

January 21, 2020

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

**Re: California Independent System Operator Corporation
Compliance Filing
Docket No. ER19-468-002**

Dear Secretary Bose:

The California Independent System Operator Corporation (“CAISO”) submits this filing to comply with the Commission order issued in this proceeding on November 21, 2019 (“Compliance Order”),¹ in response to the CAISO’s initial filing to comply with Order No. 841.² The Commission’s Compliance Order accepted the CAISO’s initial compliance filing effective December 3, 2019, and directed the CAISO to submit a further compliance filing on three issues:

1. Reflecting storage resources’ physical and operational characteristics in the CAISO tariff;
2. Lowering the minimum capacity requirements for storage resources to provide ancillary services from 500 kW to 100 kW; and
3. Ensuring that the CAISO’s metering practices allow for storage resources to participate in the retail and wholesale markets.

The CAISO addresses each issue below in this further compliance filing and requests that the Commission find that this compliance filing satisfies the directives in the Compliance Order.

¹ *California Independent System Operator Corp.*, 169 FERC 61,126 (2019) (“Compliance Order”). Capitalized terms not otherwise defined herein have the meanings set forth in the CAISO tariff, and references to specific sections, articles, and appendices are references to sections, articles, and appendices in the current CAISO tariff as revised or proposed in this filing, unless otherwise indicated.

² *Electric Storage Participation in Markets Operated by Regional Transmission Organizations and Independent System Operators*, Order No. 841, 162 FERC ¶ 61,127 (2018) (“Order No. 841”), *order on reh’g*, Order No. 841-A, 167 FERC ¶ 61,154 (2019) (“Order No. 841-A”).

I. Physical and Operating Characteristics

A. Background

The Compliance Order found the CAISO tariff generally complies with Order No. 841's requirement to account for storage resources' specific physical and operational characteristics through biddable and Master File parameters.³ Biddable parameters capture dynamic characteristics, and Master File parameters capture relatively more static characteristics.⁴ The CAISO's market optimization uses these parameters to ensure the CAISO does not issue infeasible operating instructions to any resource.⁵

Although the Commission noted in the Compliance Order that the CAISO's Business Practice Manual for Market Instruments may define certain parameters in a manner consistent with Order No. 841's descriptions of discharge ramp rates, charge ramp rates, maximum/minimum state of charge, maximum charge limit, maximum discharge limit, maximum/minimum charge time, and maximum/minimum run time in Order No. 841, the Commission found that the CAISO does not account for these parameters in its tariff.⁶ The Commission directed the CAISO to submit a compliance filing accounting for these characteristics through bidding parameters or other means in the tariff.⁷

B. Proposed Tariff Revisions

To comply with the Commission's Order, the CAISO proposes to include a new tariff provision, Section 4.6.11, specific to storage resources and their operating characteristics.⁸ The CAISO also proposes to revise and expand Section 27.9 of the CAISO tariff to expressly capture the operating characteristics storage resources can include as CAISO Master File parameters.⁹ Of the ten parameters in the Compliance Order, the CAISO accounts for eight as Master File parameters: maximum/minimum state of charge, maximum charge limit, maximum discharge limit, maximum/minimum charge time, and

³ Compliance Order at P 99.

⁴ Scheduling coordinators can propose changes to update their Master File parameters at any time. The CAISO reviews, approves, and incorporates all master file changes between five and eleven business days from submission. Section 30.7.3.2 of the CAISO tariff.

⁵ See Compliance Order at PP 86 *et seq.* (citing CAISO filings).

⁶ *Id.* at P 100.

⁷ *Id.*

⁸ Proposed Section 4.6.11 of the CAISO tariff.

⁹ Proposed Section 27.9 of the CAISO tariff.

maximum/minimum run time.¹⁰ The CAISO accounts for charge and discharge ramps rates as biddable parameters.

Section 4 of the CAISO tariff specifies the roles and responsibilities of the different entities that interact with the CAISO: scheduling coordinators; transmission owners; utility distribution companies; generating units, *etc.* The CAISO proposes to include a new Section 4.6.11 specific to storage resources.¹¹ This tariff provision will state that a scheduling coordinator for a storage resource participating as a Non-Generator Resource (“NGR”) or Pumped-Storage Hydro Unit must submit into the Master File the operational and technical constraints that accurately represent the resource’s design capabilities and constituent equipment when operating at maximum sustainable performance over Minimum Run Time, recognizing that resource performance may degrade over time. This language is modelled after the CAISO tariff’s existing Section 4.6.4 for generating units. Additionally, Section 4.6.11 provides that NGRs and Pumped-Storage Hydro Units may include among their Master File parameters the specific constraints listed in Section 27.9.

