the Forecast Fee. Scheduling Coordinators for Hybrid Resources that include an individual component that is capable of being separately registered with the CAISO as an Eligible Intermittent Resource must provide the CAISO with the meteorological data for that component that would be required by Appendix Q, if it were registered with the CAISO as an Eligible Intermittent Resource. Scheduling Coordinators electing to use the forecast provided by the CAISO also are subject to the Forecast Fee.

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## **Section 27**

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### **27.13 Aggregate Capability Constraint**

The CAISO may enforce an Aggregate Capability Constraint that reflects a Generating Facility's maximum and minimum capability for purposes of Day-Ahead Market Awards, Real-Time Market Awards, and Real-Time Dispatch as described in the CAISO's Business Practice Manuals. If the combined PMax of Co-located Resources associated with a single Generating Facility would exceed the Interconnection Service Capacity of that Generating Facility, the Interconnection Customer may request that the CAISO enforce an Aggregate Capability Constraint. If the Interconnection Customer elects to forego an Aggregate Capability Constraint, the combined PMax of the Co-located Resources registered in the Master File for that Generating Facility may not exceed the Generating Facility's Interconnection Service Capacity. EIM Participating Resource Scheduling Coordinators also may request that the CAISO enforce an Aggregate Capability Constraint for Co-located Resources, subject to the prior written approval of the applicable EIM Entity Balancing Authority that enforcing an Aggregate Capability Constraint for Co-located Resources does not create a threat to safety or reliability. Notwithstanding Section 34.13, a Generating Facility whose Co-located Resources, including Variable Energy Resources, do not comply with Dispatch Instructions such that their output would exceed the Interconnection Service Capacity of the Generating Facility, will be ineligible for the Aggregate Capability Constraint. In such cases, the CAISO will adjust those Co-located Resources' PMaxes proportionate to each Generating Unit's capacity such that the sum of the PMaxes equals the Interconnection

Service Capacity of the Generating Facility, or as requested by the Interconnection Customer so long as the total value does not exceed the Interconnection Service Capacity of the Generating Facility.

In the event that Co-located Resources in an EIM Entity Balancing Authority area do not comply with Dispatch Instructions such that their output exceeds the interconnection service for the Co-located Resources, the CAISO will ask the applicable EIM Entity Balancing Authority whether it will revoke its prior approval of enforcing the Aggregate Capability Constraint for such Co-located Resources.

The following resources are not eligible to use the Aggregate Capability Constraint: Multi-Stage Generators, Pseudo-Tie Resources, Proxy Demand Response, Pumped Storage Hydro Units, Metered Sub-Systems, and Use-Limited Resources.

Scheduling Coordinators may not offer or self-provide Ancillary Services into the CAISO's Markets or receive Uncertainty Awards from Generating Units that are subject to Aggregate Capability Constraints until the CAISO issues a Market Notice stating this restriction will no longer apply. The Pricing Node for the Generating Units or EIM Participating Resources subject to an Aggregate Capability Constraint will be their Point of Interconnection.

## **Appendix A**

\* \* \* \* \*

### **- Aggregate Capability Constraint**

A constraint that reflects the combined maximum and the combined minimum capability of Generating Units that comprise a single Generating Facility so that the capability

does not exceed the Generating Facility's Interconnection Service Capacity or charging capacity specified in its Generator Interconnection Agreement. In the case of EIM Participating Resources, a constraint that reflects the combined maximum and the combined minimum capability of individual EIM Participating Resources or non-participating resources that comprise a single resource.

\* \* \* \* \*

### **Co-located Resource**

A Generating Unit with a unique Resource ID that is part of a Generating Facility with other Generating Units. An EIM Participating Resource with a unique Resource ID that is part of a single resource with other EIM Participating Resources.

\* \* \* \* \*

### **Hybrid Resource**

A Generating Unit, with a unique Resource ID at a single Point of Interconnection, with components that use different fuel sources or technologies.

