

May 1, 2019

The Honorable Kimberly D. Bose  
Secretary  
Federal Regulatory Energy Commission  
888 First Street, NE  
Washington, DC 20426

**Re: California Independent System Operator Corporation  
Order No. 841 Compliance  
Response to Request for Additional Information  
Docket No. ER19-468-\_\_\_\_\_**

Dear Secretary Bose:

The California Independent System Operator (“CAISO”) herein responds to the letter requesting additional information issued in this docket on April 1, 2019.<sup>1</sup> The CAISO has worked on integrating energy storage into the CAISO markets since before Order No. 841,<sup>2</sup> and continues to do so. In addition to supporting traditional Pumped-Storage Hydro Units, the CAISO has successfully deployed a new market participation model, the Non-generator Resource (“NGR”), that newer storage technologies are using today. The CAISO also has enhanced its demand response models to accommodate storage technologies, which many storage resources use. These enhancements have resulted from the numerous stakeholder initiatives the CAISO has conducted on energy storage, including the Energy Storage and Distributed Energy Resources (“ESDER”) stakeholder initiative, which is now in its fourth cycle.<sup>3</sup> The CAISO currently has 230 interconnection requests for new energy storage projects, totaling 48,559 MW.<sup>4</sup> The CAISO’s most recent interconnection request window, which just closed on April 15, included 155 interconnection requests, 141 of which included energy storage.

As the CAISO explains below, the CAISO’s tariff complies with Order No. 841. Order No. 841 identified the CAISO’s operations as best practices, and numerous

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<sup>1</sup> Pursuant to the Commission’s letter, the CAISO has filed this response under Code 80, Compliance Filing, and emailed a copy to Franklin Jackson at [Franklin.Jackson@ferc.gov](mailto:Franklin.Jackson@ferc.gov).

<sup>2</sup> *Electric Storage Participation in Markets Operated by Regional Transmission Organizations and Independent System Operators*, 162 FERC ¶ 61,127 (“Order No. 841”).

<sup>3</sup> [http://www.caiso.com/informed/Pages/StakeholderProcesses/EnergyStorage\\_DistributedEnergyResources.aspx](http://www.caiso.com/informed/Pages/StakeholderProcesses/EnergyStorage_DistributedEnergyResources.aspx).

<sup>4</sup> The CAISO’s generator interconnection queue data are available at <https://rimspub.caiso.com/rims5/logon.do>.

commenters agreed. The CAISO respectfully requests that the Commission approve the CAISO's filing in compliance with Order No. 841.

## 1) **Creation of a Participation Model for Electric Storage Resources**

### A. **Participation Model for Electric Storage Resources**

*To identify the set of resources that are eligible to use the required participation model for electric storage resources, Order No. 841 revised section 35.28(b) of the Commission's regulations<sup>5</sup> to define an electric storage resource as "a resource capable of receiving electric energy from the grid and storing it for later injection of electric energy back to the grid, regardless of their storage medium (e.g., batteries, flywheels, compressed air, and pumped-hydro).<sup>6</sup> Order No. 841 added section 35.28(g)(9)(i) to the Commission's regulations to require that each RTO/ISO have tariff provisions providing a participation model for electric storage resources consisting of market rules that, recognizing the physical and operational characteristics of electric storage resources, facilitates their participation in the RTO/ISO markets.<sup>7</sup>*

- a. *Please explain whether it is CAISO's position that each of the three participation models - the Non-Generator Resources (NGRs) model, Pumped Storage Hydro Units model, and Demand Response model, considered on its own, complies with all of the requirements of Order No. 841. Please explain and provide citations to the relevant proposed tariff language that demonstrates compliance with this requirement, including tariff provisions that allow for electric storage resources to set the marginal price, be compensated according to the wholesale services they provide in the same manner as other resources that provide those services, and purchase power at the Locational Marginal Price (LMP) to charge. To the extent CAISO intends to comply with Order No. 841 by relying on existing tariff provisions generally applicable to many types of resources, please explain and provide tariff citations to demonstrate that such provisions will apply to electric storage resources as required by Order No. 841.*

The CAISO's NGR model, Pumped-Storage Hydro Unit model, and Demand Response models all fully comply with Order No. 841 in that they "ensure[] eligibility to participate in the RTO/ISO markets in a way that recognizes the physical and operational characteristics of [different] electric storage resources."<sup>8</sup> In Order No. 841,

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<sup>5</sup> 18 C.F.R § 35.28(b).

<sup>6</sup> Order No. 841 at P 29.

<sup>7</sup> *Id.* P 51.

<sup>8</sup> Order No. 841 at P 51.

the Commission clarifies that “where an RTO/ISO already has a separate participation model that electric storage resources may use . . . we are not requiring the RTO/ISO to consolidate that participation model with the participation model for electric storage resources . . . .”<sup>9</sup>

As the Commission recognizes in Order No. 841, “storage” comes in a variety of different forms and different technologies with different characteristics. The CAISO has established different participation models where storage resources differ from each other in critical ways. For example, lithium-ion and sodium sulfur batteries do not have pumping levels, shut-down costs, or hourly pumping costs like hydroelectric pumped storage. Nor do batteries have the same physical and operating constraints as pumped storage. Using one model to rule them all would either unduly constrain certain technologies or provide them with market attributes their physical characteristics do not warrant.

The CAISO tariff does not assign one exclusive label to different resource technologies. Like all tariffs, the CAISO’s tariff is centered on the rates, terms, and conditions of transmission service the CAISO provides. The terms, labels, and models the CAISO uses are centered on the rates, terms, and conditions of service available to all resources rather than the name of any particular resource.<sup>10</sup>

A “storage resource” may include a number of different technologies, but it would still have a Scheduling Coordinator, and would still be encompassed by the definition of a number of other resource definitions, including Generator, Generating Facility, Generating Unit, Interconnection Customer, and Metered Entity. The same is true for pumped storage resources. The CAISO tariff defines Generating Units as resources “whose electrical output is capable of being separately identified and metered,” that are located in the CAISO Balancing Authority Area,<sup>11</sup> connected to the CAISO Controlled Grid directly or through distribution facilities,<sup>12</sup> and capable of producing and delivering

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<sup>9</sup> *Id.* at P 55.

<sup>10</sup> For example, the CAISO does not have any term or model for “wind resources.” But wind turbines may be, *inter alia*, Generators, Participating Generators, Qualifying Facilities, Generating Units, Generating Facilities, Interconnection Customers, Variable Energy Resources, Eligible Intermittent Resources, CAISO Metered Entities, Scheduling Coordinator Metered Entities, and EIM Resources under the CAISO tariff. Moreover, a significant portion of the rules for wind turbines center on the rules centered on Scheduling Coordinators, many without mentioning other labels a particular wind turbine may have. Each of these terms provides important distinctions under different provisions of the CAISO tariff that would be difficult to capture by listing all the pertinent rules based on resource technology taxonomy.

<sup>11</sup> Or EIM Entity’s Balancing Authority Areas for participation in the Real Time Market.