Currently, Section 27.9 states that the CAISO will observe NGRs’ energy constraints in the CAISO market processes. The CAISO proposes to expand this section in three ways consistent with the Compliance Order and Order No. 841. First, the CAISO proposes to include Pumped-Storage Hydro Units so this provision addresses both types of storage participation models.¹² Second, the CAISO proposes to include capacity constraints besides the energy constraints listed. Third, and most important, the CAISO proposes to enumerate the specific energy and capacity constraints NGRs and Pumped-Storage Hydro Units may include in the CAISO Master File (besides the Master File parameters available to all other Generating Units).¹³ For NGRs, these will include minimum and

¹⁰ Section 4.6.4 of the CAISO tariff requires each Generating Unit—which includes Non-Generator Resources (“NGRs”) and Pumped-Storage Hydro Units—to submit operational and technical constraints in the Master File that represent an accurate reflection of the design capabilities of the resource and its constituent equipment when operating at maximum sustainable performance over Minimum Run Time, recognizing that resource performance may degrade over time.

¹¹ Proposed Section 4.6.11. The CAISO uses “storage resources” as a generic term to include the growing list of technologies that can store energy for later resale, and because storage resources can participate in the CAISO markets under different models based upon their physical characteristics and their own elections. As the CAISO has explained in this proceeding, storage resources generally participate as NGRs, Pumped-Storage Hydro Units, Proxy Demand Resources, and Reliability Demand Response Resources. Storage resources are also encompassed by the definitions in Appendix A to the CAISO tariff of other terms, including Generator, Generating Facility, Generating Unit, Interconnection Customer, and Metered Entity, to name a few.

¹² Proposed Section 27.9 of the CAISO tariff.

¹³ *Id.*

maximum states of charge (in MWh),¹⁴ and minimum and maximum charge and discharge limits (in MW). For Pumped-Storage Hydro Units, these will include:

- a) minimum and maximum pumping and generating limits (in MW);
- b) pump minimum up time: minutes a pump must continue pumping;
- c) pump minimum down time: minutes a pump cannot return to pumping after shutting down;
- d) minimum on time: minutes Generating Unit must stay on before shut down or switch to pumping mode;
- e) gen-to-pump minimum down time: minutes after being de-committed from generation mode before able to be dispatched in pumping mode; and
- f) pump-to-gen minimum down time: minutes after being de-committed from pumping mode before able to be dispatched in generation mode.¹⁵

Capturing these Master File parameters in the CAISO tariff recognizes that the CAISO market optimization will respect the unique physical and operating characteristics different storage technologies may have. The CAISO notes these lists are neither exhaustive nor exclusive. The CAISO is enumerating these specific parameters to comply with Order No. 841; however, the Master File parameters available to CAISO resources are still available to storage resources using either model.¹⁶

Consistent with Order No. 841, the CAISO does not use a “one-size-fits-all” model for every storage technology.¹⁷ Because Pumped-Storage Hydro Units rely on gravity and the flow of water to generate energy or demand, they

¹⁴ As explained below, Pumped-Storage Hydro Units submit their MW capacity limits as Master File values, but they submit their daily MWh minimum and maximum limits as a biddable parameter. Where the state of charge limits are static for batteries using the NGR methodology, they are far more dynamic for hydroelectric facilities because the MWh limits depend on reservoir levels.

¹⁵ Proposed Section 27.9 of the CAISO tariff. Currently the section repeats similar language for each CAISO market process. The CAISO also proposes to consolidate these provisions into fewer sentences.

¹⁶ The CAISO’s Network and Resource Modeling website maintains a spreadsheet of all Resource Data Template/Master File definitions and each available option. <http://www.caiso.com/Documents/GRDTandIRDTDefinitions.xls>; see also Attachment B to the CAISO’s Business Practice Manual for Market Instruments, available at <https://bpmcm.caiso.com/Pages/BPMDetails.aspx?BPM=Market%20Instruments>.

¹⁷ See Order No. 841 at PP 51, 55.

have physical constraints on how quickly they can transition from “charging” to “discharging.” The CAISO accounts for these limitations in the Master File parameters described above. Battery technologies using the NGR model, on the other hand, can transition between charging and discharging near instantaneously. The CAISO has examined this issue in its Energy Storage and Distributed Energy Resources (“ESDER”) stakeholder initiative, and concluded that NGRs may manage their charging and discharging run times through the minimum and maximum continuous energy limit Master File parameters, the biddable state-of-charge parameters, and their bid curves.¹⁸ 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. 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.

This distinction between Pumped-Storage Hydro Units and NGRs follows the CAISO’s Master File requirements that information provided to the CAISO Master File accurately account for operational and technical constraints rather than economic targets.¹⁹ If future storage technologies must account for operational and technical constraints—such as minimum charge or discharge times—they can submit Master File parameters that account for them. The CAISO’s proposed Section 27.9 only enumerates the parameters the CAISO knows every Pumped-Storage Hydro Unit or NGR has. But the Master File parameters for other supply units are available to storage resources to the extent they represent operational constraints.²⁰

These proposed tariff revisions capture how the CAISO accounts for storage resources’ maximum/minimum state of charge, maximum charge limit, maximum discharge limit, maximum/minimum charge time, and maximum/minimum run time. The Commission should find that the CAISO’s proposed tariff revisions are just and reasonable and comply with Order No. 841.

