

**UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION**

Electric Storage Participation in)
Markets Operated by Regional)
Transmission Organizations and)
Independent System Operators)
_____)

Docket Nos. RM16-23; AD16-20

**COMMENTS OF
THE CALIFORNIA INDEPENDENT SYSTEM OPERATOR CORPORATION**

The California Independent System Operator Corporation (CAISO) submits these comments on the Commission's notice of proposed rulemaking (NOPR) to remove barriers to the participation of electric storage resources and distributed energy resource aggregations in the capacity, energy, and ancillary service markets operated by regional transmission organizations (RTO) and independent system operators (ISO). The CAISO generally supports the Commission's proposed reforms.

With its stakeholders, the CAISO has developed and continues to enhance participation models for energy storage resources and distributed energy resource aggregations. The non-generator resource model and other market participation models support electric storage resource participation in CAISO markets.¹ Likewise, the CAISO's distributed energy resource provider framework, which the Commission accepted in 2016, formalizes the distributed energy resource provider as a CAISO

¹ *Cal. Indep. Sys. Operator Corp.*, 137 FERC ¶ 61,165 (2011) (implementing non-generator resource model).

market participant and provides an effective model for aggregations of distributed energy resources to participate in the CAISO's market.²

Any final rule in this proceeding should allow the CAISO and its stakeholders to continue to fashion these market participation models in a manner that accommodates both market participants' business use cases and reliable operation of the CAISO system and electric distribution systems served by the CAISO system. By their very nature, market participation models will have certain rules that some parties believe constitute barriers. For purposes of this rulemaking, the Commission must first assess whether any market participation rule addresses a legitimate operational concern. A rule that addresses a legitimate operational concern does not constitute an unreasonable "barrier".

In these comments, the CAISO addresses specific areas of the Commission's proposal and identifies its efforts and processes that allow electric storage resources and distributed energy resource aggregations to participate in the CAISO markets safely and reliably. As part of any final rule it adopts, the Commission should allow RTO/ISOs flexibility to develop specific design elements of market participation models for electric storage resources and distributed energy resource aggregations that best align with their stakeholders' business models and support reliable operation of their respective systems. The CAISO also discusses the importance of coordination between the transmission system operator and distribution utilities in a system with high levels of distributed energy resources and the possible roles and responsibilities of distribution system operators in connection with this grid evolution.

² *Cal. Indep. Sys. Operator Corp*, 155 FERC ¶ 61,229 (2016)

I. Electric storage resources should be able to participate in RTO/ISO markets in a manner that recognizes their physical and operational characteristics

In its NOPR, the Commission proposes to require each RTO/ISO to revise its tariff to include a participation model consisting of market rules that, recognizing the physical and operational characteristics of electric storage resources, accommodates their participation in organized wholesale electric markets.³ The CAISO supports the direction of this proposal. If an electric storage resource can meet technical capabilities required to provide an existing wholesale electric service, there is no reason to exclude these resources from wholesale electric market participation.

The Commission proposes that a model for electric storage to participate in wholesale electric markets must satisfy the following minimum criteria:

- a. Electric storage resources must be eligible to provide all capacity, energy, and ancillary services that they are technically capable of providing in the organized wholesale electric markets;
- b. The bidding parameters incorporated in the participation model must reflect and account for the physical and operational characteristics of electric storage resources;
- c. Electric storage resources can be dispatched and can set the wholesale market clearing price as both a wholesale seller and a wholesale buyer consistent with existing rules that govern when a resource can set the wholesale price;
- d. The minimum size requirement for electric storage resources to participate in the organized wholesale electric markets must not exceed 100 kW; and
- e. The sale of energy from the organized wholesale electric markets to an electric storage resource that the resource then resells back to those markets must be at the wholesale LMP.⁴

³ NOPR at P 26.

⁴ NOPR at P 28.

The CAISO generally supports these minimum criteria for electric storage resources to participate in organized markets. However, as discussed below, the CAISO does not support every aspect of the Commission's proposal. The Commission should recognize that RTO/ISOs have unique market designs and transmission systems, and therefore they need flexibility to fashion rules and evolve the frameworks for market participation by electric storage resources and aggregations of distributed energy resources.

In its NOPR, the Commission proposes to require each RTO/ISO to identify in its tariff the criteria for resources to use an electric storage participation model.⁵ The Commission states the criteria cannot limit participation of any type of electric storage device or other technology and must ensure the RTO/ISO can dispatch the resource in a way that recognizes its physical constraints and optimizes its benefits. At the same time, the Commission is not proposing to specify the qualification criteria that each RTO/ISO must adopt.

The CAISO supports this approach. Under the CAISO's tariff, electric storage resources can qualify as sellers in the CAISO energy and ancillary service markets. Electric storage resources may use a variety of participation models depending on their physical characteristics and how they wish to participate in the CAISO markets. Generally, electric storage resources participate in the CAISO markets as non-generator resources, pumped storage hydro units, or as one of the CAISO's two demand response entities, *i.e.*, proxy demand resources or reliability demand response resources. Electric storage resources connected to the distribution system within the

⁵ NOPR at P 29.

CAISO's balancing authority area may also participate in CAISO markets through a distributed energy resource aggregation⁶ or as a participating generator through a wholesale distribution access tariff.

The Commission also proposes that RTO/ISOs should specify in their tariffs: (1) whether resources that qualify to use the participation model for electric storage resources will participate in the organized wholesale electric markets through existing or new market participation agreements; and (2) whether particular existing market rules apply to resources participating under the electric storage resource participation model.⁷ The CAISO supports this proposal. Under its current electric storage market participation model, the CAISO requires electric storage resources to enter into relevant market participation agreements. The CAISO also agrees that RTO/ISOs should clarify how existing market rules apply to electric storage resource in their tariffs.

A. Electric storage resources should be eligible to provide all services for which they are technically capable but should operate under rules comparable to other resources

The Commission proposes that electric storage resources should be able, as part of the participation model, to be eligible to provide services that the RTOs/ISOs do not procure through a market mechanism, such as blackstart, primary frequency response, and reactive power, if they are technically capable. Electric storage resources

⁶ In its NOPR, the Commission cites comments filed by NextEra that state every RTO/ISO prohibits behind-the-meter resources from having net injections to the grid. (NOPR at P 13 fn 30.) This is incorrect. The CAISO does not prohibit behind the meter resources from having net injection to the grid. The ability of a behind the meter resource to have a net injection to the grid depends on whether the resource's interconnection allows it to deliver power to the grid and whether the resource is operating as part of a demand response model or other market participation model.

⁷ NOPR at P 31.

participating in the CAISO's market have the opportunity to provide energy and ancillary services if they meet the technical criteria to do so. These resources also are eligible to provide services that the CAISO may procure outside of its market processes. For example, the CAISO tariff does not preclude electric storage resources from providing services under a reliability must run contract or a black start agreement, so long as the electric storage resource is the resource identified to provide the applicable service under those agreements.

The Commission also proposes to require each RTO/ISO to clarify that an electric storage resource may de-rate its capacity to meet minimum run-time requirements to provide capacity or other services. The Commission states this proposed requirement will help ensure that electric storage resources are able to provide all services that they are technically capable of providing by accommodating their physical and operational characteristics, while still maintaining the quality and reliability of services they seek to provide.⁸ The Commission should not require any specific outage rules for electric storage resources. The general outage management rules applicable to resources in individual RTO/ISO markets should also apply to electric storage resources.

In its NOPR, the Commission states that a market participant's eligibility to provide a particular reserve service should not be conditioned on requirements that were designed for synchronous generators, specifically the requirement to be online and synchronized to the grid to be eligible to provide ancillary services.⁹ The

⁸ NOPR at P 49.

⁹ NOPR at P 50.

Commission states that participation in ancillary service markets should be based on a resource's ability to provide services when it is called upon rather than on the real-time operating status of the resource. The CAISO agrees and has already modified its technical requirements to facilitate the participation of non-generator resources in its ancillary services market.¹⁰ Of importance, however, the CAISO revised these requirements in order to apply them generically to *all* resources. The CAISO did not adopt specific rules for electric storage resources.¹¹ Any final rule in this proceeding should acknowledge that RTOs/ISOs should apply comparable technical and operational requirements to all resources, including electric storage resources. To the extent the Commission believes RTOs/ISOs should revise the technical and operational requirements to provide ancillary services, it should open a separate rulemaking.

In this regard, the Commission should not adopt any rules specific to electric storage resource or other resources that would exempt them from submitting an energy schedule to provide ancillary services, or from other standard market participation rules.¹² Creating new rules for a specific class of resources will constrain the ability of an RTO/ISO to achieve an optimal dispatch of resources and likely result in undue advantages. In the CAISO's markets, resources certificated to provide spinning reserve or non-spinning reserves can self-provide or bid these services as contingency only,

¹⁰ *California Indep. System Operator Corp.* 132 FERC ¶ 61,211 (2010).

¹¹ The CAISO did adopt separate requirements for resources seeking to provide spinning reserve that are not equipped with a governor, but these requirements serve to ensure that these resources are responsive to frequency disturbances in manner similar to resources that are equipped with a governor.