\* \* \* \* \*

### **Point of Interconnection**

The point, as set forth in Appendix A to the Large Generator Interconnection Agreement or Attachment 3 to the Small Generator Interconnection Agreement, where the Interconnection Facilities connect to the CAISO Controlled Grid. For Generating

Facilities connected to the Distribution System, the Point of Interconnection is the point at which the Generating Facility connects to the CAISO Controlled Grid. For an EIM Participating Resource or non-participating resource, the Point of Interconnection is the point at which the EIM Participating Resource or non-participating resource connects to an EIM Entity's transmission facilities.

\* \* \* \* \*

## **Appendix Q**

### **Eligible Intermittent Resources Protocol (EIRP)**

#### 1 SCOPE

##### 1.1 Scope of Application to Parties

This EIRP applies to the CAISO and to:

- (a) Scheduling Coordinators (SCs);
- (b) Eligible Intermittent Resources;
- (c) Participating Intermittent Resources; and
- (d) Hybrid Resources with a wind generation or solar generation component.

\* \* \* \* \*

**Attachment B – Redline Tariff**  
**Hybrid Resources Initiative - Phase 1**  
**California Independent System Operator Corporation**  
**September 16, 2020**

## **Section 4**

\* \* \* \* \*

### **4.8.2 Forecasting**

All Scheduling Coordinators for Eligible Intermittent Resources are subject to the forecasting requirements and the Forecast Fee as described below. All Eligible Intermittent Resources must provide the CAISO meteorological ~~and outage~~ data as specified in Appendix Q. Scheduling Coordinators for Variable Energy Resources not located in the CAISO Balancing Authority Area that elect to use the forecast provided by the CAISO are also subject to the Forecast Fee. Scheduling Coordinators for Hybrid Resources that include an individual component that is capable of being separately registered with the CAISO as an Eligible Intermittent Resource must provide the CAISO with the meteorological data for that component that would be required by Appendix Q, if it were registered with the CAISO as an Eligible Intermittent Resource. Scheduling Coordinators electing to use the forecast provided by the CAISO also are subject to the Forecast Fee.

\* \* \* \* \*

## **Section 27**

\* \* \* \* \*

### **27.13 Aggregate Capability Constraint**

The CAISO may enforce an Aggregate Capability Constraint that reflects a Generating Facility's maximum and minimum capability for purposes of Day-Ahead Market Awards, Real-Time Market Awards, and Real-Time Dispatch as described in the CAISO's Business Practice Manuals. If the combined PMax of Co-located Resources associated with a single Generating Facility would exceed the Interconnection Service Capacity of that Generating Facility, the Interconnection Customer may request that the CAISO enforce an Aggregate Capability Constraint. If the Interconnection Customer elects to forego an Aggregate Capability Constraint, the combined PMax of the Co-located Resources registered in the Master File for that Generating Facility may not exceed the Generating Facility's Interconnection Service Capacity. EIM Participating Resource Scheduling Coordinators also may request that the CAISO enforce an Aggregate Capability Constraint for Co-located Resources, subject to the prior written approval of the applicable EIM Entity Balancing Authority that enforcing an Aggregate Capability Constraint for Co-located Resources does not create a threat to safety or reliability. Notwithstanding Section 34.13, a Generating Facility whose Co-located Resources, including Variable Energy Resources, do not comply with Dispatch Instructions such that their output would exceed the Interconnection Service Capacity of the Generating Facility, will be ineligible for the Aggregate Capability Constraint. In such cases, the CAISO will adjust those Co-located Resources' PMaxes proportionate to each Generating Unit's capacity such that the sum of the PMaxes equals the Interconnection

Service Capacity of the Generating Facility, or as requested by the Interconnection Customer so long as the total value does not exceed the Interconnection Service Capacity of the Generating Facility.

In the event that Co-located Resources in an EIM Entity Balancing Authority area do not comply with Dispatch Instructions such that their output exceeds the interconnection service for the Co-located Resources, the CAISO will ask the applicable EIM Entity Balancing Authority whether it will revoke its prior approval of enforcing the Aggregate Capability Constraint for such Co-located Resources.