¹⁸ Because NGRs submit a single bid curve, storage resources can represent their full economic range (both charging and discharging) in a single bid, which gives the resource the flexibility to participate as supply, demand, or both, through one bid. Compliance Order at P 88.

¹⁹ Section 4.6.4 of the CAISO tariff.

²⁰ The CAISO’s Network and Resource Modeling website maintains a spreadsheet of all Resource Data Template/Master File definitions and each available option. <http://www.caiso.com/market/Pages/NetworkandResourceModeling/Default.aspx>; <http://www.caiso.com/Documents/GRDTandIRDTDefinitions.xls>; see also Attachment B to the CAISO’s Business Practice Manual for Market Instruments, available at <https://bpmcm.caiso.com/Pages/BPMDetails.aspx?BPM=Market%20Instruments>.

C. Current Compliance with Requirement to Account for Ramp Rates

The Commission's Compliance Order and Order No. 841 also require the CAISO to account for storage resources' charge and discharge ramping rates.²¹ Section 30.5.2.3 of the CAISO tariff currently states that scheduling coordinators for Pumped-Storage Hydro Units may include Ramp Rates and Energy Limits when submitting Bids, besides the common elements for supply bids in Section 30.5.2.1 of the CAISO tariff and the other pump-specific bid elements in Section 30.5.2.3. Appendix A to the CAISO tariff defines "Ramp Rate" as "the Bid component that indicates the Operational Ramp Rate,²² Regulation Ramp Rate,²³ and Operating Reserve Ramp Rate²⁴ for a Generating Unit, and the Load drop rate and Load pick-up rate for Participating Loads, Reliability Demand Response Resources, and Proxy Demand Resources, for which the Scheduling Coordinator is submitting Energy Bids or Ancillary Services Bids." Scheduling coordinators for Pumped-Storage Hydro Units submit supply and demand Bids for the trading interval, and the CAISO's market optimization effectively processes them as one bid curve to determine the most economic dispatch, which also accounts for the corresponding ramp rates.²⁵ As such, scheduling coordinators for Pumped-Storage Hydro Units can include the load drop rate (for "charging") and operational ramp rate (for "discharging") in their bids. These biddable parameters are simply different terms for charging and discharging ramp rates, already captured in the CAISO tariff.

Additionally, Section 30.5.2.3 of the CAISO tariff allows scheduling coordinators for Pumped-Storage Hydro Units to submit Energy Limits as biddable parameters. 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." Because Pumped-Storage Hydro Units' MWh limits vary based on daily reservoir levels,

²¹ Compliance Order at P 100; Order No. 841 at PP 224, 229, 231.

²² Defined in Appendix A as "[a] staircase function of up to 4 segments (in addition to Ramp Rate segments needed for modeling Forbidden Operating Regions). Operational Ramp Rates are submitted with Energy Bid data."

²³ Defined in Appendix A as "[a] single number included in Ancillary Service Bids and Submissions to Self-Provide Ancillary Services for Regulation that represents the Ramp Rate of a resource used in the procurement of Regulation capacity."

²⁴ Defined in Appendix A as "[a] single number included in Ancillary Service Bids and Submissions to Self-Provide Ancillary Services for Spinning Reserve and Non-Spinning Reserve that represents the Ramp Rate of a resource used in the procurement of Operating Reserve capacity."

²⁵ See Compliance Order at P 12.

the CAISO optimizes their minimum and maximum states of “charge” on a daily basis based on bids. This allows Pumped-Storage Hydro Units to reflect their minimum and maximum states of charge in their bids.

For storage resources participating under the NGR model, Section 30.5.2.2 of the CAISO tariff states that scheduling coordinators for Participating Generators—which include NGRs²⁶—may include Energy Limits and Ramp Rates in their supply bids, besides the common elements for supply bids in Section 30.5.2.1 and the other generator-specific bid elements in Section 30.5.2.2. Because the NGR bid curve allows storage resources to represent their full economic range (both charging and discharging) in a single bid, their biddable Ramp Rates include the ramping rates and MWh state-of-charge limits for charging and discharging.²⁷

Sections 30.5.2.2 and 30.5.2.3 of the CAISO tariff thus allow storage resources to account for their ramp rates and minimum and maximum states of charge as biddable parameters in the CAISO markets. As a result, the Commission should find that the CAISO’s existing tariff provisions comply with the Compliance Order and Order No. 841.