¹² In its NOPR, FERC seeks comment on whether dispatch and pricing of energy and ancillary services would continue to be internally consistent if a resource were not required to offer to provide energy in order to offer to provide ancillary services. NOPR at PP 50-51.

which means the CAISO will not dispatch the resource except in the event of the occurrence of an unplanned outage, a contingency or an imminent or actual system emergency.¹³ However, the CAISO needs the resource to submit an energy bid for purposes of its real-time contingency dispatch. This bid allows the CAISO to assess the optimal dispatch of resources offering contingency reserves when the CAISO needs to dispatch these reserves. The Commission has not identified a sufficient rationale for why RTOs/ISOs should modify their existing practices.

The Commission also seeks comments on whether and to what extent the Commission-approved NERC Glossary of Terms and associated Reliability Standards or regional reliability requirements may create barriers to the participation of electric storage resources or other non-synchronous technologies in the organized wholesale electric markets.¹⁴ At this time, the CAISO does not believe that NERC or regional reliability standards present a barrier to electric storage resources providing energy and ancillary services in wholesale electric markets. In the CAISO's markets, all resources that meet applicable technical criteria can provide spinning and non-spinning reserve. RTO/ISO tariffs should provide the specifications for these wholesale services to operate consistent with NERC and regional reliability standards. To the extent there is a conflict between a reliability standard and an RTO/ISO tariff, a process exists to resolve that conflict.¹⁵ The Commission should rely on this process.

¹³ See e.g. CAISO tariff sections 30.5.2.7.2; 30.5.2.7.3.

¹⁴ NOPR at 52.

¹⁵ Section 215(d)(6) of the Federal Power Act, provides a procedure to resolve conflicts between reliability standards and any RTO/ISO function, rule, or tariff provisions, affirming that such function, rule, or tariff provision must remain in place until the Commission finds that a conflict exists and that it should

B. The CAISO agrees that RTOs/ISOs should adopt bidding parameters and other modeling rules for electric storage resources to recognize their physical and operational characteristics.

In its NOPR, the Commission proposes that the RTOs/ISOs establish state of charge, upper charge limit, lower charge limit, maximum energy charge rate, and maximum energy discharge rate as bidding parameters for the participation model for electric storage resources.¹⁶ The Commission states it expects that the state of charge would be telemetered in real time when the RTO/ISO is managing the state of charge, but the Commission does not propose any specific telemetry requirements. In addition, the Commission proposes that RTOs/ISOs use a maximum energy charge rate and maximum energy discharge rate to indicate how quickly the resource can receive electricity from or inject it back to the grid. The Commission preliminarily finds that these are the minimum bidding parameters necessary for RTOs/ISOs to effectively dispatch electric storage resources because they provide the RTOs/ISOs with the information about the physical and operational characteristics of electric storage resources that allow these resources to provide the services that they are technically capable of providing.¹⁷

The Commission's proposal appears to include references to bid parameters as well as other modeling information RTOs/ISOs may use to dispatch electric storage resources. In the CAISO's markets, resources submit operational information through a

be resolved by a change to either the applicable RTO or ISO tariff provision or reliability standard. 16 U.S.C. Section 824o.

¹⁶ NOPR at P 67.

¹⁷ NOPR at P 67.

resource data template that the CAISO includes in its Master File. This information is relatively static (e.g., maximum energy discharge rate) and informs the CAISO's market model.¹⁸ Resources also submit operational information through their bids. For example, under the CAISO's non-generator resource model, an electric storage device can manage its own state of charge by using biddable parameters.¹⁹ Finally, the CAISO uses telemetry (where applicable) to assess whether a resource has the capability to support a dispatch schedule. For instance, resources providing ancillary services must provide telemetry, which the CAISO will use to assess if the resource has available capacity to support an ancillary services award.

The CAISO generally agrees that a participation model for electric storage resources should include the parameters that should guide a resource's participation based on its physical constraints or desired operation. The Commission identifies minimum charge time, maximum charge time, minimum run time, and maximum run time as biddable parameters.²⁰ The CAISO does not agree that these parameters should necessarily be subject to bids or bid parameters/components *per se*. These parameters are physical characteristics of the resource. Other resources—such as pumped hydro—do not have the opportunity to change their physical operating characteristics through a bid. These are static values that can be updated if the physical operating characteristics of the resource change. Although the CAISO

¹⁸ See CAISO tariff section 30.7.3.2.

¹⁹ *California Indep. System Operator Corp.* 156 FERC ¶ 61,110 (2017) accepting CAISO tariff revisions to allow non-generator resources, which may include energy storage resources, to submit their state-of-charge as a bid parameter in the day-ahead market and self-manage their state of charge and energy limits.

²⁰ NOPR at P 68.

believes that RTOs/ISOs will need to understand these parameters to optimally dispatch electric storage resources, it is not necessary that the Commission direct that RTOs/ISOs make these parameters biddable; some may be biddable parameters, but others may be accounted for in other ways

The Commission proposes to require that the RTOs/ISOs allow electric storage resources to self-manage their state of charge and upper and lower charge limits. The Commission states an electric storage resource that opts to self-manage its state of charge and upper and lower charge limits would keep its state of charge at an optimal level through its own bidding strategy, rather than the RTO/ISO market processes ensuring that dispatch does not violate its physical constraints.²¹ The CAISO supports this proposal. As referenced above, the CAISO allows resources to submit state of charge as a bid parameter in the day-ahead market and self-manage their state of charge and energy limits. Critically, however, the CAISO also offers functionality called regulation energy management under which the CAISO itself can optimize the resource's state of charge.²² This functionality allows non-generator resources located within the CAISO balancing authority area to rely on energy from the real-time market to offer their full capacity as regulation consistent with continuous energy requirements for that service.²³ Where a resource uses the CAISO's regulation energy management functionality, the CAISO requires the resource owner to provide the CAISO with the

²¹ NOPR at P 68.

²² FERC requests comment on whether there are conditions under which an RTO/ISO should not allow an electric storage resource to manage its state of charge and upper and lower charge limits. NOPR at P 70.

²³ CAISO tariff section 8.4.1.2.

state of charge via telemetry in order for the CAISO to ensure the resource has sufficient energy from the real-time market to meet its regulation awards. To date, CAISO market participants have expressed appreciation for the flexibility to choose how to manage their resources. The CAISO thus urges the Commission to require RTOs/ISOs to *allow* state of charge as a biddable parameter, but not *require* state of charge as a biddable parameter in all cases.

To the extent the Commission decides to require that all physical operating parameters such as state of charge must be biddable, the CAISO believes it will require at least 24 months to design and incorporate these bidding parameters into its modeling and dispatch software.²⁴ This effort would require stakeholder discussions, market design work, and implementation testing. Perhaps more critically, these efforts would result in less flexibility for electric storage resource participation. The CAISO thus discourages the Commission from issuing any such directive as part of a final rule in this proceeding. Such a directive would be inconsistent with how the CAISO models other resources in its markets. Instead, the Commission should direct that RTOs/ISOs account for the physical operating constraints of resource in their market modeling and dispatch software and that the RTOs/ISOs explain how they do so.

C. Electric storage resources should have the ability to set wholesale locational marginal prices as both a seller and buyer.

The Commission proposes to require each RTO/ISO to revise its tariff to ensure that electric storage resources can be dispatched and can set the wholesale market

²⁴ FERC requests seeks comment on the time and resources that would be necessary for the RTOs/ISOs to incorporate these bidding parameters, including the optional bidding parameters, into their modeling and dispatch software. NOPR at P 71.

clearing price as both a wholesale seller and wholesale buyer consistent with existing rules that govern when a resource can set the wholesale price. The Commission, however, warns that these requirements cannot prohibit electric storage resources from participating in organized wholesale electric markets as price takers, consistent with the existing rules for self-scheduled load resources.²⁵ The CAISO concurs with the Commission's proposed direction. In the CAISO's markets, electric storage resources can set the marginal price of energy and ancillary services in the CAISO's markets based on their economic bids where they are the marginal resource.

The Commission also preliminarily concludes that electric storage resources should have the ability to participate as a supply resource and a demand resource simultaneously (i.e., submit bids to buy and offers to sell during the same market interval) to maximize the value that electric storage resources can provide, and allow market operators to identify whether it is more economic to dispatch an electric storage resource as supply or demand during a given market interval.²⁶ The Commission seeks comment on whether there should be a mechanism that identifies bids and offers coming from the same resource that ensures the price for the offer to sell is not lower than the price for the bid to buy during the same market interval so that an RTO/ISO does not accept both the offer and bid of a resource using the electric storage resource participation model for that interval.²⁷

²⁵ NOPR at P 81.

²⁶ NOPR at P 83.

²⁷ NOPR at P 83.