<sup>12</sup> Or via a Pseudo-Tie.

net Energy.<sup>13</sup> Similarly, a Generator is merely “the seller of Energy or Ancillary Services produced by a Generating Unit.”<sup>14</sup>

The CAISO’s general tariff provisions that apply to all resource types allow for electric storage resources to set the marginal price as well as receive compensation for wholesale services they provide in the same manner as other resources that provide those services. Separately, the CAISO has specified that electric storage resources may purchase power at the Locational Marginal Price (LMP) to charge.<sup>15</sup>

Electric storage resources are expressly able to set the Day-Ahead Market LMP and the Real-Time LMP under the CAISO tariff. CAISO tariff sections 31.3.1.4 and 34.20.2.3 state that Generating Units, Participating Loads (which include Pumped-Storage Hydro resources),<sup>16</sup> non-Participating Loads, Proxy Demand Resources, Reliability Demand Response Resources, *inter alia*, are eligible to set the LMP.<sup>17</sup> As discussed above and in the CAISO’s compliance filing, most storage resources—using the Non-Generator Resources or Pumped-Storage Hydro Unit models—are Generating Units under these sections unless they are participating as demand response resources, in which case these sections still expressly provide that demand response resources are eligible to set the LMP.

Likewise, the CAISO compensates resources for services provided and not on the basis of resource type. Section 11.2 of the CAISO tariff states:

All transactions in the IFM and RUC as specified in the Day-Ahead Schedule, AS Awards and RUC Awards, respectively, are financially binding and will be settled based on the Day-Ahead LMP, ASMP or RUC Price for the relevant Location for the specific resource or transaction identified for the Bid. The CAISO will settle the costs of Demand, capacity, Energy and Ancillary Services as separate Settlement charges and payments for each Settlement Period of the Day-Ahead Schedule, Day-Ahead AS Award or RUC Award, as appropriate.

This provision is resource-type agnostic because ultimately the CAISO compensates every resource equally based upon its performance in the market. As such, the provisions related to settlement center on the awards and prices scheduling

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<sup>13</sup> “Generating Unit,” Appendix A to the CAISO tariff.

<sup>14</sup> “Generator,” Appendix A to the CAISO tariff.

<sup>15</sup> See Section 11.2 of the CAISO tariff, discussed in detail below.

<sup>16</sup> Under the CAISO tariff, Participating Load is merely defined as “An entity, including an entity with Pumping Load . . . providing Curtailable Demand.” Pumped-Storage Hydro Units thus participate as Participating Load when in pumping mode. See Appendix A to the CAISO tariff.

<sup>17</sup> Appendix C to the CAISO tariff describes the LMP calculations in detail.

coordinators receive on behalf of the resources they represent, regardless of their fuel or technology.

The CAISO tariff expressly explains the settlement of resources using the NGR participation model and the NGR Generic Modeling functionality (Generic NGR), which, like the NGR model, recognizes that “resources may be dispatched to any operating level within a continuous generating operating range from a negative PMin to a positive PMax.”<sup>18</sup> Because these aggregations can occur across multiple PNodes, the CAISO tariff provides different settlement treatment for NGRs and Generic NGRs:

Settlements for Energy generated or consumed by a Non-Generator Resource or a resource using Non-Generator Resource Generic Modeling functionality will reflect the applicable PNode or Aggregated PNode. For such resources comprising a single PNode, settlement for Energy transactions will reflect the LMP at that PNode. For such resources comprising multiple PNodes settlement for Energy transactions will reflect the weighted average LMP of the PNode(s) based on the applicable Generation Distribution Factors submitted through the resources’ Bid or as registered in the Master File. Consistent with the provisions of Section 11.5.2, the CAISO will impose UIE on a resource’s Scheduling Coordinator if the resource does not follow a Dispatch Instruction. When operating in a negative range between PMin and 0, the CAISO will not consider a Non-Generator Resource or a resource using Non-Generator Resource Generic Modeling functionality as Measured Demand so long as the resource can generate Energy. If a Non-Generator Resource operates solely as dispatchable demand response, the CAISO will treat the resource as Measured Demand.<sup>19</sup>

This tariff provision expressly provides that storage resources using the NGR model will be settled at the relevant LMP, and that the CAISO treats charging as negative Energy rather than Demand.

Provisions relating to the settlement of specific costs unique to hydroelectric pumped storage are addressed in Sections 11.8.2.1.3 and 11.8.4.1.4 of the CAISO tariff.<sup>20</sup> These provisions are based on the relevant market and settlement type (e.g., bid cost recovery,<sup>21</sup> instructed energy<sup>22</sup>). Provisions relating to the settlement of resources using demand response models are addressed in Section 11.6 of the CAISO tariff.

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<sup>18</sup> “Non-Generator Resource Generic Modeling,” Appendix A to the CAISO tariff.

<sup>19</sup> Section 11.6.5 of the CAISO tariff.

<sup>20</sup> And Section 11 generally.

<sup>21</sup> Section 1.8 of the CAISO tariff.

<sup>22</sup> Section 11.5.1.1 of the CAISO tariff.

2) **Eligibility of Electric Storage Resources to Participate in the RTO/ISO Markets**

A. **Eligibility to Provide all Capacity, Energy, and Ancillary Services**

*Order No. 841 adds section 35.28(g)(9)(i)(A) to the Commission's regulations to require that each RTO/ISO have tariff provisions providing that a resource using the participation model for electric storage resources is eligible to provide all capacity, energy, and ancillary services that it is technically capable of providing, including services that the RTOs/ISOs do not procure through an organized market, such as black start, primary frequency response, and reactive power services.<sup>23</sup>*

- a. *Please explain and provide citations to the relevant proposed tariff language that demonstrates the eligibility requirements for all "other services the CAISO procures on behalf of its market," including CAISO's backstop capacity procurement mechanism. To the extent CAISO intends to comply with Order No. 841 by relying on existing tariff provisions generally applicable to many types of resources, please explain and provide tariff citations to demonstrate that such provisions will apply to electric storage resources as required by Order No. 841.*

As the CAISO explained in its transmittal letter, the CAISO tariff does not expressly call for specific technologies or participation models where it describes eligibility requirements to provide services, including services the CAISO procures.<sup>24</sup> In the case of energy, all participating resources may submit energy bids or self-schedules into the CAISO's day-ahead and real-time markets.<sup>25</sup> Likewise, all participating resources that meet the minimum technical requirements to provide ancillary services (Regulation Up, Regulation Down, Spinning Reserve and Non-Spinning Reserve) may submit bids or self-provide these services.<sup>26</sup>

Similar to energy and ancillary services, nothing in the CAISO tariff prevents the CAISO from procuring backstop capacity from storage resources (or any technology) type. Section 43A.4.2 of the CAISO tariff sets forth the criteria the CAISO uses in identifying effective resources for the Capacity Procurement Mechanism. First, the CAISO will "establish the minimum criteria needed to meet the requirements for the type of CPM to be issued to resolve the underlying reliability need."<sup>27</sup> Once the CAISO has

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<sup>23</sup> Order No. 841 at PP 76, 80.

<sup>24</sup> CAISO compliance filing at pp. 12 *et seq.* (citing to Section 40.4 of the CAISO tariff regarding eligibility requirements to provide resource adequacy).

<sup>25</sup> See *generally* Section 30 of the CAISO tariff.

<sup>26</sup> See *generally* section 8.4.1 of the CAISO and Appendix K of the CAISO tariff.