II. Minimum Capacity Requirements

A. Background

The Compliance Order found that the CAISO’s tariff complies with Order No. 841’s requirement to allow storage resources as small as 100 kW in capacity to participate in the CAISO markets.²⁸ Additionally, the Commission directed the CAISO to revise its tariff to lower the minimum capacity requirement for storage

²⁶ See *id.* at PP 36, 40, 116. Executing a Participating Generator Agreement is a requirement for storage resources participating under the NGR model to participate in the CAISO markets. Appendix A to the CAISO tariff defines a Participating Generator as “[a] Generator or other seller of Energy or Ancillary Services through a Scheduling Coordinator over the CAISO Controlled Grid . . .” Appendix A defines a “Generator” as “[t]he seller of Energy or Ancillary Services produced by a Generating Unit.” Appendix A defines a “Generating Unit” as “[a]n individual electric generator and its associated plant and apparatus whose electrical output is capable of being separately identified and metered . . . capable of producing and delivering net Energy (Energy in excess of a generating station’s internal power requirements).” Appendix A defines a “Generating Facility” as “[a]n Interconnection Customer’s Generating Unit(s) used for the production and/or storage for later injection of electricity identified in the Interconnection Request, but shall not include the Interconnection Customer’s Interconnection Facilities.”

²⁷ Scheduling coordinators for NGRs may submit Energy Limits as biddable parameters if their daily minimum/maximum states of charge are different than their Master File values. If they do not, the CAISO market optimization will use the Master File values.

²⁸ Compliance Order at P 116.

resources to provide ancillary services from 500 kW to 100 kW.²⁹

B. Proposed Tariff Revisions

In compliance with the Commission's order, the CAISO proposes to revise its certification requirements to provide ancillary services. Each of the three ancillary services—regulation, spinning reserve, and non-spinning reserve—require a rated capacity of 500 kW or greater unless the resource is participating in an aggregation arrangement approved by the CAISO.³⁰ The CAISO proposes to include tariff provisions stating that storage resources 100 kW or greater also may be certified to provide regulation, spinning reserve, and non-spinning reserve.³¹ The Commission should find that the CAISO's tariff revisions are just and reasonable and comply with the Compliance Order and Order No. 841.

III. Metering and Accounting Practices

A. Background

The Compliance Order found that the CAISO complies with Order No. 841's requirement that electric storage resources be directly metered.³² However, the Commission found it unclear how the CAISO's metering and accounting practices allow for simultaneous participation in both retail and wholesale markets. The Compliance Order directed the CAISO to include tariff provisions to ensure that storage resources specifically pay the locational-marginal price for charging energy only, and do not "double-pay" due to retail billing.³³ Additionally, the Commission directed the CAISO to revise its tariff to expressly allow electric storage resources that provide retail services to also participate in the CAISO markets.³⁴ Finally, the Commission directed the CAISO to file tariff revisions providing that, if a host utility is unable or unwilling to net out any energy purchases associated with an electric storage resource's wholesale

²⁹ *Id.*

³⁰ Sections A.1.1.1, B.1.1, and C.1.1 of Appendix K to the CAISO tariff. The CAISO notes that there are a number of other certification requirements to provide ancillary services. See Appendix K to the CAISO tariff.

³¹ Proposed Sections A.1.1.1, B.1.1, and C.1.1 of Appendix K to the CAISO tariff. This would not exclude storage resources' ability to participate in an approved aggregation arrangement. In any case, storage resources still must meet all other certification requirements in Appendix K. The CAISO purposely has avoided using any defined term for "storage resources" to avoid excluding any current or future storage technology.

³² Compliance Order at P 159.

³³ *Id.* at P 160.

³⁴ *Id.* at P 162.

charging activities from the host customer's retail bill, then the CAISO would be prevented from charging that resource wholesale rates for the charging energy for which it is already paying retail rates.³⁵

B. Proposed Tariff Revisions

In compliance with the Commission's order, the CAISO proposes to include a new tariff section describing the metering and accounting rules for storage resources.³⁶ This new section will have several provisions to comply with Order No. 841. First, the CAISO proposes to include a general statement that storage resources may elect to provide the CAISO with meter data as either a CAISO Metered Entity or a Scheduling Coordinator Metered Entity.³⁷ CAISO Metered Entities have meters directly polled by the CAISO, and the CAISO performs the validation, estimation, and editing procedures to produce settlement quality meter data. Scheduling Coordinator Metered Entities have meters directly polled by the scheduling coordinator, and the scheduling coordinator performs the validation, estimation, and editing before providing the CAISO with the settlement quality meter data.

The CAISO affords storage resources the flexibility to elect how they would like to be metered because there are advantages to being a CAISO Metered Entity or a Scheduling Coordinator Metered Entity. These advantages depend on the complexity of the resource's configuration, its capital and ongoing financing needs, and its local regulatory standards. For storage resources electing to be CAISO Metered Entities, installing CAISO-approved meters and undergoing the certification process can represent significant costs to new resources, particularly smaller resources.³⁸ However, CAISO Metered Entities can mitigate initial upfront costs by avoiding the ongoing costs associated with meter data collection, validation, estimation, editing, and submission to the CAISO. For variable energy resources that are CAISO Metered Entities, the CAISO also reports output to the Western Electricity Coordinating Council ("WECC") for those resources' renewable energy certificate requirements, which saves the resources the cost of doing the reporting themselves. In addition, CAISO Metered Entities can avoid rules of conduct penalties for late or inaccurate meter data (because the CAISO polls the meters instantaneously).³⁹ On the other hand, Scheduling Coordinator Metered Entities must comply with

³⁵ *Id.* at P 164.