In the CAISO's markets, the non-generator resource participation model, which was designed with electric storage resources in mind, addresses this concern in the following manner. A non-generator resource may submit an economic bid similar to participating generators, namely, a monotonic, non-decreasing price curve for discrete energy segments. The distinction is that for a non-generator resource, the bid range of MW spans a negative to positive capacity range. For these economic bids, there would be just one bid curve that spans the negative MW (charging) to the positive MW (discharging) with monotonic increasing prices (just like a generator bid). As long as the market participation model allows for such bid curves, the CAISO does not believe two different bids to buy and sell energy are necessary for electric storage resources. In particular, the requirement for monotonic increasing prices ensures that the bid to buy price cannot exceed the offer to sell price. In addition, having separate buy and sell bids would add unnecessary complexity to the modeling of energy storage resources, because they would effectively require the RTO/ISO to model and dispatch an electric storage resource as two separate resources, one as a load and another as a generator. Thus the use of a single bid curve in the CAISO's non-generator resource model accommodates the capability of a storage resource to move between its charging and discharging modes.

The Commission also notes that resources using the proposed participation model for electric storage resources that elect to submit economic bids as a wholesale buyer and participate as dispatchable demand resources would still be able to self-

schedule their charging and be price takers.²⁸ However, it is also possible that the RTO/ISO could dispatch an electric storage resource as load when the wholesale price for energy is above the price of its bid to buy (a circumstance under which the resource would lose the opportunity to earn greater revenues as a supply resource). To help alleviate any potential financial risk to these resources when being dispatched as a demand resource, the Commission seeks comments on whether the proposed participation model for electric storage resources should allow make-whole payments when a resource participating under this participation model is dispatched as load and the price of energy is higher than the resource's bid price.²⁹ The CAISO understands this situation mirrors one in which a market operator dispatches a participating generator even though the resource's bid price is higher than the location marginal price for energy. In the CAISO's markets, this resource would be eligible to receive bid cost recovery so long as its market revenues do not exceed bid costs across the entire operating day.³⁰ In this respect, electric storage resources asked to charge and pay a locational marginal price for energy that is more than its bid price should also be eligible to receive bid cost recovery. These resource, however should be subject to the same bid cost recovery limits as all other resources, namely, their bid costs should be netted against market revenues across an entire operating day to determine if the resource should receive a make whole payment).

²⁸ NOPR at PP 81; 85.

²⁹ NOPR at P 85.

³⁰ See Section 11.8 of the CAISO tariff.

D. The Commission should not mandate a minimum size requirement for electric storage resources participating in wholesale markets.

In its NOPR, the Commission proposes that the minimum size requirement to participate in the organized wholesale electric markets under the proposed electric storage resource participation model must not exceed 100 kW. The CAISO does not support this proposal. For purposes of resource participation in the CAISO markets, the CAISO generally requires resources to have a capacity of at least 500 kW.³¹ Additionally, the minimum size requirement for all resources—including electric storage resources—to provide ancillary services in the CAISO’s markets is 500 kW.³² Importantly, however, the CAISO allows distributed energy resources below the 500kW requirement to aggregate with other resources to meet that size requirement as a distributed energy resource aggregation.³³ In addition, the CAISO allows demand response resources below 500 kW but above 100 kW to participate in the CAISO markets, but these resources cannot inject energy onto the system. Storage resources serving as demand response can provide load curtailment by discharging energy using the CAISO’s recently approved metering generator output baseline methodology.³⁴

³¹ See CAISO tariff sections 4.6.3.2; 4.13.5.2.2; and 4.17.5.1.

³² See CAISO tariff, Appendix K, Parts A 1.1.1 (regulation), B 1.1 (spinning reserve) and C 1.1 (non-spinning reserve).

³³ *Calif. Indep. Sys. Operator Corp.*, 155 FERC ¶ 61,229 (2016). The CAISO believes it would be extremely unlikely for a resource that is less than 500 KW to interconnect to the transmission system in light of the costs of necessary interconnection facilities.

³⁴ *Calif. Indep. Sys. Operator Corp.*, 156 FERC ¶ 61,110 (2016).

³⁵ The CAISO adopted this minimum size requirement for its “proxy demand resources” through a stakeholder initiative process that considered the trade-offs associated with entities seeking to participate as demand response providers, the need to model how curtailable demand affects congestion on the transmission system, and the processing demands on CAISO systems for a high number of smaller resources. For all resources, the CAISO allows bid/offer segments above the initial segment as low as 10 kW/kWh.

The Commission preliminarily concludes that requiring that the minimum size requirement not exceed 100 kW balances the benefits of increased competition with the ability of RTO/ISO market clearing software to effectively model and dispatch smaller resources often located on the distribution system. The Commission proposes to require each RTO/ISO to revise its tariffs to include a participation model for electric storage resources that establishes a minimum size requirement for participation in the organized wholesale electric markets that does not exceed 100 kW. This would include any minimum capacity requirements, minimum offer requirements, and minimum bid requirements for resources participating in these markets under the electric storage resource participation model.³⁶

The CAISO recommends that the Commission allow ISOs and RTOs the flexibility to set minimum size requirements up to 500 kW (0.5 MW) for installed capacity, up to 100 kW for the amount offered into the market and also for the first bid segment. Resources below these requirements could still participate in the wholesale

³⁵ See CAISO tariff section 4.13.5.2.1.

³⁶ NOPR at P 94.

markets through aggregation models or as demand response providers under a metering generator output methodology. Thus, for a storage resource of 500 kW or greater installed capacity, for any market interval in which the resource submits an offer to supply energy or ancillary service capacity or a bid to buy energy, the total amount of energy or capacity offered for sale or the amount of energy the resource bids to buy would need to be at least 100 kWh (energy) or 100 kW (ancillary service capacity), and the initial segment on its offer or bid curve would also have to be at least 100 kWh (energy) or 100 kW (ancillary service capacity). If the resource wishes to offer or bid beyond 100 kW/kWh, bid/offer segments above the initial segment must be at least 10 kW/kWh.

The CAISO's recommendation is consistent with the Commission's proposal, except for increasing the minimum installed capacity to 500 kW. Although the CAISO agrees with the Commission that its software could model and dispatch a resource of 100 kW capacity, the CAISO has concerns with the continued growth of distributed storage and other distributed resources on the system. Within a few years, the CAISO software could have to optimize many thousands of small resources. If the CAISO establishes a lower minimum size for storage, that lower minimum size would have to apply to all resources as well, so that storage devices would not be the only resource type to take advantage of the lower minimum size. Applying a 500 kW minimum capacity requirement for electric storage resources places these resources on the same level playing field with generating resources. The 500 kW minimum size for generating resources exists for good reason. The CAISO market software must clear congestion on the grid in conjunction with clearing the energy market. The CAISO is concerned

that clearing congestion with thousands of resources in the 100 kW range will reduce the efficiency and performance of market software that must provide for a peak load over 50 GW.

The Commission should not adopt a minimum size requirement for electric storage resources that is less than 500 kW. Instead, the Commission should direct RTOs/ISOs to explain how electric storage resources smaller than 500 KW may participate in RTO/ISO markets (such as through aggregation models or as demand response providers). To the extent that a business use case exists for electric storage resources sized at 100 kW to participate in wholesale markets, the record does not reflect that such a business use case exists.

E. RTO/ISOs should settle the use of energy to charge electric storage resources for later sale at wholesale locational marginal prices.

In its NOPR, the Commission cites authority proving that the sale of energy from the grid that is used to charge electric storage resources for later resale into the energy or ancillary service markets constitutes a sale for resale. The Commission proposes to require each RTO/ISO to revise its tariff to specify that the sale of energy from the organized wholesale electric markets to an electric storage resource that the resource then resells back to those markets must be at the wholesale LMP.³⁷ The CAISO supports this proposed directive.

In its NOPR, the Commission recognizes concerns that behind-the-meter electric storage resources should not be allowed to charge at a wholesale rate and discharge to serve a retail customer as a means for the retail customer to avoid paying the retail rate.

³⁷ NOPR at P 100.

The Commission seeks comments regarding whether RTO/ISO tariff need to establish metering and accounting practices to delineate between wholesale and retail activities.³⁸ In any final rule adopted in this proceeding, the Commission should ask RTO/ISO's to explain how their market rules account for wholesale and retail activities.

The CAISO's current market rules governing behind the meter resources effectively addresses these concerns. If a behind the meter resource participates under the CAISO's non-generator resource model and generates and consumes energy either as an individual resource or as part of a distributed energy resource aggregation, it must separately meter its output and consumption and report that meter data to the CAISO for settlement purposes in all settlement intervals. Whatever amount of energy the resource consumes or generates in each settlement interval will be settled at the wholesale price, either as instructed energy in response to a CAISO schedule or dispatch instruction, or as uninstructed energy if it deviates or has no schedule or instruction. Moreover, the behind the meter resource's meter data could serve as an adjustment to the end-use customer meter data to ensure that the meter data for retail settlement accurately reflects the actual end-use load.