<sup>27</sup> Section 43A.4.2.1 of the CAISO tariff.

identified the resources that can meet the reliability need, the CAISO will “then designate Eligible Capacity from that pool of resources in order to minimize the overall cost of meeting the designation criteria.”<sup>28</sup> Eligible Capacity is defined in part to include: “[c]apacity of Generating Units, System Units, System Resources, PDRs, or Participating Loads that, on any day for which it potentially would hold a CPM designation, is not Committed RA Capacity and not under an RMR Contract.”<sup>29</sup> Generating Units may encompass electric storage that qualifies as a Non-Generator Resource as well as pumped hydro resources. Proxy Demand Resources (“PDRs”) may encompass electric storage resources participating as demand response. The CAISO also may consider whether use limitations would create a risk that a resource would be unavailable to meet the reliability need warranting procurement.<sup>30</sup> However, the tariff expressly provides that “[i]n exercising this discretion, the CAISO shall not unduly discriminate against resources with use limitations.”<sup>31</sup>

The CAISO’s capacity procurement mechanism procures the most cost-effective resource that can meet reliability needs. Specific technologies are neither prescribed nor proscribed.

**B. Ability to De-Rate Capacity to Meet Minimum Run-Time Requirements**

*To implement section 35.28(g)(9)(i)(A) of the Commission’s regulations, Order No. 841 required that each RTO/ISO have tariff provisions ensuring that resources using the participation model for electric storage resources can de-rate their capacity to meet minimum run-time requirements.*<sup>32</sup>

- a. *Please explain and provide citations to the relevant proposed tariff language that demonstrate that CAISO allows resources using the participation model or models for electric storage resources to de-rate their capacity. To the extent CAISO intends to comply with Order No. 841 by relying on existing tariff provisions generally applicable to many types of resources, please explain and provide tariff citations to demonstrate that such provisions will apply to electric storage resources as required by Order No. 841.*

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<sup>28</sup> Section 43A.4.2.2 of the CAISO tariff. (“Aside from considering the respective offer prices from the Eligible Capacity, as part of this cost minimization the CAISO also may consider: the quantity of a resource’s available Eligible Capacity, based on a resource’s PMin, relative to the remaining amount of capacity needed; and the quantity of a resource’s available Eligible Capacity, based on outages and substitute daily RA Capacity.”)

<sup>29</sup> “Eligible Capacity,” Appendix A to the CAISO tariff.

<sup>30</sup> Section 43A.4.2.2 of the CAISO tariff.

<sup>31</sup> *Id.*

<sup>32</sup> Order No. 841 at P 94.

The CAISO tariff provides that Participating Generators, which include electric storage resources, “shall provide data identifying each of its Generating Units and such information regarding the capacity and the operating characteristics of the Generating Unit as may be reasonably requested from time to time by the CAISO.”<sup>33</sup> The CAISO includes this data on resource characteristics within its Master File. The CAISO’s tariff states in part that “all information provided to the CAISO regarding the operational and technical constraints in the Master File must be an accurate reflection of the design capabilities of the resources and its constituent equipment when operating at maximum sustainable performance over Minimum Run Time, recognizing that resource performance may degrade over time.”<sup>34</sup> However, to the extent that a particular service has a requirement for minimum run-times (e.g., regulation), a scheduling coordinator for an electric storage resource can de-rate its capacity in order to qualify to provide that service. This occurs through the certification process established through Section 8 and Appendix K of the CAISO tariff. In addition, as referenced below, an electric storage resource may de-rate its capacity to meet minimum operating requirements to provide resource adequacy capacity in the CAISO’s markets. For example, a resource seeking to provide flexible resource adequacy capacity as a peak ramping resource must be capable of providing Energy for a minimum of three continuous hours up to its full Effective Flexible Capacity value including PMin.<sup>35</sup> An electric storage resource with a MWh constraint may de-rate its capacity to a value at which it can meet this requirement in order to offer its capacity as a peak ramping resource.

Section 40.4.3 of the CAISO tariff sets forth the qualifications for supplying Net Qualifying Capacity, which is the resource adequacy capacity a resource can provide. The first qualification is that a resource is available to validate its Qualifying Capacity, “which can be no less than a resource’s PMin as registered in the Master File.” PMin is synonymous with Minimum Load,<sup>36</sup> which the CAISO tariff defines as “the minimum sustained operating level at which it can operate at a continuous sustained level, as defined in the Master File.”<sup>37</sup> As such, the CAISO tariff expressly allows resources to set their capacity level to any level above their minimum sustained operating level.

For Flexible Capacity, CAISO tariff Section 40.10.4.1 states that the Effective Flexible Capacity value for an energy storage resource will be “the MW output range the resource can provide over three hours of charge/discharge while constantly ramping;” or “the resource’s 15-minute energy output capability” for storage resources electing to provide resource energy management.

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<sup>33</sup> CAISO Tariff Section 4.6.4.

<sup>34</sup> *Id.*

<sup>35</sup> CAISO Tariff Section 40.10.3.3.(a)(2).

<sup>36</sup> See “PMin,” Appendix A to the CAISO tariff.

<sup>37</sup> “Minimum Load,” Appendix A to the CAISO tariff.



Accordingly, the CAISO does not require storage resources to use their nameplate capacity for offering energy or ancillary services resource adequacy capacity or flexible capacity. The CAISO's eligibility requirements focus on the minimum technical requirements only, and the CAISO allows resources to submit their values in the CAISO's Master File.

### **3) Participation in the RTO/ISO Markets as Supply and Demand**

#### **A. Eligibility to Participate as a Wholesale Seller and Wholesale Buyer**

*Order No. 841 added section 35.28(g)(9)(i)(B) to the Commission's regulations to require that each RTO/ISO have tariff provisions to ensure that a resource using the participation model for electric storage resources can be dispatched and can set the wholesale market clearing price as both a wholesale seller and wholesale buyer, consistent with rules that govern the conditions under which a resource can set the wholesale price.<sup>38</sup>*

- a. *To the extent CAISO intends to comply with Order No. 841 by relying on existing tariff provisions generally applicable to many types of resources, please explain and provide tariff citations to demonstrate that such provisions will apply to electric storage resources as required by Order No. 841. Please explain and provide citations to the relevant proposed tariff language that demonstrate the following:*
  - i. *that NGRs can be dispatched as supply or demand, set marginal price, self-schedule, and otherwise participate fully in CAISO's markets.*
  - ii. *that pumped storage hydro resources can be dispatched as supply and demand, set wholesale market clearing prices, and submit bids and self-schedules.*

The CAISO describes storage resources' ability to participate fully in the CAISO markets and set the marginal price in response to Question 1, above. The CAISO's rules for bidding, including rules for the submission of self-schedules, are set forth in Section 30.5 of the CAISO tariff. These rules generally center on the type of bid (e.g., supply, demand, wheeling) rather than the technology type or participation model. Consistent with the approach described herein, the CAISO does not enumerate every type of bid and service every resource can provide. Instead, the CAISO tariff provides general rules and only notes where certain resources diverge. The CAISO notes that self-schedules and ancillary service bids all fall under the defined term "Bid" in the CAISO tariff. Self-schedules are merely bids that do not specify a price per quantity of

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<sup>38</sup> Order No. 841 at P 142.