³⁶ Proposed Section 10.1.3.4 of the CAISO tariff.

³⁷ *Id.* As stated above, here the CAISO purposely has avoided using any defined term for "storage resources" to avoid excluding any current or future storage technology.

³⁸ See Section 10.2 of the CAISO tariff.

³⁹ See Section 37.5.2 of the CAISO tariff.

several initial and ongoing requirements to ensure that their meters and their processing procedures comply with CAISO tariff requirements.⁴⁰ However, they avoid the initial relatively higher programming, inspecting, and sealing costs. And, importantly, Scheduling Coordinator Metered Entities may propose unique, complex metering configurations for CAISO review and approval.⁴¹ This can especially benefit storage resources participating in retail programs because it allows the scheduling coordinator to parse multiple meters and remove any retail data from what it submits to the CAISO. The CAISO notes these elections follow the CAISO's existing practices for all resources.⁴² The CAISO explained these practices in detail in its Metering Rules Enhancement filing in 2017,⁴³ which the Commission accepted as just and reasonable.⁴⁴

To avoid double-billing for wholesale and retail activities, the CAISO proposes to include tariff provisions stating that (a) CAISO Metered Entities' revenue quality meters must be installed and programmed to exclude any retail meter data, and (b) Scheduling Coordinator Metered Entities must describe to the CAISO how their metering arrangement or validation, estimation, and editing procedure prevents commingling retail and CAISO meter data.⁴⁵ This requirement will ensure that each storage resource separates its wholesale and retail meter data, and that the CAISO has reviewed and verified its method of doing so. Purposely, the CAISO has not proposed to include tariff requirements stating *how* storage resources must avoid commingling wholesale and retail meter data. Instead, the CAISO tariff states the market rule that requires separation of a storage resource's wholesale and retail meter data. Storage resources—especially those that may participate in retail and wholesale markets simultaneously—have highly variable metering needs, local regulatory

⁴⁰ See Section 10.3 of the CAISO tariff. For example, Scheduling Coordinator Metered Entities must submit an initial "SQMD Plan" describing their metering configuration, programming, validation, and testing. Section 10.3.7.1 of the CAISO tariff. Additionally, they must submit an annual affirmation that they remain in compliance, and must audit and test their compliance at least every two years, and be subject to spot audits by the CAISO. Section 10.3.10 of the CAISO tariff.

⁴¹ Section 10.3.7.1 of the CAISO tariff. CAISO Metered Entities' options for highly complex arrangements are limited because the complexities would have to be addressed in the programming of the meters rather than through the validation, estimation, and editing.

⁴² See Section 10.1 of the CAISO tariff.

⁴³ *California Independent System Operator Corp.*, Metering Rules Enhancements, Docket No. ER17-949-000 (Feb. 8, 2017), available at http://www.caiso.com/Documents/Feb8_2017_TariffAmendment-MeteringRulesEnhancements_ER17-949.pdf.

⁴⁴ *California Independent System Operator Corp.*, Letter Order, Docket No. ER17-949-000 (Mar. 31, 2017); *California Independent System Operator Corp.*, Letter Order, Docket No. ER17-949-001 (Dec. 15, 2017).

⁴⁵ Proposed Section 10.1.3.4 of the CAISO tariff.

requirements, and configurations. By including simple, flexible tariff provisions, the CAISO will avoid a one-size-fits-few approach, and instead be able to review each storage resource's proposal to ensure the CAISO receives settlement quality meter data for wholesale charges only.

The CAISO also proposes to include an express tariff provision stating that nothing in this new tariff section should be interpreted as prohibiting a CAISO storage resource's ability to participate in retail markets.⁴⁶ Likewise, the CAISO proposes to reiterate in the tariff that, although storage resources must exclude retail meter data from their CAISO settlement quality meter data, they may continue to net their Station Power from their output under the CAISO tariff and local regulatory authority requirements.⁴⁷ The CAISO explained its netting rules for storage resources' Station Power in detail in its ESDER Phase Two filing,⁴⁸ which the Commission accepted in 2018.⁴⁹ These netting provisions allow storage resources to net Station Power load from their charging or discharging, as allowed by their local regulatory authority, to avoid retail settlement of Station Power load.⁵⁰

To avoid any gaming of dual-markets participation, the CAISO also proposes to include a tariff provision stating that storage resources participating in the CAISO markets may not charge their resources except to provide energy or ancillary services to the CAISO markets upon discharge.⁵¹ The CAISO is concerned that storage resources participating in both retail and CAISO markets may charge their resource at a CAISO locational-marginal price, but then seek to discharge at a much higher retail rate. Doing so would mean that the storage resource's charging was not part of a sale for resale, and therefore should not have been subject to a wholesale rate.