Alternatively, if the behind the meter resource participates under the CAISO's proxy demand resource model, its only settlement with the CAISO is for intervals in which it has submitted a bid and received a schedule or dispatch instruction to effectively reduce load as a demand response resource by discharging energy. In other intervals the electric storage resource is not metered or settled in the CAISO settlement system. Thus, under the proxy demand resource model its energy consumption for

³⁸ NOPR at P 102.

charging is simply a portion of the end-use retail load and will be included in the end-use meter data and settled at the retail price. As the CAISO and other RTOs/ISOs explore multiple use cases in which a behind the meter resource participates as both a wholesale and retail resource, there will be a need for companion rules to account for whether a resource is engaged in a wholesale or retail activity. The Commission should permit RTOs/ISOs to develop those rules in collaboration with their stakeholders—especially the states with jurisdiction over retail sales—and not attempt to legislate them through this rulemaking. Such cross-jurisdictional disputes have mired participants in litigation in the past.³⁹

II. The CAISO supports adoption of a market participation model for aggregations of distributed energy resources.

The Commission proposes to require each RTO/ISO to establish distributed energy resource aggregations as a type of market participant, and then allow the distributed energy resource aggregations to register distributed energy resource aggregations under the participation model in the RTO/ISO tariff that best accommodates the physical and operational characteristics of the distributed energy resource aggregation.⁴⁰

Consistent with FERC's proposal, the CAISO's distributed energy resource provider participation model recognizes distributed energy resource aggregations as a new type of market resource that participates in the CAISO energy and ancillary

³⁹ See, e.g., *Southern California Edison Co. v. FERC*, 603 F.3d 996 (2010).

⁴⁰ NOPR at P 124.

services markets, similar to a generating facility.⁴¹ Under this model, the CAISO treats the aggregation, rather than the individual distributed energy resources, as the market resource. This new resource accommodates smaller distributed-connected generation and emerging resource types that may need a different model for wholesale market participation.

In its NOPR, the Commission proposes to require each RTO/ISO to revise its tariff to allow distributed energy resource aggregators to participate directly in the organized wholesale electric markets and to establish market rules to accommodate the participation of distributed energy resource aggregations, consistent with the following:

- (1) Eligibility to participate in the organized wholesale electric markets through a distributed energy resource aggregator;
- (2) Locational requirements for distributed energy resource aggregations;
- (3) Distribution factors and bidding parameters for distributed energy resource aggregations;
- (4) Information and data requirements for distributed energy resource aggregations;
- (5) Modifications to the list of resources in a distributed energy resource aggregation;
- (6) Metering and telemetry system requirements for distributed energy resource aggregations;
- (7) Coordination between the RTO/ISO, the distributed energy resource aggregator, and the distribution utility; and
- (8) Market participation agreements for distributed energy resource aggregators.⁴²

⁴¹ *Cal. Indep. Sys. Operator Corp*, 155 FERC ¶ 61,229 (2016)

⁴² NOPR at P 132.

The CAISO provides comments on each element of this proposal and offers comment in response to specific questions regarding the evolving roles and responsibilities of transmission and distribution operators on a grid that includes greater numbers of distributed energy resources.

A. Any distributed energy resource aggregation model should allow for participation by all distributed energy resources that can offer capabilities to the transmission system.

In its NOPR, the Commission proposes that each RTO/ISO revise its tariff so that it does not prohibit the participation of any particular type of technology in the organized wholesale electric markets through a distributed energy resource aggregation. The CAISO supports this proposed directive. Consistent with the Commission's proposal, the CAISO's distributed energy resource provider model allows aggregations to consist of different distributed energy resource types.

The Commission also proposes that it is appropriate for each RTO/ISO to limit the participation of resources in the organized wholesale electric markets through a distributed energy resource aggregator receiving compensation for the same services as part of another program. Because resources able to register as part of a distributed energy resource aggregation will be located on the distribution system, they may also be eligible to participate in retail compensation programs—such as net metering—or other wholesale programs—such as demand response programs. To ensure that there is no duplication of compensation, the Commission proposes that distributed energy resources participating in one or more retail compensation programs (such as net metering or another wholesale market participation program) will not be eligible to

participate in the organized wholesale electric markets as part of a distributed energy resource aggregation.⁴³

Consistent with FERC's proposal, the CAISO's distributed energy resource provider model specifies that resources participating in a wholesale market aggregation may not also participate in a retail net energy metering program that does not expressly permit wholesale market participation.⁴⁴ This rule extends to various aspects of retail net metering programs such as net metering with storage or virtual net metering. The rationale for this rule is that under California's current net energy metering program, a participating resource already benefits from netting its excess energy against subsequent electricity bills. Based on this netting approach, there is no energy available to offer into the CAISO markets because the excess energy is banked for later withdrawal. The CAISO believes this initial approach is consistent with Commission orders determining that exports to the transmission grid under a net energy metering program do not constitute a sale for resale of electricity under the Federal Power Act because these customers are, on a net basis, consumers. The CAISO's distributed energy resource provider model permits non-net-energy-metering-distributed-energy resources to participate in an aggregation as a wholesale market participant.

With respect to the capacity of the individual distributed energy resources that can participate in the wholesale electric markets through a distributed energy resource aggregator, the Commission proposes not to establish a minimum or maximum capacity requirement. The CAISO strongly agrees with this approach; minimum or maximum

⁴³ NOPR at P 134.

⁴⁴ See *Calif. Indep. Sys. Operator Corp.*, 155 FERC ¶ 61,229 at P 6 (2016).

size requirements should be developed by market operators in collaboration with their stakeholders in order to support grid reliability and market efficiency. Moreover, any requirements imposed by RTOs/ISOs would require review and approval by the Commission under the Federal Power Act.

With respect to the size of the distributed energy resource aggregations themselves, FERC proposes that these aggregations meet any minimum size requirements of the participation model under which they elect to participate in the organized wholesale electric markets.⁴⁵ The CAISO also concurs with this approach and recommends that the Commission not establish a uniform minimum size requirement for any RTO/ISO market participation model.⁴⁶ In order for traditional supply resources to participate in the CAISO markets, they must meet the CAISO's minimum size requirement of 0.5 MW. This same requirement applies to distributed energy resources that wish to participate in the CAISO's markets. However, unlike traditional supply resources, individual distributed energy resources may be too small to meet the minimum size requirement. The aggregation of multiple distributed energy resources can overcome this challenge. Under the CAISO's distributed energy resource provider model, each aggregation must be no smaller than 0.5 MW. The CAISO selected the minimum size of an aggregation based on the minimum size of a generating unit (without an aggregation) to participate in the CAISO markets. The CAISO's distributed energy resource provider model also imposes a maximum capacity requirement on aggregations that span multiple pricing nodes. Each aggregation that

⁴⁵ NOPR at P 136.

⁴⁶ The CAISO recommends that the Commission not adopt a minimum size requirement for electric storage resources as proposed in its NOPR.

includes distributed energy resources located at different pricing nodes must be no larger than 20 MW. The CAISO and its stakeholders selected the upper limit for those aggregations that span multiple pricing nodes in order to limit the impact of these aggregations on congestion on the CAISO grid without severely constraining the ability of distributed energy resource providers to form viable aggregations. The CAISO believes that adopting an initial limit on the size of these aggregations is a prudent and appropriate means to ensure reliable operation of the transmission system while the CAISO obtains experience with the behavior of distributed energy resource aggregations operating at multiple pricing nodes.

The Commission also proposes that each RTO/ISO revise its tariff to allow a single qualifying distributed energy resource to avail itself of the proposed distributed energy resource aggregation rules by serving as its own distributed energy resource aggregator.⁴⁷ Consistent with the Commission's proposal, the CAISO's distributed energy resource provider model allows a distributed energy resource provider to aggregate one or more distributed energy resources for purposes of wholesale market participation.

B. Participation by distribution energy resource aggregations should not contribute to constraints on the transmission system.

In its NOPR, the Commission proposes to require each RTO/ISO to revise its tariff to establish locational requirements for distributed energy resources to participate in a distributed energy resource aggregation that are as geographically broad as

⁴⁷ NOPR at P 137.

technically feasible.⁴⁸ The Commission acknowledges that the appropriate locational requirements may differ based on the services that a distributed energy resource aggregator seeks to provide (e.g., the locational requirements for participation in the day-ahead energy market may differ from those for participation in the ancillary service markets).⁴⁹

Consistent with the Commission's proposal, the CAISO's distributed energy resource provider model specifies that each aggregation must be located in a single sub-load aggregation point (Sub-LAP) to ensure that it does not create additional congestion on the CAISO controlled grid. Sub-LAPs were initially developed with the advent of congestion revenue rights to reflect major transmission constraints within each utility service territory (i.e., within a default LAP).⁵⁰ Limiting aggregations to Sub-LAP boundaries ensures that a resource is not operating on both sides of a constraint and potentially exacerbating congestion by virtue of its own operation. For example, absent this limit, an aggregation with sub-resources in two adjoining Sub-LAPs could find its sub-resources on both sides of a constraint identified by the CAISO's market processes. As a result, there is potential that a CAISO dispatch instruction to the aggregation to alleviate a constraint between these two Sub-LAPs may actually exacerbate the problem.

⁴⁸ NOPR at P 139.

⁴⁹ *Id.*

⁵⁰ A sub-LAP is a CAISO defined subset of pricing nodes within a default load aggregation point (default LAP). See Appendix A to CAISO tariff, Master Definitions and Supplement.

These locational rules demonstrate that the Commission should not adopt universal locational requirements for all RTOs/ISOs.⁵¹ The topology of each RTO/ISO transmission system (and how it connects to distribution systems) may require different locational requirements for aggregations of distributed energy resources. In this respect, attempting to craft a uniform rule makes little sense. The Commission should instead require each RTO/ISO to justify any locational requirements as part of compliance with any final rule.