MWh, which indicates that the resource is a Price Taker in those intervals.<sup>39</sup> To the extent a resource may submit “Bids,” those bids can include “an offer for the Supply or Demand of Energy or Ancillary Services, including Self-Schedules.”<sup>40</sup>

For NGRs, Section 30.5.6 of the CAISO tariff provides:

Scheduling Coordinators must ensure that Non-Generator Resource Bids or Bids from resources using Non-Generator Resource Generic Modeling functionality contain the Bid components specified in this Section 30.5 based on how the resource is then participating in the CAISO Markets, namely, whether it is providing Supply, Demand, and/or Ancillary Services Bids. In addition to the Bid components listed in this Section 30.5, Scheduling Coordinators representing Non-Generator Resources may submit Bids including the State of Charge for the Day-Ahead Market to indicate the forecasted starting physical position of the Non-Generator Resource.

As such, storage resources using the NGR model bid and schedule like other generation resources, although NGRs also have the ability to submit state of charge parameters.

Likewise, Section 30.5.2.3 of the CAISO tariff allows pumped storage hydro resources to submit specific parameters related to pumping “[i]n addition to the common elements listed” for supply bids generally (when generating). Under the CAISO tariff, Participating Load is merely defined as “An entity, including an entity with Pumping Load . . . providing Curtailable Demand.” Pumped-Storage Hydro Units thus participate as Participating Load when in pumping mode, and may submit Demand Bids pursuant to Section 30.5.3 of the CAISO tariff.

Moreover, as discussed above, electric storage resources are expressly able to set the Day-Ahead Market LMP and the Real-Time LMP under the CAISO tariff. Section 31.3.1.4 and Section 34.20.2.3 state that Generating Units, Participating Loads (which include Pumped-Storage Hydro Units),<sup>41</sup> non-Participating Loads, Proxy Demand Resources, Reliability Demand Response Resources, *inter alia*, are eligible to set the LMP.

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<sup>39</sup> “Self-Schedule,” Appendix A to the CAISO tariff.

<sup>40</sup> “Bid,” Appendix A to the CAISO tariff.

<sup>41</sup> Under the CAISO tariff, Participating Load is merely defined as “An entity, including an entity with Pumping Load . . . providing Curtailable Demand.” Pumped-Storage Hydro Units thus participate as Participating Load when in pumping mode. See Appendix A to the CAISO tariff.

**B. Mechanism to Prevent Conflicting Dispatch Signals**

*To implement the new requirement in section 35.28(g)(9)(i)(B) of the Commission's regulations, Order No. 841 required each RTO/ISO to either (1) demonstrate that its market design will not allow for conflicting supply offers and demand bids from the same resource for the same market interval or (2) modify its market rules to prevent conflicting supply offers and demand bids from the same resource for the same market interval.<sup>42</sup>*

- a. *To the extent CAISO intends to comply with Order No. 841 by relying on existing tariff provisions generally applicable to many types of resources, please explain and provide tariff citations to demonstrate that such provisions will apply to electric storage resources as required by Order No. 841. Please explain and provide citations to the relevant proposed tariff language that demonstrate the following:*
  - i. *whether CAISO uses a single bid curve to comply with the requirement to prevent conflicting dispatch signals.*

CAISO tariff Section 30.5.2.1 states that all Supply Bids must contain, *inter alia*, an Energy Bid Curve. As explained above, storage resources using the NGR model submit Supply Bids like other resources, and therefore submit Energy Bid Curves. The CAISO tariff defines an Energy Bid Curve as

The Bid component that indicates the prices and related quantity at which a resource offers Energy in a monotonically increasing (decreasing for Participating Load) staircase function, consisting of no more than 10 segments defined by 11 pairs of MW operating points and \$/MWh, which may be different for each Trading Hour of the applicable Bid time period.

Nothing in this provision provides a lower or upper limit for the MWh input for the Energy Bid Curve; resources are only limited by their PMin and PMax. Because storage resources have a PMin below 0, they can submit MWh values below 0 MWh.

- ii. *that in the event a Pumped-Storage Hydro Unit submits conflicting supply offers and demand bids, CAISO's market optimization process will only dispatch one, whichever is more economic in that interval while respecting the unit's operating constraints, to avoid conflicting dispatch signals.*

The Pumped-Storage Hydro Unit models predates the NGR model, but the CAISO market optimization treats the two similarly. Scheduling Coordinators for Pumped-Storage Hydro Units submit Supply and Demand Bids, and the market optimization process effectively processes them as one bid curve to determine the most

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<sup>42</sup> Order No. 841 at P 162.

economic dispatch. The CAISO Business Practice Manual for Market Operations explains:

Under this model, the resource looks like a Generating Unit on one side and looks like Load (On or off – single segment) on the other. There are thus three distinct operating modes for a Pumped-Storage Hydro Unit that uses the full functionality of the model. These operating modes include:

- Pumping (i.e., pump on and consuming Energy)
- Offline (i.e., both generation and pump off and not producing or consuming Energy)
- Generating Energy like an ordinary Generating Unit

It is not necessary to utilize all three modes. Some pumps are just pumps in that they only consume Energy, and do not generate Energy. If these pumps wish to participate and sell Imbalance Energy or Non-Spinning Reserves then they must use the same model as the Pumped-Storage Hydro Unit for submission of their Bids into the CAISO Market, but need not enter the Generation side of the model for the optimization. The Generator Bid data of the Pumped-Storage Hydro Unit model can be left blank. Thus whether a facility is a Pumped-Storage Hydro Unit or merely a pumping facility the same model is used in the optimization, but with differing levels of Bid data required depending on the functionality being supported.

Pumped-Storage Hydro Unit can perform either as Generating Unit by supplying Energy or as Loads by consuming Energy from the grid, and therefore they are modeled in the CAISO Markets as Generating Units whose output can go negative when they are functioning as pumps. The Pumped-Storage Hydro Unit model for Participating Loads models the pumps as Generating Unit with negative Generation capabilities and therefore schedules and settles them at nodal LMPs.<sup>43</sup>

Pumped-Storage Hydro Units have participated in the CAISO markets since its inception, and the CAISO is unaware of any instance of conflicting dispatch signals.

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<sup>43</sup> Section 2.1.6.1 of the BPM for Market Operations.

#### 4) **Physical and Operational Characteristics of Electric Storage Resources**

##### A. **Incorporating Bidding Parameters**

*Order No. 841 added section 35.28(g)(9)(i)(C) to the Commission's regulations to require that each RTO/ISO have tariff provisions providing a participation model for electric storage resources that accounts for the physical and operational characteristics of electric storage resources through bidding parameters or other means.<sup>44</sup>*

- a. *Please explain and provide citations to the relevant proposed tariff language that demonstrate that a resource using the participation model or models for electric storage resources is permitted to submit its biddable parameters in both the day-ahead and the real-time markets. To the extent CAISO intends to comply with Order No. 841 by relying on existing tariff provisions generally applicable to many types of resources, please explain and provide tariff citations to demonstrate that such provisions will apply to electric storage resources as required by Order No. 841.*

As explained in response to Question (3)(A), above, the CAISO's rules for bidding, including rules for the submission of self-schedules, are set forth in Section 30.5 of the CAISO tariff. These rules generally center on the type of bid (e.g., supply, demand, wheeling) rather than the technology type or participation model. Consistent with the approach described herein, the CAISO does not enumerate every type of bid and service every resource can provide. Instead, the CAISO tariff provides general rules and only notes where certain resources diverge. The CAISO notes that self-schedules and ancillary service bids all fall under the defined term "Bid" in the CAISO tariff. Self-schedules are merely bids that do not specify a price per quantity of MWh, which indicates that the resource is a Price Taker in those intervals.<sup>45</sup> To the extent a resource may submit "Bids," those bids can include "an offer for the Supply or Demand of Energy or Ancillary Services, including Self-Schedules."<sup>46</sup>

For NGRs, Section 30.5.6 of the CAISO tariff provides:

Scheduling Coordinators must ensure that Non-Generator Resource Bids or Bids from resources using Non-Generator Resource Generic Modeling functionality contain the Bid components specified in this Section 30.5 based on how the resource is then participating in the CAISO Markets, namely, whether it is providing Supply, Demand, and/or Ancillary Services Bids. In addition to the Bid components listed in this Section 30.5,

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<sup>44</sup> Order No. 841 at P 191.