The following resources are not eligible to use the Aggregate Capability Constraint: Multi-Stage Generators, Pseudo-Tie Resources, Proxy Demand Response, Pumped Storage Hydro Units, Metered Sub-Systems, and Use-Limited Resources.

Scheduling Coordinators may not offer or self-provide Ancillary Services into the CAISO's Markets or receive Uncertainty Awards from Generating Units that are subject to Aggregate Capability Constraints until the CAISO issues a Market Notice stating this restriction will no longer apply. The Pricing Node for the Generating Units or EIM Participating Resources subject to an Aggregate Capability Constraint will be their Point of Interconnection.

## **Appendix A**

\* \* \* \* \*

### **- Aggregate Capability Constraint**

A constraint that reflects the combined maximum and the combined minimum capability of Generating Units that comprise a single Generating Facility so that the capability

does not exceed the Generating Facility's Interconnection Service Capacity or charging capacity specified in its Generator Interconnection Agreement. In the case of EIM Participating Resources, a constraint that reflects the combined maximum and the combined minimum capability of individual EIM Participating Resources or non-participating resources that comprise a single resource.

\* \* \* \* \*

### **Co-located Resource**

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\* \* \* \* \*

### **Hybrid Resource**

A Generating Unit, with a unique Resource ID at a single Point of Interconnection, with components that use different fuel sources or technologies.

\* \* \* \* \*

### **Point of Interconnection**

-The point, as set forth in Appendix A to the Large Generator Interconnection Agreement or Attachment 3 to the Small Generator Interconnection Agreement, where

the Interconnection Facilities connect to the CAISO Controlled Grid. For Generating Facilities connected to the Distribution System, the Point of Interconnection is the point at which the Generating Facility connects to the CAISO Controlled Grid. For an EIM Participating Resource or non-participating resource, the Point of Interconnection is the point at which the EIM Participating Resource or non-participating resource connects to an EIM Entity's transmission facilities.

\* \* \* \* \*

## **Appendix Q**

### **Eligible Intermittent Resources Protocol (EIRP)**

#### 1 SCOPE

##### 1.1 Scope of Application to Parties

This EIRP applies to the CAISO and to:

- (a) Scheduling Coordinators (SCs);
- (b) Eligible Intermittent Resources; ~~and~~
- (c) Participating Intermittent Resources; and
- (d) Hybrid Resources with a wind generation or solar generation component.

\* \* \* \* \*

**Attachment C – EIM Briefing**

**Hybrid Resources Initiative - Phase 1**

**California Independent System Operator Corporation**

**September 16, 2020**

# WESTERN ENERGY IMBALANCE MARKET

## Briefing on hybrid resources phase 1 and decision on advisory role (co-located resources)

Greg Cook

Executive Director, Market & Infrastructure Policy

EIM Governing Body Meeting

General Session

June 30, 2020



# Management is developing two different models for generation with different technology types at the same location

- Co-located Resource – Individual resource ID for each generator behind a single point of interconnection
  - Each component will be modelled similar to other resources on the grid today
  - ISO Board decision in July, Fall 2020 implementation
- Hybrid Resource – A single resource ID aggregating multiple generators at a single point of interconnection
  - ISO has visibility to a single resource which can allow flexibility for hybrid resource management
  - ISO Board decision in November, Fall 2021 implementation

## Co-located resources proposal falls under the EIM Governing Body's advisory role

- Under the co-located resources proposal, the ISO will provide new functionality to manage multiple resources behind a point of interconnection
- New functionality will be available to the ISO and EIM balancing authority areas
- Rules apply generally to the entire market, therefore proposal falls under EIM Governing Body's advisory role

## Management proposes that co-located resources be constrained by limits at the point of interconnection (POI)

- Under current rules, resources are constrained so aggregate Pmax values are less than the POI limits
- Proposal manages dispatches of co-located resources to be within POI limits allowing Pmax of each resource up to POI limit
  - POI limit will be implemented as a constraint in market model
  - Resources will be priced at the POI
- Initial implementation in Fall 2020 will limit new functionality to energy dispatches
  - Full constraint, including AS, planned for Fall 2021