The Commission also seeks comment on potential concerns about dispatch, pricing, or settlement that the RTOs/ISOs must address if the distributed energy resources in a particular distributed energy resource aggregation are not limited to the same pricing node or behind the same point of interconnection.⁵² Under the CAISO's distributed energy resource provider model, distributed energy resource aggregations may operate at a single pricing node or across multiple pricing nodes. Under either approach, the resource must provide a net response at the pricing node level that is consistent with the CAISO's dispatch instructions. In the case of aggregations across multiple pricing nodes, the resource also must provide a net response consistent with applicable generation distribution factors that the resource submits with its bid.⁵³

Through its dispatch, the CAISO thus seeks a net response at the pricing node level

⁵¹ FERC seeks further comment on what locational requirements it could require each RTO/ISO to adopt that would allow distributed energy resources to be aggregated as widely as possible without threatening the reliability of the transmission grid or the efficiency of the organized wholesale electric markets. NOPR at P 140.

⁵² NOPR at P 141.

⁵³ See CAISO tariff section 4.17.6.

rather than an individual distributed energy resource location in order to capture the value that the aggregation provides at the transmission-distribution interface.

Under the CAISO's model, the scheduling coordinator submits schedules and bids for an aggregation based on the aggregation's generation distribution factors. CAISO market awards and dispatch instructions will then reflect these distribution factors that correlate to individual pricing nodes. Scheduling coordinators will submit aggregated meter data to the CAISO and the CAISO will settle the resource's response at the level of the aggregation based on a weighted locational marginal price associated with each pricing node.⁵⁴

C. RTOs/ISOs must have sufficient information from distributed energy resource aggregations to permit feasible dispatch schedules

The Commission proposes that the market rules governing distributed energy resource aggregations allow the RTOs/ISOs to require sufficient information from the resources in a distributed energy resource aggregation to reliably operate their systems.⁵⁵ To this end, the Commission proposes to require that distributed energy resource aggregators (1) provide default distribution factors when they register their distributed energy resource aggregation and (2) update those distribution factors if

⁵⁴ If meter data reflects that a distributed energy resource aggregation did not accurately respond to its dispatch instructions, the resource will face financial consequences in the form of uninstructed imbalance energy charges. However, under the CAISO's design, the CAISO does not have the ability to impose uninstructed imbalance energy charges at individual pricing nodes unless the aggregation is located behind a single pricing node. If an aggregation operating across multiple pricing nodes fully responds to its dispatch instruction at the resource level but its response deviates from its distribution factors, the resource would face no uninstructed imbalance energy charges because the CAISO settles on meter data at the resource level, not the pricing node level. The CASIO has committed to assess how aggregations perform across multiple pricing nodes and make its findings available to market participants to inform the need for potential market design enhancements.

⁵⁵ NOPR at P 143.

necessary when they submit offers to sell or bids to buy into the organized wholesale electric markets.⁵⁶ The Commission also proposes to require each RTO/ISO to revise the bidding parameters for each participation model in its tariff to allow distributed energy resource aggregators to update their distribution factors when participating in the organized wholesale electric markets. In addition to comments on this proposal, the Commission seeks comment on alternative approaches that may provide the RTOs/ISOs with the information from geographically or electrically dispersed resources in a distributed energy resource aggregation necessary to reliably operate their systems.

The CAISO generally supports the Commission's proposal. RTOs/ISOs must have sufficient information about the resources in their markets to model them appropriately and issue feasible dispatch instructions. For purposes of aggregations of distributed energy resources, this modeling and dispatch problem may be significantly more complex than for transmission-connected resources. As distributed energy resources proliferate, the ability to understand how their operation may impact flows at the transmission distribution interface could prove difficult, especially if multiple aggregators represent resources on the distribution side of that interface.

Under the CAISO's initial framework to facilitate distributed energy resource aggregations, resources submit bids similar to how bids are submitted for other CAISO market participants and their resources. In addition, supply bids for distributed energy resource aggregations are required to contain various bid components, as applicable.⁵⁷

⁵⁶ *Id.*

⁵⁷ See CAISO tariff section 30.5.2.6 specifying applicable bid component such as Ramp Rate, Minimum and Maximum Operating Limits, Energy Limit, and Contingency Flag. These resources will not submit start-up or minimum load bids because the CAISO does not commit these resources or operate them at minimum load through its market processes.

For example, the CAISO requires an aggregation to submit generation distribution factors with its bids.⁵⁸ If the aggregation does not submit generation distribution factors in its bids, the CAISO will use the aggregation's default generation distribution factors registered in the CAISO's Master File for the aggregation.⁵⁹ This approach allows the resource to reflect the dynamic operating nature of some of the distributed energy resources comprising an aggregation. The approach also provides for a reasonable expectation of how the resource will perform across applicable pricing nodes in the event an aggregation does not submit generation distribution factors with its bid.

In its NOPR, the Commission also seeks comment on whether bidding parameters in addition to those already incorporated into existing participation models may be necessary to adequately characterize the physical or operational characteristics of distributed energy resource aggregations.⁶⁰ For the CAISO, the existing market participation models available to distributed energy resource aggregations (e.g., the CAISO's participating generator or non-generator resource models) provide the means to account for the physical and operational characteristics of an aggregation. Accordingly, the CAISO does not believe that any universal bidding parameters need to be established for RTOs/ISOs to account for distributed energy resource aggregations.

D. Similar to other resources distributed energy resource aggregations must provide resource characteristics to RTOs/ISOs.

⁵⁸ *Id.*

⁵⁹ *Id.*

⁶⁰ NOPR at P 144.

The Commission proposes that the distributed energy resource aggregator initially provide to the RTO/ISO a description of the physical parameters of the distributed energy resource aggregation, including (1) total capacity; (2) minimum and maximum operating limits; (3) ramp rate; (4) minimum run time; and (5) default distribution factors, if applicable.⁶¹ The Commission also proposes to require each RTO/ISO to revise its tariff to require distributed energy resource aggregators to provide the RTO/ISO with a list of the distributed energy resources in the distributed energy resource aggregation that includes information about each of those distributed energy resources, including each resource's capacity, location on the distribution system, and its operating limits. The CAISO supports these proposals.

Consistent with the Commission's proposal, the CAISO requires distributed energy resource providers to provide accurate information to the CAISO about the sub-resources participating in its aggregation. The distributed energy resource provider must provide the CAISO with information pertaining to the location, capacity, and operating characteristics of aggregations so that the CAISO can appropriately model the resource in the CAISO's market model. Providers are obligated to maintain an accurate list of the resources that participate in their aggregations.

The Commission requests comment on whether there are information and data requirements imposed by RTOs/ISOs that apply to other market participants that should not apply to individual distributed energy resources participating in the organized wholesale electric markets through a distributed energy resource aggregation.⁶² The

⁶¹ NOPR at P 145.

⁶² NOPR at P 146.

CAISO urges the Commission to maintain a degree of flexibility in connection with this issue. In some cases, the CAISO has certain requirements that do not apply to distributed energy resource providers or their aggregations. For example, the Commission approved as just and reasonable the CAISO's proposal to not extend its meteorological data requirements that apply to eligible intermittent resources to distributed energy resources comprising an aggregation.⁶³ Although distributed energy resource aggregations may include variable energy resources, the CAISO does not believe requiring these individual resources to collect and submit meteorological data is necessary at this time because this framework is only a first step to allow for aggregations of distributed energy resources to aggregate. To impose such a requirement could create an undue burden on individual distributed energy resources. These individual variable energy resources will be less than 1 MW. In addition, aggregations may consist of multiple distributed energy resource types in dispersed locations throughout a Sub-LAP. Meteorological data at the sub-resource level may not provide meaningful information about the operation of the aggregation. Instead, the CAISO believes distributed energy resource providers and their scheduling coordinators should be responsible for managing any production forecasts necessary to support the accuracy of their bids. Based on operational experience with aggregations, the CAISO may re-examine meteorological requirements at the aggregation or pricing node level as a future refinement to its distributed energy resource aggregation framework. In any case, this issue demonstrates that the Commission should allow RTOs/ISOs some

⁶³ *Calif. Indep. Sys. Operator Cop.*, 155 FERC ¶ 61,229 at P 22 (2016).

flexibility in tailoring their information and data requirements to distributed energy resources and their aggregations.

The Commission also proposes to require each RTO/ISO to revise its tariff to require distributed energy resource aggregators to maintain aggregate settlement data and to maintain data for a length of time consistent with the RTO's/ISO's auditing requirements, for each individual resource in its distributed energy resource aggregation so that each resource can verify its performance if audited.⁶⁴ The Commission's proposed requirements are reasonable. Under its distributed energy resource aggregation framework, the CAISO requires the distributed energy resource provider to provide meter data from the distributed energy resources participating in its aggregation upon request. This information will allow the CAISO to assess whether aggregations performed consistently with their generation distribution factors in response to CAISO dispatch instructions. The CAISO requires that the aggregator retain the meter data of each distributed energy resource in its aggregation for a period of at least three years consistent with the CAISO's settlement recalculation timeframe. These rules strike a balance between imposing requirements on aggregators and the need to validate data that support payment of market revenue to participating resources.