<sup>45</sup> "Self-Schedule," Appendix A to the CAISO tariff.

<sup>46</sup> "Bid," Appendix A to the CAISO tariff.

Scheduling Coordinators representing Non-Generator Resources may submit Bids including the State of Charge for the Day-Ahead Market to indicate the forecasted starting physical position of the Non-Generator Resource.

As such, storage resources using the NGR model bid and schedule like other generation resources, although NGRs also have the ability to submit state of charge parameters.

Likewise, Section 30.5.2.3 of the CAISO tariff allows pumped storage hydro resources to submit specific parameters related to pumping “[i]n addition to the common elements listed” for supply bids generally (when generating). Under the CAISO tariff, Participating Load is merely defined as “An entity, including an entity with Pumping Load . . . providing Curtailable Demand.” Pumped-Storage Hydro Units thus participate as Participating Load when in pumping mode, and may submit Demand Bids pursuant to Section 30.5.3 of the CAISO tariff.

Because storage resources submit general supply and demand bids like other resources, their scheduling coordinators may submit bids or self-schedules in both the day-ahead and real-time markets.<sup>47</sup> The CAISO tariff does not restrict resources from submitting bids in the day-ahead or real-time markets based on technology or fuel type.

**B. State of Charge**

*Order No. 841 added section 35.28(g)(9)(i)(C) to the Commission’s regulations to require each RTO/ISO to have tariff provisions providing a participation model for electric storage resources that accounts for the following physical and operational characteristics of such resources: State of Charge, Minimum State of Charge, Maximum State of Charge, Minimum Charge Limit and Maximum Charge Limit.*<sup>48</sup>

- a. *Please explain and provide citations to the relevant proposed tariff language that demonstrate the following. To the extent CAISO intends to comply with Order No. 841 by relying on existing tariff provisions generally applicable to many types of resources, please explain and provide tariff citations to demonstrate that such provisions will apply to electric storage resources as required by Order No. 841.*

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<sup>47</sup> See Sections 30.1 (Bid and Self-schedule Submission for all CAISO Markets), 31.1 (Bid Submission and Validation in the day-ahead Market), and 34.1.3 (Bids in the real-time market) of the CAISO tariff.

<sup>48</sup> *Id.* at PP 191, 211, 236.

- i. *that the State of Charge value in CAISO is the level of energy that an electric storage resource is anticipated to have available at the start of the market interval.*

Section 30.5.6 of the CAISO tariff provides that storage resources may submit bids including the state of charge for the day-ahead market to indicate the forecasted starting physical position. Once submitted, the CAISO's market optimization process constantly tracks storage resources' state of charge through 4-second telemetry. Where storage resources do not submit a state of charge, the CAISO's market optimization process uses its previous state of charge. Pumped-Storage Hydro Units likewise submit a "Pumping Level" in MW as a biddable parameter.<sup>49</sup>

- ii. *that CAISO's participation model or models for electric storage resources accounts for Minimum State of Charge, Maximum State of Charge, Minimum Charge Limit and Maximum Charge Limit, as defined in Order No. 841.<sup>50</sup>*

As the CAISO explained in its compliance filing,<sup>51</sup> the CAISO captures the relatively more static physical parameters of storage resources through Master File entries, which each resource submits through a Resource Data Template. Section 4.6.4 of the CAISO tariff requires Scheduling Coordinators to submit Master File parameters that accurately reflect generating units' "operational and technical constraints."<sup>52</sup> Likewise, Article 4.1.3 of the CAISO's Participating Generator Agreement<sup>53</sup> and Article 4.4 of the CAISO's Participating Load Agreement<sup>54</sup> require resources to submit any changes to their technical information pursuant to the CAISO's Master File modification process.<sup>55</sup>

Master File parameters are described in Attachment B to the CAISO's Business Practice Manual for Market Instruments.<sup>56</sup> Additionally, the CAISO's Network and Resource Modeling website<sup>57</sup> maintains a spreadsheet of all Resource Data

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<sup>49</sup> Section 30.5.3 of the CAISO tariff. Appendix A to the CAISO tariff defines Pumping Level as the "level of MW that the Pumping Load resources would consume as submitted in their Bid."

<sup>50</sup> Order No. 841 at P 236.

<sup>51</sup> CAISO compliance filing at pp. 18 *et seq.*

<sup>52</sup> As explained above, storage resources are considered Generating Units, among other designations under the CAISO tariff.

<sup>53</sup> Appendix B2 to the CAISO tariff.

<sup>54</sup> Appendix B4 to the CAISO tariff.

<sup>55</sup> Section 30.7.3.2 of the CAISO tariff.

<sup>56</sup> Available at <https://bpmcm.caiso.com/Pages/BPMLibrary.aspx>.

<sup>57</sup> Available at <http://www.caiso.com/market/Pages/NetworkandResourceModeling/Default.aspx>.

Template/Master File<sup>58</sup> definitions and each available option.<sup>59</sup> The CAISO also describes the Bid components and Master File parameters for NGRs in Sections 4.1.1 and 5.1.1.4 of the CAISO's BPM for Market Instruments, and Section 5.1.1.2.4 of the same BPM for Pumped-Storage Hydro Units.

For both NGRs and Pumped-Storage Hydro Units, the CAISO captures minimum/maximum states of charge as the resource's minimum/maximum continuous energy limits,<sup>60</sup> and the minimum/maximum charge limits as the resource's minimum/maximum generation capacity limits.<sup>61</sup>

Additionally, both models may submit daily minimum/maximum states of charge as biddable parameters for the day in MWh.<sup>62</sup>

### **C. Charge and Run Times**

*Order No. 841 added section 35.28(g)(9)(i)(C) to the Commission's regulations to require that each RTO/ISO have tariff provisions providing a participation model for electric storage resources that accounts for the following physical and operational characteristics of such resources: Minimum Charge Time, Maximum Charge Time, Minimum Run Time, and Maximum Run Time.*<sup>63</sup>

- a. *Please explain and provide citations to the relevant proposed tariff language that demonstrates that CAISO's participation model or models for electric storage resources accounts for Minimum Charge Time, Maximum Charge Time, Minimum Run Time, and Maximum Run Time as defined in Order No. 841. To the extent CAISO intends to comply with Order No. 841 by relying on existing tariff provisions generally applicable to many types of resources, please explain and provide tariff citations to demonstrate that such provisions will apply to electric storage resources as required by Order No. 841.*

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<sup>58</sup> Available at <https://www.aiso.com/Documents/GeneratorResourceDataTemplate-NewSolarResource.xlsx>.