Finally, the CAISO proposes to include a provision stating that, beginning

⁴⁶ *Id.*

⁴⁷ *Id.*

⁴⁸ *California Independent System Operator Corp.*, ESDER Phase Two filing, Docket No. ER18-2242-000 (Aug. 17, 2018), available at http://www.aiso.com/Documents/Aug17_2018_TariffAmendment-EnergyStorage_DistributedEnergyResourcesPhase2Enhancements_ER18-2242.pdf.

⁴⁹ *California Independent System Operator Corp.*, Letter Order approving tariff revisions, Docket No. ER18-2242-000 (October 24, 2018).

⁵⁰ Where allowed by the local regulatory authority, the CAISO does not consider Station Power load retail, but a sale for resale under the Federal Power Act, and therefore wholesale. As such, including Station Power load in its settlement quality meter data does not conflict with the CAISO's requirement to exclude retail meter data from CAISO settlement.

⁵¹ Proposed Section 10.1.3.4 of the CAISO tariff.

October 1, 2020, for any NGR where the utility distribution company or retail utility verifies in writing to the CAISO⁵² that it is unable or unwilling to net out from its retail billing any energy purchases associated with the NGR's charging pursuant to CAISO settlement, the CAISO will not settle the NGR's negative Energy⁵³ for charging.⁵⁴ This provision will ensure that storage resources billed at retail rates for wholesale charging activities are not also billed by the CAISO for the same energy, consistent with Order No. 841. To avoid metering and settlement discrepancies and to monitor how much storage resources rely on this treatment, the CAISO proposes to include clarifying tariff language requiring the scheduling coordinators for these NGRs to continue to report to the CAISO all meter data, including meter data for charging, rather than zeroing out that meter data itself before submitting it to the CAISO.⁵⁵ In other words, these NGRs will continue to submit their meter data consistent with tariff requirements, and the CAISO will zero out their charges for charging through the CAISO's settlement software.

Because this service will require new market software to identify such resources and then zero out their settlements for charging, the CAISO must develop and test the software before implementation. The CAISO proposes to do so as early as possible with its Fall 2020 software release, October 1, 2020.⁵⁶ The CAISO does not believe this delay will prejudice any party or hinder any storage resources' market participation.

Collectively, these tariff revisions will ensure that storage resources will have the flexibility and technology to avoid double-billing for retail and wholesale participation, and that storage resources maintain metering and accounting practices consistent with other supply resources. The Commission should find that the CAISO's tariff revisions are just and reasonable and comply with the Compliance Order and Order No. 841.

⁵² Order No. 841-A clarified that ISO/RTOs may request verification from the host distribution utility. Order No. 841-A at P 326; Compliance Order at P 141.

⁵³ As the CAISO has explained in this proceeding, NGRs' charging and discharging presents to the CAISO as negative and positive Energy, rather than Demand. Under this tariff provision, NGRs would have their settlements set to \$0 for settlement intervals below 0 MWh.

⁵⁴ Proposed Section 10.1.3.4 of the CAISO tariff.

⁵⁵ *Id.*

⁵⁶ The CAISO has included this date for this provision in the tariff itself so that the Commission may approve the tariff provisions effective December 3, 2019 (*i.e.*, the same effective date specified in the Compliance Order), rather than having different effective dates for different provisions.

IV. Effective Date

The CAISO requests that the Commission accept the tariff revisions contained in this compliance filing effective as of the same date that the Commission granted for the tariff revisions contained in the CAISO's initial compliance filing in this proceeding, *i.e.*, December 3, 2019.

V. Communications

Under Rule 203(b)(3) of the Commission's Rules of Practice and Procedure,⁵⁷ the CAISO requests that all correspondence, pleadings, and other communications regarding this filing should be directed to following:

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General Counsel
Sidney L. Mannheim
Assistant General Counsel
William H. Weaver
Senior Counsel
California Independent System
Operator Corporation
250 Outcropping Way
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VI. Service

The CAISO has served copies of this filing on the California Public Utilities Commission, the California Energy Commission, all parties with scheduling coordinator agreements under the CAISO tariff, and all parties in this proceeding (Docket No. ER19-468). In addition, the CAISO has posted a copy of the filing on the CAISO website.

VII. Contents of Filing

Besides this transmittal letter, this compliance filing includes these attachments:

Attachment A	Clean CAISO tariff sheets incorporating this compliance filing; and
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⁵⁷ 18 C.F.R. § 385.203(b)(3).

Attachment B Red-lined document showing the revisions in this
compliance filing.