E. Distributed energy resource aggregations must inform RTOs/ISOs of changes to the list of distributed energy resources that comprise an aggregation.

The Commission proposes that each RTO/ISO revise its tariff to allow a distributed energy resource aggregator to modify the list of resources in its distributed

⁶⁴ NOPR at P 147.

energy resource aggregation without re-registering all of the resources if the modification will not result in any safety or reliability concerns. The Commission also recognizes that the relevant distribution utility (or utilities) must have the opportunity to review the list of individual resources that are located on their distribution system in a distributed energy resource aggregation before those resources may participate in the organized wholesale electric markets through the aggregation, so that they can assess whether the resources would be able to respond to RTO/ISO dispatch instructions without posing any significant risk to the distribution system.⁶⁵ The CAISO strongly agrees with this approach. In order for distributed energy resource aggregations to participate effectively in the RTO/ISO markets, there must be robust engagement among all affected entities, including the distribution utilities.

In its on-boarding process for distributed energy resource aggregations, the CAISO provides an opportunity for the relevant distribution utility to raise concerns with distributed energy resources that seek to join a distributed energy resource aggregation. This up-front review is intended to help assess whether an individual distributed energy resource participating in an aggregation can operate in response to CAISO dispatch instructions without posing a threat to the distribution system. This upfront screening of potential impacts to distribution systems and ongoing interaction with utility distribution companies and metered subsystems will help ensure the safe and reliable operation of distribution systems within the CAISO balancing authority area. Like all new market resources, distributed energy resource aggregations must go through a new resource

⁶⁵ NOPR at P 149.

implementation process at the CAISO.⁶⁶ Prior to a distributed energy resource aggregation entering the process, the CAISO provides notice to the applicable distribution utility and requests comment on specific issues associated with the distributed energy resource participating in the aggregation as a CAISO market resource.⁶⁷ The CAISO provides the distribution utility an opportunity to raise concerns regarding the accuracy of the information about distributed energy resources in a proposed aggregation and requires the distributed energy provider to demonstrate that the applicable distribution utility concur that the following conditions do not apply:

- (1) The distributed energy resource is participating in another distributed energy resource aggregation;
- (2) The distributed energy resource is participating as a proxy demand response resource or a reliability demand response resource;
- (3) The distributed energy resource is participating in a retail net energy metering that does not expressly permit wholesale market participation;
- (4) The distributed energy resource is not in compliance with applicable utility distribution company/metered subsystem tariffs or applicable requirements of the local regulatory authority; or
- (5) The distributed energy resource may pose a threat to the safe and reliable operation of the distribution system, if operated as part of a distributed energy resource aggregation.⁶⁸

These criteria help ensure the CAISO avoids dispatching a distributed energy resource aggregation that includes resources already participating in a demand

⁶⁶ See proposed CAISO tariff section 4.17.4. More information about the CAISO's new resource implementation process is available at the following website:
<http://www.caiso.com/participate/Pages/NewResourceImplementation/Default.aspx>

⁶⁷ This process aligns with the similar process for demand response resources. See CAISO tariff section 4.13.2.

⁶⁸ See CAISO tariff section 4.17.4.

response program, for example. The criteria also avoid resources' receiving a retail rate credit for output under a net energy metering program and also selling the same output to obtain a wholesale market payment. Without rules that expressly allow for the use of this energy for wholesale market purposes and appropriate credit/payment adjustments, the CAISO believes it is not just and reasonable to permit these resources to participate in a distributed energy resource aggregation. Finally, these rules permit a distribution utility to raise concerns regarding compliance with its tariffs, local regulatory authority requirements, and the safe and reliable operation of its distribution system.

These criteria are not necessarily a barrier to entry, because they allow for utility to propose mitigation so a distributed energy resource can participate in an aggregation. The CAISO expects that in the overwhelming majority of cases, operators of distribution systems will have performed reliability screens as part of providing interconnection service to distributed energy resources. Nevertheless, the CAISO believes it is important to confirm that no concerns exist prior to initiating the new resource implementation process for any distributed energy resource aggregations. To the extent a distributed energy resource provider seeks to augment its aggregation with new distributed energy resources, the CAISO will undertake a similar process. Each RTO/ISO should explore similar constructs for the onboarding of distributed energy resource aggregations so as to preserve the safe and reliable operation of the distribution grids within their systems.

- F. The Commission should provide RTOs/ISOs sufficient flexibility to fashion metering and telemetry requirements that ensure the reliable operation of distributed energy resource aggregations.**

In its NOPR, the Commission proposes to require each RTO/ISO to revise its tariff to identify any necessary metering and telemetry hardware and software requirements for distributed energy resource aggregators and the individual resources in a distributed energy resource aggregation.⁶⁹ These requirements must ensure that the distributed energy resource aggregator will be able to provide the necessary information and data to the RTO/ISO but also not impose unnecessarily burdensome costs on the distributed energy resource aggregators and individual resources in a distributed energy resource aggregation that may create a barrier to their participation in the organized wholesale electric markets. Under the CAISO's distributed energy resource provider model, aggregations are required to adhere to the same metering and telemetry standards as other resources. The CAISO recommends that the Commission forbear from directing specific metering and telemetry requirements because distributed energy resources often must also meet local metering requirements. In other words, distributed energy resources generally are already subject to a local regulatory authority's metering standards. RTOs/ISOs thus need significant flexibility to fashion rules to ensure they can leverage and accommodate existing metering structures that are already in place in order to avoid imposing additional costs or barriers to entry on prospective distributed energy resource aggregations. Moreover, distributed energy resource aggregations are a nascent construct that can present in many new, unique configurations. A one-size-fits-all approach could squander new opportunities.

⁶⁹ The Commission seeks comment on whether the RTOs/ISOs need to establish metering and telemetry hardware and software requirements for each of the different types of distributed energy resources that participate in the organized wholesale electric markets through distributed energy resource aggregations, as well as whether we should establish specific metering and telemetry system requirements and, if so, what requirements would be appropriate. NOPR at P 151.

Similarly, the Commission should not mandate telemetry requirements for all distributed energy resource aggregations. RTOs/ISOs should have the flexibility to impose telemetry requirements that are comparable with requirements for other market resources.

G. The Commission should encourage robust coordination between the RTOs/ISOs, distributed energy resource aggregators, and the distribution utilities.

In its NOPR, the Commission appropriately proposes to require each RTO/ISO to revise its tariff to provide for coordination among the RTO/ISO, a distributed energy resource aggregator, and the relevant distribution utilities with respect to (1) the registration of new distributed energy resource aggregations and (2) ongoing coordination, including operational coordination, among the RTO/ISO, the distributed energy resource aggregator, and the relevant distribution utility or utilities.⁷⁰

i. Coordination between RTO/ISO and distribution utilities is necessary to support distributed energy resource aggregations.

The CAISO supports the Commission's general direction regarding the registration and implementation phase of bringing a new distributed energy resource aggregation into the wholesale market. In the CAISO's distributed energy resource aggregation framework, the distributed energy resource provider is the entity accountable for the aggregation's performance. Stated otherwise, the provider is the resource operator and the aggregation (the virtual resource comprised of individual distributed energy resources) is the resource the CAISO models in its optimization

⁷⁰ NOPR at PP 154-156.

software and schedules or dispatches. Thus, a crucial element of the CAISO's new resource implementation process is for the distributed energy resource provider to specify the performance characteristics and parameters of the virtual resource in sufficient detail for the CAISO to model the resource accurately in the market optimization software. This ensures that the CAISO schedules and dispatches for the aggregation will be feasible for the aggregation's performance capabilities.

The CAISO also acknowledges that assessing "whether the resources [participating in the aggregation] would be able to respond to RTO/ISO dispatch instructions without posing any significant risk to the distribution system" is certainly a matter of concern to the distribution utility, but there is an additional dimension to this matter that the Commission's NOPR does not appear to capture.⁷¹ Each of the individual resources that comprise an aggregation typically will have gone through an interconnection process managed by the distribution utility, in which the distribution utility will have assessed whether the resource can operate in accordance with its specified performance characteristics and under normal distribution grid conditions without posing risk to the distribution system. What the distribution utility would not have assessed prior to the formation of the aggregation, however, is the impact on the distribution system of all sub-resources in the aggregation acting in concert to deliver a response to the CAISO's dispatch instruction. Based on the CAISO's discussions with distribution utilities, they do have a need to assess the impacts of the behavior of an aggregation as a whole in order to determine whether the aggregation's operation will pose distribution system operational risks. The CAISO notes, however, that this aspect

⁷¹ NOPR at P 149.

of the utility's review of the aggregation is a level of detail that would not belong in an RTO/ISO tariff; rather the tariff should just allow time for adequate review by the utility and specify what the utility should report to the CAISO as a result of its review.