<sup>59</sup> Available at <http://www.aiso.com/Documents/GRDTandIRDTDefinitions.xls>.

<sup>60</sup> Defined as the minimum/maximum stored energy in MWh.

<sup>61</sup> Defined as the minimum/maximum charging/discharging capacity at a sustainable rate in MW.

<sup>62</sup> Section 30.5.2.2 of the CAISO tariff for generators (including NGRs); Section 30.5.2.3 for Pumped-Storage Hydro Units. Appendix A to the CAISO tariff defines "Energy Limit" as "The Bid component that indicates the maximum and minimum daily Energy limits for the Generating Unit. Energy Limit applies to net pumping Demand and Generation over the Operating Day for a Pumped-Storage Hydro Unit."

<sup>63</sup> Order No. 841 at P 220.



Because Pumped-Storage Hydro Units rely on gravity and the flow of water to generate energy or demand, they have physical constraints on how quickly they can transition from “charging” to “discharging” and vice versa. To account for these constraints, the CAISO allows Pumped-Storage Hydro Units to provide the following Master File parameters:

- Pump Minimum Up Time: minutes a pump must continue to pump
- Pump Minimum Down Time: minutes a pump cannot return to pumping after shutting down
- (Gen) Minimum On Time: minutes generator must stay on before shut down due to physical operating constraints
- Gen-to-Pump Minimum Down Time: minutes after being de-committed from generation mode before able to be dispatched in pumping mode
- Pump-to-Gen Minimum Down Time: minutes after being de-committed from pumping mode before able to be dispatched in generation mode<sup>64</sup>

Pursuant to Section 4.6.4 of the CAISO tariff, these parameters must accurately reflect the resource’s “operational and technical constraints.”<sup>65</sup>

The CAISO has examined whether NGRs need additional parameters to capture unique operating constraints through its ESDER initiative. As Generating Units, storage resources using the NGR participation model could specify a Minimum On Time, but to date, the battery technologies that use the NGR participation model have not demonstrated these operational and technical constraints (apart from state of charge limits). Specifically, the batteries participating under the NGR model can transition from charging to discharging and vice versa near instantaneously. As such, the CAISO does not have similar default Master File parameters for NGRs. The CAISO Resource Data Template instructs NGRs to enter 0 for Minimum On Time.<sup>66</sup> As explained above, storage resources electing to use the NGR model may manage their charging and discharging run times through the optional state of charge parameters enumerated above, minimum and maximum continuous energy limits, and their bid curve. If an NGR has economic costs or benefits driving a need to continue to charge or discharge, it can include them in its bid curve, subject to any applicable bid cap. This enables the CAISO to evaluate NGRs’ need to continue to charge or discharge in the market and not as an out-of-market constraint.

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<sup>64</sup> See Section B.2.1 of the CAISO BPM for Market Instruments; CAISO Resource Data Template Instructions and Definitions, available at <http://www.caiso.com/Documents/GRDTandIRDTDefinitions.xls>.

<sup>65</sup> As explained above, storage resources are considered Generating Units, among other designations under the CAISO tariff.

<sup>66</sup> Section B.2.1 of the CAISO BPM for Market Instruments.

**D. Additional Characteristics**

*Order No. 841 added section 35.28(g)(9)(i)(C) to the Commission's regulations to require that each RTO/ISO have tariff provisions providing a participation model for electric storage resources that accounts for the Discharge Ramp Rate and Charge Ramp Rate of such resources, whether through bidding parameters or other means.*<sup>67</sup>

- a. *Please explain and provide citations to the relevant proposed tariff language that demonstrate that CAISO accounts for ramping rates for NGRs just as it does for conventional generators, and that NGRs can submit Ramp Rates as both bid components and master file parameters. To the extent CAISO intends to comply with Order No. 841 by relying on existing tariff provisions generally applicable to many types of resources, please explain and provide tariff citations to demonstrate that such provisions will apply to electric storage resources as required by Order No. 841.*

Section 30.5.2.2 requires Participating Generators, including NGRs, to include the Ramp Rate in their Bids. As explained above, storage resources participating under the NGR model also must submit Master File values to account for their “operational and technical constraints.”<sup>68</sup>

**5) Minimum Size Requirement**

*Order No. 841 added section 35.28(g)(9)(i)(D) to the Commission's regulations to require that each RTO/ISO have tariff provisions providing a participation model for electric storage resources that establishes a minimum size requirement for participation in the RTO/ISO markets that does not exceed 100 kW.*<sup>69</sup>

- a. *Please explain or reconcile the difference between CAISO's proposal to comply with the minimum size requirements of Order No. 841, and CAISO's 500 kW minimum size requirements in CAISO Tariff Appendix K (Ancillary Service Requirements Protocol) for a resource providing Regulation, Spinning Reserve, or Non-Spinning Reserve as an ancillary service.*

The CAISO has complied with Order No. 841's requirement to “establish[] a minimum size requirement for participation in the RTO/ISO markets that does not exceed 100 kW,” including “all minimum capacity requirements, minimum offer to sell

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<sup>67</sup> Order No. 841 at P 229.

<sup>68</sup> Section 4.6.4 of the CAISO tariff.

<sup>69</sup> Order No. 841 at P 270.

requirements, and minimum bid to buy requirements for resources participating in these markets under the participation model for electric storage resources.”<sup>70</sup> Order No. 841 states that to be eligible to provide ancillary services, “a resource using the participation model for electric storage resources will still need to meet the technical requirements for any of the services that it wants to provide.”<sup>71</sup> The CAISO’s minimum capacity resources for ancillary services are a technical requirement, approved by the Commission as just and reasonable. Modifying that provision exceeds the scope of Order No. 841 compliance. The Commission has made no findings that the CAISO’s technical requirements for resources to provide ancillary services are unjust or unreasonable or unduly preferential or discriminatory.<sup>72</sup>

- b. *The CAISO tariff requires that a Distributed Energy Resource Aggregation be no smaller than 0.5 MW.<sup>73</sup> Please explain and provide citations to the relevant proposed tariff language that demonstrates how an electric storage resource, located on the distribution system or behind-the-meter, with a rated capacity between 100 kW and 0.5 MW may participate in the CAISO markets without participating in a Distributed Energy Resource Aggregation given the 0.5 MW size requirement for these aggregations. To the extent CAISO intends to comply with Order No. 841 by relying on existing tariff provisions generally applicable to many types of resources, please explain and provide tariff citations to demonstrate that such provisions will apply to electric storage resources as required by Order No. 841.*

This question appears to be based on the premise that distribution-level and behind-the-meter resources can only participate in the CAISO markets as Distributed Energy Resource Aggregations (“DERAs”). Such a premise is inaccurate. Numerous distribution-level generators participate in the CAISO Markets. DERAs were designed for a resource that was unable to meet the CAISO’s minimum size requirement, and therefore needed to aggregate with other small resources to participate. Storage resources below 100 kW could participate in the CAISO Markets through a DERA. But

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<sup>70</sup> *Id.*

<sup>71</sup> *Id.*

<sup>72</sup> Under Section 206 of the Federal Power Act, the Commission must find an existing rate is unlawful before it may establish the just and reasonable rate. “A finding that an existing rate is unjust and unreasonable is the ‘condition precedent’ to FERC’s exercise of its section 206 authority to change that rate.” *Emera Maine v. FERC* 854 F.3d 9, 25 (D.C. Cir. 2017). To satisfy this burden, “FERC [is] required to do more than show” that its new rate is just and reasonable. *Id.* at 26. “The Commission’s decision must actually be the result of reasoned decision-making to receive . . . deference. Without further explanation, a bare conclusion that an existing rate is ‘unjust and unreasonable’ is nothing more than ‘a talismanic phrase that does not advance reasoned decision making.’” *Id.* at 27 (quoting *TransCanada Power Mktg. Ltd. v. FERC*, 811 F.3d 1, 12-13 (D.C. Cir. 2015)).