# Stakeholders support new policy for managing co-located resources, but have remaining concerns

- Concern over policy implementation timeline
  - Some stakeholders believe policy is moving too fast
  - Some stakeholders want ancillary services functionality available for 2021 operational year
- Some stakeholders requested additional functionality to allow storage resources to absorb differences between VER forecasts and actual output
  - Due to operational concerns, management proposes conservative path for implementations
  - Consider additional functionality for later enhancements
- DMM concerned pricing resources at POI instead of resource nodes could incent resources to deviate from dispatch instructions
  - POI is not part of the ISO controlled grid
  - Would price co-located resources different than hybrid resources
  - Physical equipment required to maintain dispatch within POI limit

# Management recommends EIM Governing Body support proposal for co-located resources

- Co-located proposal will provide new functionality to efficiently manage resources located at the same POI
- Conservative implementation approach will allow for the ISO and market participants to learn how to best manage these new resource configurations before addition additional functionality
  - ISO will provide a report out after the first year of experience with co-located resource operations
- Management will consider new functionality for 2023 interconnections

**Attachment D – Board Memorandum**

**Hybrid Resources Initiative - Phase 1**

**California Independent System Operator Corporation**

**September 16, 2020**



# Memorandum

**To:** ISO Board of Governors

**From:** Mark Rothleder, Vice President, Market Policy and Performance

**Date:** July 15, 2020

**Re:** **Decision on hybrid co-located resources proposal**

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*This memorandum requires Board action.*

## EXECUTIVE SUMMARY

Interest in energy storage is significant and continues to grow as state and federal policy makers and regulators promote energy storage development to help decarbonize the grid. Throughout the West, it is expected that energy storage paired with wind and solar resources will be pursued to accommodate the retirement of natural gas and coal fired generation. In particular, the ISO has identified a potential shortfall of capacity to meet projected system net load peaks over the next few years because of pending retirements of the once-through cooled natural gas generation fleet. To address this shortfall, storage resource developers have submitted a significant number of interconnection requests and are moving quickly to fill the 3,300 MW procurement mandate from the California Public Utilities Commission prior to 2023. To meet this need, the ISO anticipates a significant amount of new storage generation capacity in California alone in 2020, 2021 and 2022.

Management proposes a new policy to facilitate and manage strong developer interest to add storage resources to existing solar and other resource sites. Developers are adding storage to existing sites because adding resources at these locations can be done more quickly and at a lower cost than establishing new interconnections. Lower costs are achieved due to the existing infrastructure, such as step-up transformer equipment that is already a part of the existing facility. Siting at existing facilities takes less time to go through the ISO's interconnection process because the capacity addition can be considered through the material modification process, rather than the process of siting a new facility, which includes additional analysis and approvals.

Management is developing two different market models for generation with different technology types located behind the same interconnection. The first proposed option is a model for 'co-located' resources. Under this model the resources behind the

interconnection have separate resource IDs and are separately dispatched through the ISO market even though they may have a shared commercial interest. The second option is a model for 'hybrid' resources, where the generation resources are modelled under a single resource ID. The co-located model allows for the underlying resources to be modeled in a manner similar to existing resources today, but requires the ISO market to manage a constraint at the point of interconnection to ensure that the combination of resources does not receive market instructions beyond the interconnection limit. Enabling hybrid resources requires several new features for the resource operator to communicate to the ISO when portions of the generating facility is unavailable because of deviations in the variable output component of the hybrid resource.

Management is developing these policy changes as quickly as possible to facilitate the addition of new storage capacity at existing interconnection locations needed to address pending capacity shortfalls. Management proposes to implement the new market functionality in phases to manage its timely development and implementation. Co-located resources require less new functionality than hybrid resources given they participate in the market under existing generation models as two separate and operationally distinct resources. As a result, Management proposes to implement the co-located resource model in the fall of this year. The hybrid functionality requires additional time to vet with stakeholders and implement, thus, Management proposes to implement the hybrid model a year later in the fall 2021.