The CAISO also agrees with the NOPR's proposal that the distribution utility should report to the CAISO its findings on impacts an aggregation's behavior may have on the distribution grid.⁷² Beyond sharing this information, however, some process is needed to resolve or mitigate any problems the distribution utility finds. It would not be a desirable outcome if the only options for the distribution utility are to accept or reject a proposed aggregation. To realize the full value of a distributed energy resource aggregation, if the distribution utility finds an unacceptable risk posed by the expected behavior of an aggregation of distributed energy resource, the utility should report its recommendations for how to mitigate the risk, and if possible develop a solution with the distributed energy resource provider. For example, if the aggregation includes too many sub-resources on a circuit with limited capacity, the mitigation might be for the distributed energy resource provider to revise the proposed aggregation to reduce the amount of sub-resources on that circuit. Alternatively, if the utility and the distributed energy resource provider cannot agree on an effective mitigation, the utility should provide sufficient information on the nature of the risk and its proposed mitigation so that the distributed energy resource provider can explore other means to resolve the issue.

The Commission also proposes that each RTO/ISO revise its tariff to establish a process for ongoing coordination, including operational coordination among itself, the

⁷² NOPR at P 154.

distributed energy resource aggregator, and the distribution utility to maximize the availability of the distributed energy resource aggregation consistent with the safe and reliable operation of the distribution system. To account for the possibility that distribution facilities may be out of service and impair the operation of certain individual resources in a distributed energy resource aggregation, the Commission also proposes to require each RTO/ISO to revise its tariff to require the distributed energy resource aggregator to report to the RTO/ISO any changes to its offered quantity and related distribution factors that result from distribution line faults or outages. The Commission seeks comment on the level of detail necessary in the RTO/ISO tariffs to establish a framework for ongoing coordination between the RTO/ISO, a distributed energy resource aggregator, and the relevant distribution utility or utilities. The Commission also seeks comment on any related reliability, safety, and operational concerns and how they may be effectively addressed.⁷³

Over the past year, the CAISO has discussed this subject with stakeholders and with the operations departments of the CAISO's investor-owned utilities. This work will continue. The CAISO's initial recommendations include:

1. Distribution utilities should communicate advisory information on system conditions (if and when such information exists) that constrain distributed energy resource aggregation performance on an *ex ante* basis to the distributed energy resource provider, so that the distributed energy resource provider may modify its CAISO market bids accordingly.
2. The CAISO should provide day-ahead distributed energy resource aggregation schedules to the applicable distribution utility so that the utility can identify any infeasibilities in those schedules due to current distribution system conditions and notify the distributed energy

⁷³ NOPR at P 155.

resource provider (e.g., a “condition red” notification). This exchange may be a manual process initially but could also lead to an automated process for the CAISO to share real-time dispatch information with the distribution utility.

3. Distributed energy resource providers should communicate constraints on distributed energy resource performance to the CAISO through the CAISO’s outage management system.
4. Distribution utilities should consider pursuing a *pro forma* “aggregation agreement” with any Distributed Energy Resource Provider that is aggregating multiple distributed energy resources to form a virtual resource for CAISO market participation. The aggregation agreement would specify the aggregation’s obligation to the distribution utility as a condition for wholesale market participation and the distribution’s utility’s obligations to the distributed energy resource provider.

The CAISO firmly believes that there needs to be a process for the distribution utility to notify a distributed energy resource provider of changes to distribution system conditions that will affect its ability to perform to its maximum capability. The utility performs interconnection studies under the “normal configuration” of the distribution system, but distribution system topology is more changeable than transmission topology, and at any given time there may be multiple abnormal configurations—normal abnormalities—across a distribution system. At present, a resource participating in the CAISO market has to inform the CAISO about outages or derates to its capacity through the CAISO’s outage management system. But a distribution system constraint or line outage is different, because it’s not really a reduction of the resource’s physical capability, nor is it a system change that would be modeled in the CAISO’s network model if it were on the transmission grid. Accordingly, there is a need to implement a process for the distribution utility to inform a distributed energy resource provider of distribution constraints or topology changes that will limit the resource’s capacity to

participate in the CAISO market. Initially such information might be in the form of a red/green traffic signal for each circuit, meaning that if a given circuit is in abnormal configuration, the distributed energy resources on that circuit are not available to participate in the market for the duration. For an aggregation whose sub-resources are spread over multiple circuits this would be a partial reduction in its capacity. With this information, the distributed energy resource provider can, depending on when it is received, modify its market bid accordingly or, if the resource has already received a dispatch, submit an outage notification to the CAISO.

Moreover, if an aggregation spans multiple pricing nodes on the CAISO system, a reduction due to a distribution constraint will likely alter the distribution factors that normally would characterize the resource's response to a CAISO dispatch. The CAISO market provides for such impacts by allowing a distributed energy resource provider to include distribution factors as part of its market bid, which means that if the distributed energy resource provider is notified of a constraint prior to submission of its real-time market bid (T-75 minutes) it can take that constraint into account and adjust its total capacity and its distribution factors.

Another coordination procedure the CAISO has explored with distribution utilities is the idea of the CAISO providing its day-ahead schedules and real-time dispatches of distributed energy resource aggregations to the distribution utility to allow the utility to conduct a feasibility test and identify infeasible schedules and dispatches. In the near-term, this procedure would likely be a manual exercise and limited to day-ahead schedules, allowing the CAISO and utilities to determine the optimal methodology while the number of participating aggregations is still small. In the future, if this approach

proves useful and feasible, the CAISO and distribution utilities would need to automate a process that tests feasibility of real-time dispatches as well.

ii. The Commission's final rule should accommodate different models for distribution system operators.

The Commission also seeks comment on the appropriate lines of communication to require among distributed energy resource aggregations, RTOs/ISOs and utility distribution companies.⁷⁴ The Commission solicits comments on how the distributed energy resource aggregator model proposed herein would interact with or complement the distribution system operator (DSO) model currently being discussed in some states, and whether a DSO model might add value to the distributed energy resource aggregator model in terms of facilitating communication among affected entities.

Operational coordination for a future grid with high levels of distributed energy resources will likely involve three-way arrangements among the RTO/ISO, the distribution utility, and the distributed energy resource provider. Coordination between the distributed energy resource provider and the RTO/ISO is obvious because the wholesale market-participating aggregation will have equivalent requirements to those of a generator connected to the bulk system. Similarly, each distributed energy resource participating in an aggregation will have a relationship with the distribution utility by virtue of its interconnection. What may be less obvious is the basis for direct communication and coordination between the RTO/ISO and the distribution utility.

A significant, and perhaps counterintuitive, driver of the need for direct RTO/ISO to distribution utility coordination and communication will be the growth of diverse

⁷⁴ NOPR at P 156.

distributed resources that are *not* participating in the wholesale market. Such resources (especially in large numbers) can have significant, hard to predict impacts on the transmission system at the transmission-distribution interfaces.⁷⁵ Yet the customers who adopt such resources and the developers who install them, on either side of the customer meter, will not have any direct relationship with the CAISO if they are not participating in the CAISO market. The resources may serve end-use customers (for example, to manage demand charges or shift load in response to time-of-use retail rates) or to the distribution utility itself (for example, to manage voltage in real time or perform other services as needed to substitute for a distribution system upgrade). In general, the distribution utility will have direct and therefore highly accurate information on the installed numbers and locations of such distributed energy resources and, as a result, will be better able to perform short-term forecasting of distributed energy resource activity than an RTO/ISO could perform. As such, an important need in the high-level distributed energy resource future will be for the RTO/ISO and the distribution utilities to coordinate on developing and communicating short-term forecasts of distributed energy resource activity and their potential impact at each transmission-distribution interface substation. This measure could be incorporated in the RTO/ISO tariffs as a required element of the relationship between an RTO/ISO and the distribution utility connected to the RTO/ISO system.

Today, the CAISO has a formal relationship with utility distribution companies (UDCs) connected to the CAISO controlled grid through the UDC Operating

⁷⁵ An obvious example is the way in which sudden cloud coverage can cause very quick increases to load because of the loss of rooftop solar generation that normally makes this load invisible to the RTO/ISO.

Agreement.⁷⁶ The CAISO tariff states, “The CAISO shall operate the CAISO Controlled Grid, and each UDC shall operate its Distribution System at all times in accordance with Good Utility Practice and in a manner that ensures safe and reliable operation.”⁷⁷ This statement is very general, and it was written before there was any expectation of a large and growing volume of diverse distributed energy resources on the system, only some of which will be participating in the CAISO market. The CAISO believes that the principle quoted here could be interpreted to require new procedures for the CAISO and UDC to ensure safe and reliable operation, such as developing accurate short-term forecasts to feed into the CAISO’s real-time market optimization to support reliable operation at the transmission-distribution interfaces.

The DSO model is nascent, and there is not yet a consensus DSO model. Rather, a few different DSO models are under discussion in the industry. The optimal way to specify the details of coordination between an RTO/ISO and the distribution utility (or DSO) will depend on the DSO model that is adopted in any given area. It is also possible that different jurisdictions and different distribution utilities will adopt different DSO models. Thus, an RTO/ISO that serves multiple distribution utilities must be able to work with more than one DSO model in its territory, either as a transitional phase, or perhaps more permanently if the industry does not converge on a single DSO model.

Finally, the question of a future DSO is not really a question of “if” but rather a question of “what kind”? As long as there is an electric distribution system there will be

⁷⁶ See section 4.4 of the CAISO tariff.