VIII. Conclusion

The CAISO participation models provide significant flexibility for storage resources, and account for their unique technical operational characteristics and metering needs. For the reasons explained herein, the CAISO tariff, as modified by this compliance filing, satisfies the requirements of the Compliance Order and Order No. 841. The CAISO requests that the Commission accept this compliance filing effective December 3, 2019.

Respectfully submitted,

/s/ William H. Weaver

Roger E. Collanton
General Counsel
Sidney L. Mannheim
Assistant General Counsel
William H. Weaver
Senior Counsel

Counsel for the California Independent
System Operator Corporation

Attachment A – Clean Tariff

Order No. 841 Compliance Filing

California Independent System Operator Corporation

January 21, 2020

4.6.11 Storage Operating Characteristics

Pursuant to Section 4.6.4, a Scheduling Coordinator for a storage resource participating as a Non-Generator Resource or Pumped-Storage Hydro Unit must submit to the CAISO the operational and technical constraints to the Master File representing an accurate reflection of the resource's design capabilities and its constituent equipment when operating at maximum sustainable performance over Minimum Run Time, recognizing that resource performance may degrade over time. Non-Generator Resources and Pumped-Storage Hydro Units may include among their Master File parameters the constraints listed in Section 27.9 to the extent they comply with this Section.

...

10.1.3.4 Storage Resources

Pursuant to Section 10.1, storage resources must provide 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. Storage resources participating in the CAISO markets may not charge their resources pursuant to a CAISO wholesale rate except to provide Energy or Ancillary Services to the CAISO Markets upon discharge. To ensure that storage resources do not incur wholesale charges from the CAISO duplicative of any retail charges:

- (a) CAISO Metered Entities' revenue quality meters must be installed and programmed to exclude any retail Meter Data.

- (b) Scheduling Coordinator Metered Entities' SQMD Plans must describe how the Metered Entity's metering arrangement or Validation, Estimation, and Editing procedure prevents commingling retail and CAISO Meter Data.

Nothing in this Section 10.1.3.4 should be interpreted as prohibiting a CAISO storage resource's ability to participate in retail markets or net its Station Power from output pursuant to Section 10.1.3.2.

Effective October 1, 2020, for any Non-Generator Resource where the Utility Distribution Company or retail utility verifies in writing to the CAISO that it is unable or unwilling to net out from its retail billing any energy purchases associated with the Non-Generator Resource's charging pursuant to CAISO settlement, the CAISO will not settle the Non-Generator Resource's negative Energy for charging. Scheduling Coordinators for such a Non-Generator Resource must still include negative Energy for charging in the Non-Generator Resource's Meter Data.

...

27.9 Non-Generator Resource and Pumped-Storage Hydro Unit

Constraints

Scheduling Coordinators may elect to provide the CAISO with Non-Generator Resources' and Pumped-Storage Hydro Units' MWh constraints. In such cases, the CAISO will observe MWh constraints in the IFM, RUC, Real-Time Unit Commitment, and FMM as part of the co-optimization except for Non-Generator Resources using Regulation Energy Management. The CAISO will observe

MWh constraints in Real-Time Dispatch, including constraints of resources using Regulatory Energy Management.

Consistent with Section 4.6.11 and in addition to Master File parameters available to Generating Units, Scheduling Coordinators for Non-Generator Resources with physical operating constraints may include in the Master File:

- (a) continuous energy limits: minimum and maximum states of charge in MWh values; and
- (b) generation capacity limits: minimum and maximum charge and discharge limits in MW.

Consistent with Section 4.6.11 and in addition to Master File parameters available to Generating Units, Scheduling Coordinators for Pumped-Storage Hydro Units with physical operating constraints may include in the Master File:

- (a) generation capacity limits: minimum and maximum pumping and generating limits in MW;
- (b) pump minimum up time: minutes a pump must continue pumping;
- (c) pump minimum down time: minutes a pump cannot return to pumping after shutting down;
- (d) minimum on time: minutes Generating Unit must stay on before shut down or switch to pumping mode;
- (e) gen-to-pump minimum down time: minutes after being de-committed from generation mode before able to be dispatched in pumping mode; and

- (f) pump-to-gen minimum down time: minutes after being de-committed from pumping mode before able to be dispatched in generation mode.

...

Appendix K

A 1.1.1 the rated capacity of the resource must be 500 KW or greater (i.e. the resource must be capable of providing at least 500 KW of Regulation) unless the resource is participating in an aggregation arrangement approved by the CAISO, or is a storage resource 100 KW or greater;

...

B 1.1 the rated capacity of the resource must be 500 KW or greater (i.e. the resource must be capable of providing at least 500 KW of Spinning Reserve) unless the resource is participating in an aggregation arrangement approved by the CAISO, or is a storage resource 100 KW or greater;

...