Management has completed the policy development for the co-located resources and brings that phase of the policy forward for a decision. The hybrid resources policy is still under development and Management plans to return to request a decision on that part of the initiative at the November 2020 Board of Governors meeting.

Management proposes the following motion:

***Moved, that the ISO Board of Governors approves the tariff revisions necessary to implement the proposal for the hybrid co-located resources proposal as described in the memorandum dated July 15, 2020; 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 proposed deliverability methodology revisions, 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

Today, the ISO market already has the concept of co-located resources. However, existing market rules preclude the aggregate values for the maximum output ( $P_{max}$ ) of each resource to exceed the total interconnection limit at the point of interconnection, leaving important capacity value on the table. Management proposes that co-located resources be allowed to register their maximum operating limit as their  $P_{max}$  even if their aggregate  $P_{max}$  values are greater than the point of interconnection limit. This is appropriate as many of the new storage resources will be located at existing solar generation sites. These two technologies complement each other, in that solar only operates during daylight hours and storage is incentivized to provide energy to the market when energy prices are the highest, which usually occurs during the evening net-load ramp and the evening net-load peak. Under the proposal, the ISO will limit market awards to, and dispatches from, co-located resources to be within the point of interconnection limit by employing a new aggregate capability constraint. The aggregate capability constraint will be modeled similar to other existing constraints in the ISO market. However, congestion from the interconnection constraint will only be used to determine the megawatt dispatch for each co-located resource and will not be used to set the price for the co-located resources. Management proposes that the co-located resources receive the locational marginal price at the point of interconnection. This allows co-located resources to receive the prevailing market prices at the point of interconnection.

Management believes that pricing co-located resources in this manner is appropriate. If congestion occurs on the ISO controlled grid, it will effect the dispatch and pricing of the co-located resources in a manner consistent with all other resources on the grid. Because the point of interconnection is not the ISO controlled grid, but a part of the generator's intertie, congestion at these locations should not be used for pricing resources there. However, if the production from the co-located resources at that point of interconnection could, in theory, exceed the point of interconnection limits, the constraint should be observed for economic dispatch purposes so that signals are not sent to these co-located resources beyond their interconnection limits. Importantly, pricing co-located resources at the point of interconnection maintains pricing parity between electrically identical facilities that happen to be modeled as hybrid resources instead of co-located resources.

In addition to the model restricting dispatch of co-located resources to levels at or below the interconnection limit, the ISO also takes additional precautions to ensure that these limits are not violated by actual generation at the facility. Upon resource interconnection, new resources are required to demonstrate that a limiting "run-back" scheme is in place that will prevent the combined flow from the resources from ever exceeding point of interconnection limits in real-time. These run-back schemes are electronic and are implemented at the control center that monitors electricity flow onto the ISO controlled transmission system. These schemes are an existing requirement for resources integrating into the ISO grid and not a new proposal specific to co-located resources.

## POSITIONS OF THE PARTIES

Stakeholders are generally supportive of the policy provisions for the co-located resources within the hybrid resources initiative. Some stakeholders expressed concern that the policy development is moving too fast. However, most stakeholders that have storage capacity coming on-line in 2020 or early 2021, do not share these concerns. As noted above, given the need for new capacity additions, Management feels that moving quickly to get these rules in place is essential to meet procurement targets set for the next few years.

The ISO Department of Market Monitoring and the California Public Utilities Commission expressed concern about the proposed pricing model for co-located resources. For the reasons discussed above, Management feels that it is important to price co-located resources in the manner described, which maintains pricing parity between co-located and hybrid resources, and without would cause pricing disparity between electrically identical resources. Additionally, including congestion from the point of interconnection would mean pricing non-ISO transmission into the price of the resource, which creates new and unprecedented issues. The Department of Market Monitoring also asserted that the proposed pricing paradigm could cause prices to be inconsistent with dispatch instructions from the ISO. Management maintains that co-located storage will continue to have a tariff obligation to follow dispatch instructions received by the market. In the event that individual resources do not follow dispatch instructions, the proposal includes a provision that would enable the ISO to limit the summation of the resources' Pmax values to be less than the point of interconnection limit constraint. Furthermore, as with all tariff obligations, resources that do not follow these rules can be referred to FERC.