⁷⁷ *Id.*

an entity whose function is to operate that system, whether we call it a distribution utility, UDC, or DSO. The crucial distinction denoted by the new term “DSO” is that in a high-level distributed energy resource future that entity will need to have functional capabilities that are beyond those of the traditional distribution utility. The traditional function of moving electric power from the bulk electric system to end-use customers-- which is the current NERC definition of “distribution provider”—will constitute only a part of this entity’s function. This raises questions about new functional capabilities that the distribution utility must adopt. Moreover, there may be even more functions distribution utilities will adopt to support policy objectives such as grid resiliency or competition in end-use energy services. In other words, distribution utilities (and their regulators) will face different choices about what functions may be desirable but not necessary, and their answers will lead to different ways to define the future DSO.

Possible DSO models run the spectrum from a DSO that performs only the minimal set of functions necessary for reliable operation and a DSO that performs the total set of potentially desirable but not necessary functions being discussed in the industry today. At one end of the spectrum, the essential role of the DSO would not be different from the essential role of the distribution utility today, namely, to provide a safe and reliable system that links end-users and distributed energy resources with the transmission grid and the wholesale markets. As noted above, with a high-level of distributed energy resource penetration this role will be much more complicated than just moving power one way from the transmission grid to the end-users on the distribution system. Many end-users could install behind the meter devices that enable them to function as grid resources as well as energy consumers. At a minimum, the

DSO will entail new operational and planning procedures, communication and control capabilities, etc. to plan for and operate numerous diverse types of distributed energy resources providing diverse services. However, this DSO's core role will still be the traditional one of providing safe, reliable distribution system services.

At the other end of the spectrum, a DSO could perform all the necessary functions just mentioned as well as the optional functions being explored in many industry forums today. For example, this DSO could operate a "transactive energy" market on the distribution system, where distributed energy resources and producer-consumers with behind the meter generation or storage could transact with one another and with the distribution utility for energy services. Such markets could improve the financial viability of microgrids and increase the resilience of electricity system by allowing them to island in the event of a disruption to grid service. The DSO could itself be an aggregator of distributed energy resources and manage aggregations up to the pricing node with the transmission system.

Applying these ideas to the Commission's questions, the possible relationship between the distributed energy resource aggregator and the DSO, and in turn between the DSO and the RTO/ISO will depend on the DSO model that is adopted in a given jurisdiction or utility service territory. If the DSO were to perform only the minimal functions, the RTO/ISO could receive economic bids from and issue dispatch instructions to numerous distinct aggregations at that pricing node. Each of the resources would respond independently to its dispatch instruction, and the DSO would need to manage all the coordination functions: inform all distributed energy resource providers about current grid conditions, issue real-time operating instructions to manage

circuit congestion, and maintain reliable operation as numerous resources act independently and impact the system. At the same time, the distributed energy resource providers affected by current distribution system conditions would need to provide outage notifications or modify their bids to the RTO/ISO so that it has reasonably accurate expectations about the responses it will receive to its dispatches at that pricing node.

Alternatively, a DSO could expand its functionality and operate a distribution-level market and, through that market, act as the interface with an RTO/ISO. When an aggregation (or aggregation of aggregations) clears the wholesale market, the RTO/ISO would issue a dispatch instruction to the DSO, who would then use its local market to dispatch participating distributed energy resource aggregations in a least-cost manner, consistent with current distribution system conditions, to comply with the RTO/ISO dispatch. Under this DSO model, the DSO would be responsible to deliver the response to the dispatch (which could include providing ancillary services as well as energy). As a result, the RTO/ISO may achieve greater certainty about the response to its dispatch with less need for information because the DSO has greater operational control of the resource mix operating on the distribution system by virtue of its role in determining the best way to dispatch distributed energy resources, respecting actual system conditions and in accordance with transparent, non-discriminatory local market rules. Distributed energy resource aggregators could also benefit from this DSO model; they could have greater ability to manage their own operations and curtailment risks because they will not be subject to possible conflicts between an RTO/ISO dispatch and a real-time DSO operating instruction for reliability.

Although this last scenario may seem like a major departure from how the electric system operates today, it is in fact not too different to how metered sub-systems operate today to manage and optimize their own internal resources and meet the CAISO at a single point of interconnection.⁷⁸ Given the rapid growth of DERs expected as a result of both policies that promote them and autonomous customer adoption, the CAISO urges the Commission and affected interests to give the spectrum of DSO design possibilities careful consideration.

H. The CAISO supports the Commission proposal to require market participation agreements for operators of distributed energy resource aggregations.

The Commission proposes that each RTO/ISO revise its tariff to include a market participation agreement for distributed energy resource aggregators. The Commission does not propose specific requirements for such agreements at this time, but instead seeks comment on the information these agreements should contain.⁷⁹ The CAISO generally supports the requirement that RTOs/ISOs adopt some form of participation agreement, but does not endorse a set of standard terms and conditions for every RTO/ISO. The Commission should allow each RTO/ISO to work with its market participants to develop such an agreement. In the context of the CAISO's distributed

⁷⁸ Metered Subsystems (also known as MSSs) generally are municipal utilities in the CAISO BAA. The CAISO tariff defines them as a geographically contiguous system located within a single zone that has been operating as an electric utility for a number of years prior to the CAISO Operations Date as a municipal utility, water district, irrigation district, state agency or federal power marketing authority subsumed within the CAISO Balancing Authority Area and encompassed by CAISO certified revenue quality meters at each interface point with the CAISO Controlled Grid and CAISO certified revenue quality meters on all Generating Units or, if aggregated, each individual resource, Participating Load, Reliability Demand Response Resource, and Proxy Demand Resource internal to the system, which is operated in accordance with a MSS Agreement described in Section 4.9.1 of the CAISO tariff.

⁷⁹ NOPR at P 157.

energy resource provider framework, the CAISO requires that prospective distributed energy resource providers execute a participation agreement. This agreement sets forth the terms and conditions under which the CAISO and distributed energy resource providers will discharge their respective duties and responsibilities under the CAISO tariff.⁸⁰ The proposed agreement does not, however, establish duties and responsibilities as between a utility distribution company and distributed energy resources, except in so far as it incorporates conditions of CAISO market participation (such as operating distributed energy resources participating in an aggregation consistent with limitations or operating orders of a utility distribution company). As explained above, the Commission should consider whether a Commission jurisdictional agreement should also apply between a utility distribution company and a distributed energy resource aggregation. Such an agreement might define the roles and responsibilities between a utility distribution company (or DSO) and a distributed energy resource aggregation for the purpose of the aggregation's participation in wholesale markets.

III. The CAISO supports a flexible compliance schedule that recognizes all affected entities will “learn by doing”

In its NOPR, the Commission proposes to require each RTO/ISO to submit a compliance filing to demonstrate that it satisfies the proposed requirements set forth in the Final Rule within six months of the date the Final Rule in this proceeding is published in the Federal Register. The Commission states it believes that six months is sufficient for each RTO/ISO to develop and submit its compliance filing, but recognizes

⁸⁰ See Appendix B.21 to the CAISO tariff.

that implementation of the reforms proposed herein could take more time due to the changes that may be necessary to each RTO's/ISO's modeling and dispatch software. The Commission proposes to allow twelve months from the date of the compliance filing for implementation of the proposed reforms to become effective.⁸¹

The CAISO is not opposed to the Commission setting a timeframe for compliance and implementation of the market resource participation models proposed in the NOPR, but a more prudent approach may be to direct RTOs/ISOs to file compliance reports that establish these timelines. The Commission should recognize that the models it is proposing will require significant time to design, build and test prior to implementation. The CAISO expects this process may take as much as two years for RTOs/ISOs to complete this process and even then RTOs/ISOs and affected entities may only have established a framework. The learning process that will occur through actual implementation of these models will give rise to needed refinements and enhancements that affected entities will only discover through their implementation efforts. For these reasons, the CAISO supports a flexible implementation approach that includes opportunities for reporting progress and making course corrections necessary to ensure safe and reliable operation of both the transmission and distribution systems.

IV. Conclusion

The CAISO strongly supports ensuring wholesale market opportunities exist for all resources. With its stakeholders, the CAISO has developed robust models for market participation by electric storage resource and distributed energy resource aggregations.

⁸¹ NOPR at P 159.

These market participation models allows these resource to provide energy and ancillary services in the CAISO markets. While the CAISO supports adoption of a final rule that will permit participation by the electric storage resource and distributed energy resource aggregations these resources in organized markets, the CAISO recommends the Commission not adopt rigid rules for the design of these participation models. The potential for significant change in the roles of and responsibilities of transmission and distribution operators will likely inform how these participation models will develop. The Commission, electric grid operators, and market participants, should take the opportunity to learn by doing.

Respectfully submitted

By: /s/ Andrew Ulmer

Roger E. Collanton

General Counsel

Anthony Ivancovich

Deputy General Counsel

Andrew Ulmer

Director, Federal Regulatory Affairs

William H. Weaver

Senior Counsel

California Independent System

Operator Corporation

250 Outcropping Way

Folsom, CA 95630

Tel: (916) 608-7209

Fax: (916) 608-7222

aulmer@caiso.com

Dated: February 13, 2017

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 captioned proceeding, in accordance with 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 13th day of February, 2017.

/s/ Anna Pascuzzo
Anna Pascuzzo