<sup>73</sup> Section 4.17.5.1 of the CAISO tariff.

the DERA model is not the only model available to distribution-connected and behind-the-meter resources.<sup>74</sup>

Section 25.2 of the CAISO tariff states that the CAISO will accept the interconnection of any Generating Unit to the distribution system so long as it has (1) complied with a Wholesale Distribution Access Tariff, Rule 21 of the California Public Utilities Commission (for retail distribution interconnections), or any other applicable Local Regulatory Requirements; and (2) mitigated any adverse reliability impacts on the CAISO Controlled Grid (which rarely, if ever, present).

Moreover, Section 4.6.3.2 of the CAISO tariff expressly allows distribution-level generators to participate in the CAISO Markets. Previously this provision required such generators to be over 500 kW, but the CAISO added an exemption for storage resources of 100 kW or more pursuant to Order No. 841. As such, storage resources between 100 kW and 500 kW can participate as Participating Generators/Generating Units in the CAISO Markets.

As explained in the CAISO's compliance filing, storage resources also can participate as demand response providers. The metering generator output methodology, for example, was designed specifically for resources with both the ability to curtail load through reduced use and through the use of a behind-the-meter battery.<sup>75</sup> The aggregated demand response resource must be able to provide a load curtailment of at least 100 kW, but there is no minimum size limit on the sub-resources that make up the aggregation.<sup>76</sup>

## **6) Energy Used to Charge Electric Storage Resources**

### **A. Price for Charging Energy**

*Order No. 841 added section 35.28(g)(9)(ii) to the Commission's regulations to require that the sale of electric energy from the RTO/ISO markets to an electric storage resource that the resource then resells back to those markets be at the wholesale LMP.<sup>77</sup> An electric storage resource's wholesale energy purchases should take place at the applicable nodal LMP, and not the zonal price.<sup>78</sup>*

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<sup>74</sup> Moreover, behind-the-meter resources are simply considered distribution resources unless expressly addressed in the CAISO tariff, like for the CAISO's metering generator output methodology that allows demand response providers to separate load curtailment and behind-the-meter production.

<sup>75</sup> See Section 4.13.4.2 of the CAISO tariff.

<sup>76</sup> Section 4.13.5.2.1 of the CAISO tariff.

<sup>77</sup> Order No. 841 at P 294.

<sup>78</sup> *Id.* at P 296.

- a. *To the extent CAISO intends to comply with Order No. 841 by relying on existing tariff provisions generally applicable to many types of resources, please explain and provide tariff citations to demonstrate that such provisions will apply to electric storage resources as required by Order No. 841. Please explain and provide citations to the relevant proposed tariff language that demonstrate the following:*
- i. *that electric storage resources are charged the LMP for purchases of electric energy for later resale back to the market.*
  - ii. *that the LMP used for settlement of electric storage resource purchases is a nodal LMP and not a zonal LMP.*
  - iii. *that electric storage resources' charging is accounted for as negative generation.*

As explained in response to Question 1, storage resources constitute Generating Units, *inter alia*, under the CAISO tariff. Section 11.2.1.1 of the CAISO tariff states:

For each Settlement Period for which the CAISO clears Energy transactions in the [Integrated Forward Market (IFM)], the CAISO shall pay the relevant Scheduling Coordinator for the MWh quantity of Supply of Energy from all Generating Units, Participating Loads, Proxy Demand Resources, Reliability Demand Response Resources, Distributed Energy Resource Aggregations and System Resources in an amount equal to the IFM LMP at the applicable PNode or Aggregated PNode multiplied by the MWh quantity specified in the Day-Ahead Schedule for Supply (which consists of the Day-Ahead Scheduled Energy).

Likewise, Section 11.5.1 states that real-time market Instructed Imbalance Energy awards (for all resources) are settled by debiting or crediting the resource's IFM award at the applicable real-time LMP (based on the same PNode).

Moreover, for storage resources using the NGR model, Section 11.6.5 of the CAISO tariff states:

Settlements for Energy generated or consumed by a Non-Generator Resource or a resource using Non-Generator Resource Generic Modeling functionality will reflect the applicable PNode or Aggregated PNode. For such resources comprising a single PNode, settlement for Energy transactions will reflect the LMP at that PNode. For such resources comprising multiple PNodes settlement for Energy transactions will reflect the weighted average LMP of the PNode(s) based on the applicable Generation Distribution Factors submitted through the resources' Bid or as

registered in the Master File. Consistent with the provisions of Section 11.5.2, the CAISO will impose UIE on a resource's Scheduling Coordinator if the resource does not follow a Dispatch Instruction. When operating in a negative range between PMin and 0, the CAISO will not consider a Non-Generator Resource or a resource using Non-Generator Resource Generic Modeling functionality as Measured Demand so long as the resource can generate Energy.

As such, the CAISO settles charging energy for NGRs as negative Energy rather than Demand. As explained above, Energy is settled at the LMP at the resource's PNode. As explained in response to Question 1, Pumped-Storage Hydro Units' pumping load constitutes Demand from Participating Load under the CAISO tariff. Section 11.2.1.3 of the CAISO tariff states that Participating Loads' IFM Demand will be settled by LMP at that PNode. Any real-time award would then be settled pursuant to Section 11.5.1, as discussed above.

## 7) **Metering and Accounting Practices for Charging Energy**

*Order No. 841 required RTOs/ISOs to prevent electric storage resources from paying twice for the same charging energy (i.e., they should not have to pay both the wholesale and retail price for the same charging energy).<sup>79</sup>*

- a. *Please explain and provide citations to the relevant proposed tariff language that demonstrates whether the NGR and Pumped-Hydro Storage participation models prevent electric storage resources from paying both the wholesale and retail rates for the same charging energy. To the extent CAISO intends to comply with Order No. 841 by relying on existing tariff provisions generally applicable to many types of resources, please explain and provide tariff citations to demonstrate that such provisions will apply to electric storage resources as required by Order No. 841.*

Order No. 841 requires each RTO/ISO "to implement metering and accounting practices as needed to address the complexities of implementing the requirement that the sale of electric energy from the RTO/ISO markets to an electric storage resource that the resource then resells back to those markets be at the wholesale LMP."<sup>80</sup> The CAISO has complied with this requirement, as described in response to Question 6. Order No. 841 states that it requires each RTO/ISO "to directly meter electric storage resources, so all the energy entering and exiting the resources is measured by that

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<sup>79</sup> *Id.* at P 325.