Late in the stakeholder process, a number of stakeholders requested additional authority and functionality to absorb the difference in generation between variable energy resource production and forecast values. Today, variable energy resources, wind and solar, are allowed to deviate from their dispatch instructions and produce "as capable." Variable resources are not permitted to produce as capable when not receiving dispatch below forecasts from the ISO, when receiving explicit instructions to follow dispatch instructions from the ISO, or receiving exceptional dispatch instructions from the ISO. Management recently implemented improved controls that require variable resources to comply directly with dispatch and operator instructions under certain circumstances.

Management believes the concept has merit is seriously considering this request from stakeholders to implement such functionality. Although this functionality may be easy to conceptualize, without limitations on the scope of how this authority would be managed, implementation could present significant challenges. First, this would require real-time communication between the co-located resources and it is unclear how this would work or what the protocols for this data sharing would be, and whether they are possible or legal, especially if the scheduling coordinators are different for the co-located resources. Second, allowing a storage resource to deviate from dispatch instructions would preclude it from providing regulation, as the resource would be incapable of following four-second automatic generation control signals from the ISO. It also could be problematic for storage resources providing other kinds of ancillary services or other products that require maintenance of a

particular state of charge since the state of charge may be constantly changing based on the dynamic output of the variable energy resources. Details surrounding the interaction of ancillary service and other market products must be considered together prior to implementation. Third, allowing storage resources to deviate from their state of charge could impact unit commitment in the real-time market. If the state of charge deviates from what is expected by the real-time market optimization, it could result in reliability concerns because the state of charge available could actually be less than what was predicted by the market optimization software. Finally, it is unclear how this would be handled by the ISO settlement system. Today, the settlement system calculates statements for each resource individually. The system cannot settle net deviations among a set of resources. New policy and system enhancements would need to be developed to assess whether energy produced and consumed by this behavior should be accounted for as instructed or uninstructed imbalance energy. Management commits to continue work with stakeholders in the ongoing hybrid resources initiative to develop a policy proposal to enable such authority in a way that does not adversely impact the market optimization or present significant implementation challenges. Management plans to present this proposal as part of the hybrid resources proposal to the Board at the November Board of Governors meeting.

Until and whether these issues and level of flexibility can be resolved for co-located resources, market participants are not left without options. Market participants can elect to operate as a hybrid resource – versus as a co-located resource – which allows for employment of their own on-site optimization between their hybridized variable energy resources and storage devices.

## **FUTURE POLICY**

The ISO intends to collect performance data for hybrid and co-located resources as they integrate into the system after this policy is implemented. This information will include 1) how unique features of the hybrid and co-located models are functioning, 2) if co-located or hybrid resources are exceeding their point of interconnection capacity, 3) if there are any unintended consequences from the addition of co-located or hybrid resources, and 4) if the co-located resources are not following dispatch instructions when prices are particularly high. Some of this data may be included in monthly reports published by the ISO, and some may be included in regular market planning and performance forum meetings hosted by the ISO.

In addition to providing the ISO and the public with additional insight into how these resources are functioning, the ISO intends to use this collected data to inform future policy for hybrid resources. Currently, the ISO is planning to address additional considerations for hybrid and co-located resources in a policy initiative set to begin in the fourth quarter of 2021.

## **CONCLUSION**

Management requests Board approval of the co-located components of the hybrid resources initiative as described in this memorandum. It is critical that the ISO implement the provisions outlined in this proposal to facilitate the addition of new storage resources paired with other resource technologies behind a single interconnection. The near-term need for the new policy is being driven by the California Public Utilities Commission's prescribed procurement of 3,300 MW of new resources in response to the retirement of the once-through cooled gas resources.