C 1.1 the rated capacity of the resource must be 500 KW or greater (i.e. the resource must be capable of providing at least 500 KW of Non-Spinning Reserve) unless the resource is participating in an aggregation arrangement approved by the CAISO, or is a storage resource 100 KW or greater;

Attachment B – Marked Tariff
Order No. 841 Compliance Filing
California Independent System Operator Corporation
January 21, 2020

4.6.11 Storage Operating Characteristics

Pursuant to Section 4.6.4, a Scheduling Coordinator for a storage resource participating as a Non-Generator Resource or Pumped-Storage Hydro Unit must submit to the CAISO the operational and technical constraints to the Master File representing an accurate reflection of the resource's design capabilities and its constituent equipment when operating at maximum sustainable performance over Minimum Run Time, recognizing that resource performance may degrade over time. Non-Generator Resources and Pumped-Storage Hydro Units may include among their Master File parameters the constraints listed in Section 27.9 to the extent they comply with this Section.

...

10.1.3.4 Storage Resources

Pursuant to Section 10.1, storage resources must provide 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. Storage resources participating in the CAISO markets may not charge their resources pursuant to a CAISO wholesale rate except to provide Energy or Ancillary Services to the CAISO Markets upon discharge. To ensure that storage resources do not incur wholesale charges from the CAISO duplicative of any retail charges:

- (a) CAISO Metered Entities' revenue quality meters must be installed and programmed to exclude any retail Meter Data.

(b) Scheduling Coordinator Metered Entities' SQMD Plans must describe how the Metered Entity's metering arrangement or Validation, Estimation, and Editing procedure prevents commingling retail and CAISO Meter Data.

Nothing in this Section 10.1.3.4 should be interpreted as prohibiting a CAISO storage resource's ability to participate in retail markets or net its Station Power from output pursuant to Section 10.1.3.2.

Effective October 1, 2020, for any Non-Generator Resource where the Utility Distribution Company or retail utility verifies in writing to the CAISO that it is unable or unwilling to net out from its retail billing any energy purchases associated with the Non-Generator Resource's charging pursuant to CAISO settlement, the CAISO will not settle the Non-Generator Resource's negative Energy for charging. Scheduling Coordinators for such a Non-Generator Resource must still include negative Energy for charging in the Non-Generator Resource's Meter Data.

...

27.9 Non-Generator Resource and Pumped-Storage Hydro Units MWh Constraints

Scheduling Coordinators may elect to provide the CAISO with Non-Generator Resources' and Pumped-Storage Hydro Units' MWh constraints. In such cases, the CAISO will observe ~~Non-Generator Resources'~~ MWh constraints in the IFM, RUC, Real-Time Unit Commitment, and FMM as part of the co-optimization ~~unless-except for Non-Generator Resources the resources are~~ using Regulation

Energy Management. ~~The CAISO will observe Non-Generator Resources' MWh constraints in RUC as part of the co-optimization unless the resources are using Regulation Energy Management. The CAISO will observe Non-Generator Resources' MWh constraints in Real-Time Unit Commitment and FMM as part of the co-optimization unless the resources are using Regulation Energy Management.~~ The CAISO will observe **Non-Generator Resources' MWh** constraints in Real-Time Dispatch, including constraints of resources using Regulatory Energy Management.

Consistent with Section 4.6.11 and in addition to Master File parameters available to Generating Units, Scheduling Coordinators for Non-Generator Resources with physical operating constraints may include in the Master File:

- (a) continuous energy limits: minimum and maximum states of charge in MWh values; and
- (b) generation capacity limits: minimum and maximum charge and discharge limits in MW.

Consistent with Section 4.6.11 and in addition to Master File parameters available to Generating Units, Scheduling Coordinators for Pumped-Storage Hydro Units with physical operating constraints may include in the Master File:

- (a) generation capacity limits: minimum and maximum pumping and generating limits in MW;
- (b) pump minimum up time: minutes a pump must continue pumping;
- (c) pump minimum down time: minutes a pump cannot return to pumping after shutting down;

(d) minimum on time: minutes Generating Unit must stay on before shut down or switch to pumping mode;

(e) gen-to-pump minimum down time: minutes after being de-committed from generation mode before able to be dispatched in pumping mode; and

(f) pump-to-gen minimum down time: minutes after being de-committed from pumping mode before able to be dispatched in generation mode.

...

Appendix K

A 1.1.1 the rated capacity of the resource must be 500 KW or greater (i.e. the resource must be capable of providing at least 500 KW of Regulation) unless the resource is participating in an aggregation arrangement approved by the CAISO, or is a storage resource 100 KW or greater;

...

B 1.1 the rated capacity of the resource must be 500 KW or greater (i.e. the resource must be capable of providing at least 500 KW of Spinning Reserve) unless the resource is participating in an aggregation arrangement approved by the CAISO, or is a storage resource 100 KW or greater;

...

C 1.1 the rated capacity of the resource must be 500 KW or greater (i.e. the resource must be capable of providing at least 500 KW of Non-Spinning

Reserve) unless the resource is participating in an aggregation
arrangement approved by the CAISO, or is a storage resource 100 KW or
greater;