<sup>80</sup> *Id.* at P 322.

meter.”<sup>81</sup> In response to “commenters who argue that developing metering practices that distinguish between wholesale and retail activity is impractically complex,” the Commission states that it is not persuaded by such commenters because “CAISO provides two examples of how it has achieved market rules that accurately account for wholesale and retail activities by using direct metering.”<sup>82</sup>

Section 10.1 of the CAISO tariff states:

An entity seeking to provide or process Energy, Demand, or Ancillary Services in the CAISO Markets must provide the CAISO with Meter Data. Based upon its eligibility and election, an entity provides the CAISO with either (a) Revenue Quality Meter Data as a CAISO Metered Entity or (b) Settlement Quality Meter Data as a Scheduling Coordinator Metered Entity.

As such, all storage resources participating under the NGR or Pumped-Storage Hydro models are metered directly by the CAISO or their scheduling coordinator, depending on whether they elect to be a CAISO Metered Entity (“CAISOME”) or a Scheduling Coordinator Metered Entity (“SCME”).<sup>83</sup> CAISOME rules are set forth in Section 10.2 of the CAISO tariff, and SCME rules are set forth in Section 10 of the CAISO tariff. The CAISO’s general metering practices for these entities are also discussed at length in the CAISO’s Metering Rules Enhancement filing, which the Commission approved as just and reasonable in 2017.<sup>84</sup>

Because of the CAISO’s role as a wholesale electricity market operator and the Commission’s jurisdictional limits regarding retail energy,<sup>85</sup> the CAISO cannot direct utility distribution companies to implement retail billing practices. The CAISO tariff can only require that CAISOMEs and SCMEs meter energy output for resale and load that may be settled at wholesale, including charging energy and Station Power. As such, Section 10.1.3.2 of the CAISO tariff states that CAISOMEs and SCMEs “may not net values for output and Load that is not Station Power.” This prohibits retail demand from being included in wholesale Energy values for all resources, including storage.<sup>86</sup> In

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<sup>81</sup> *Id.*

<sup>82</sup> *Id.* at P 323.

<sup>83</sup> See “CAISO Metered Entity” and “Scheduling Coordinator Metered Entity,” Appendix A to the CAISO tariff.

<sup>84</sup> *California Independent System Operator Corp.*, Letter Order, Docket No. ER17-949-000 (March 31, 2017).

<sup>85</sup> *Duke Energy Moss Landing v. CAISO*, 132 FERC ¶ 61,183 (2010) *on remand from Southern California Edison Co. v. FERC*, 603 F.3d 996 (D.C. Cir. 2010).

<sup>86</sup> Regardless of whether they are positive (for discharging) or negative (for charging).

simplest terms, the CAISO's tariff prevents any supply resource<sup>87</sup> from including retail load in its wholesale meters.<sup>88</sup>

The CAISO addressed ambiguities between charging demand and Station Power in Phase 2 of its ESDER stakeholder initiative, which the Commission approved as just and reasonable in 2018.<sup>89</sup> In that initiative, the CAISO worked carefully with the storage community and the California Public Utilities Commission ("CPUC") to ensure that retail and wholesale metering did not result in storage resources' being over- or under-billed. As such, the CAISO included provisions in its tariff stating that CAISOMEs and SCMEs can net Station Power to the extent allowed by their Local Regulatory Authority. The CAISO also revised its Station Power from a long list of potential retail uses to "Retail Energy, as defined by the Local Regulatory Authority, for operating electric equipment, for the sole purpose of participating in the CAISO Markets."<sup>90</sup>

The CAISO also revised its tariff to accommodate those Local Regulatory Authorities that allow Station Power to be netted out of wholesale output or load—as many do, including the CPUC:

CAISO Metered Entities and Scheduling Coordinators may, when providing Meter Data to the CAISO, net kWh or MWh values for output and Station Power electrically connected at the same point, provided that the resource is on-line and producing sufficient output to serve all of its Station Power. Where permitted by the Local Regulatory Authority, CAISO Metered Entities and Scheduling Coordinators may, when providing Metered Data to the CAISO, include Station Power within the resource's wholesale Demand or output below zero (for dispatches to charge a storage resource, for example).<sup>91</sup>

Additionally, the CAISO has worked closely with the CPUC to ensure that both the CAISO and the CPUC have consistent rules for the metering and settlement of storage resources. As a result of these efforts and the CPUC's own proceeding that paralleled ESDER Phase 2, the CPUC ordered its jurisdictional retail entities to revise their tariffs to ensure:

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<sup>87</sup> Excluding demand response resources.

<sup>88</sup> See Section 10.3 of the CAISO tariff, which sets for the CAISO's permitted and prohibited netting rules.

<sup>89</sup> *California Independent System Operator Corp.*, Letter Order, Docket No. ER18-2242-000 (Oct. 24, 2018).

<sup>90</sup> "Station Power," Appendix A to the CAISO tariff.

<sup>91</sup> Section 10.1.3.1 of the CAISO tariff.



- “All energy drawn from the grid to charge energy storage resources for later resale, and including energy associated with efficiency losses, for later resale, should be subject to a wholesale tariff;”
- Specific wholesale uses include “charging energy, resistive losses, pumps (flow batteries and pumped hydro), power conversion system, and transformer, battery management system, thermal regulation, and vacuum (for flywheels);” and
- “Insofar as a storage resource withdraws energy (charges) or injects energy (discharges) subject to a dispatch at a greater absolute value of energy than its station power consumption, that consumption should be able to be netted against the response to the dispatch, within a fifteen-minute settlement period, just as it is for conventional generators.<sup>92</sup>

Utility distribution companies (“UDCs”) subject to CPUC jurisdiction (which include the CAISO’s three largest UDCs) are thus prohibited from assessing retail charges on charging energy, pumping energy, and station power that is less than a response to dispatch (positive or negative).<sup>93</sup>

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<sup>92</sup> *Order Instituting Rulemaking to Consider Policy and Implementation Refinements to the Energy Storage Procurement Framework and Design Program*, “Decision on Track 2 Energy Storage Issues, CPUC Docket No. R.15-03-011 (May 8, 2017), available at <http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M185/K070/185070054.PDF>.

<sup>93</sup> In other words, a storage resource whose output in a 15-minute interval exceeds its station power demand could simply report the output less than the station power demand for wholesale settlement (avoiding retail settlement of the station power demand). But the same resource could receive the same treatment even if it were charging or providing regulation so long as its aggregated response to dispatch in that interval (its total “movement”) exceeded its station power demand. This type of netting treatment is expressly allowed by the CAISO tariff in Section 10.1.3.1, so long as the Local Regulatory Authority allows it.

## Conclusion

For the reasons explained above and in the CAISO's compliance filing, the CAISO respectfully requests that the Commission approve the CAISO's compliance filing with Order No. 841.

Respectfully submitted,

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**CERTIFICATE OF SERVICE**

I hereby certify that I have served the foregoing document upon all of the parties listed on the official service list for the above-referenced proceeding, pursuant to the requirements of Rule 2010 of the Commission's Rules of Practice and Procedure (18 C.F.R. § 385.2010).

Dated at Folsom, California, this 1<sup>st</sup> day of May, 2019.

*/s/ Grace Clark*  
Grace Clark