Memorandum

To: ISO Board of Governors

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

Date: September 23, 2020

Re: **Decision on Energy Storage and Distributed Energy Resources Phase 4**

This memorandum requires Board action.

EXECUTIVE SUMMARY

The intent of the California Independent System Operator's (ISO) energy storage and distributed energy resources (ESDER) initiative is to lower barriers and enhance the ability for storage and distributed energy resources to participate in the ISO market.[1] As the number and diversity of these resources grow and become an increasingly important part of the resource mix, the ISO must be able to integrate and confidently operate these resources to sustain a reliable grid.

The ESDER initiative originally began in 2015 and is an omnibus initiative that covers several related but distinct topics. This is the fourth phase of the ESDER initiative, and reflects the ISO's on-going commitment to learning, evolving, and improving its market systems, operational tools, and rules to best operate a more decentralized and distributed grid and integrating non-traditional resource types like demand response, battery storage, and hybrid resources. In this phase, Management proposes the following enhancements for storage and distributed energy resources:

1. End-of-hour state-of-charge biddable parameter for storage resources;
2. Establishing parameters to better reflect demand response resource operational characteristics; and
3. Streamlining market participation agreements for non-generator resource participants.

[1] Distributed energy resources are those resources on the distribution system on either the utility side or the customer side of the end-use customer meter, including rooftop solar, energy storage, plug-in electric vehicles, and demand response.

The ESDER 4 initiative also included the development of market power mitigation measures of storage resources through a default energy bid methodology. However, Management has determined that the proposal would benefit from further consideration and plans to bring that element of the ESDER proposal to the Board for a decision later this year.

Storage resources are projected to become a significant part of the ISO's supply fleet. Management proposes an optional end-of-hour state-of-charge biddable parameter for storage resources that will provide storage resource operators better and more precise real-time state-of-charge management over their storage resources. In addition, this parameter provides the ISO more operational flexibility to use storage resources throughout the day while still respecting the resource's end-of-hour state-of-charge parameter that may be necessary for future use commitments of the resource.[2] Currently, storage operators can only use self-schedules to manage state-of-charge, but this is a blunt instrument for this purpose given the timing lag between market execution and bid submission deadlines. Additionally, self-schedules limit the ISO ability to flexibly manage these resources, whereas this new parameter gives the ISO more flexibility to dispatch the resource above or below what might have been possible if limited to self-scheduling. With this parameter, scheduling coordinators will have the option to submit an end-of-hour state-of-charge as a minimum and maximum MWh value with their bids in the real-time market, and the ISO will have the ability to flexibly manage the resource in real-time around this parameter when employed.

Management is also proposing an optional maximum daily run time constraint for demand response resources. Demand response participation in the ISO market has grown since the inception of the ISO's proxy demand resource model in 2012. Since then, the successive ESDER initiatives have continued to refine and enhance the proxy demand resource model. Over time and with experience, stakeholders have identified specific demand response modeling and rule enhancements that better leverage the unique characteristics of demand response resources. The maximum daily run time constraint addresses a typical demand response program design constraint where a program has a limited number of "activations" and a set number of hours available for dispatch per day. Day-ahead and real-time markets will optimize demand response resources considering their maximum daily run time constraint.

Next, Management proposes to streamline market participation agreements for non-generator resource participants. This will resolve today's administrative burden where new non-generator resources must execute two separate participation agreements – a participating generator agreement and a participating load agreement. To improve efficiencies and reduce administrative encumbrance, Management is proposing a single market participation agreement for non-generator resource participants.

Finally, the ESDER 4 proposal also includes a study conducted by consulting firm Energy and Environmental Economics, Inc. (E3) on applying an effective load carrying capability capacity valuation methodology to demand response resources. Demand response resources are more analogous to a variable energy resource than a fixed capacity resource like a gas-fired generator. A demand response resource's load reduction capability can vary

[2] End-of-hour state-of-charge parameter will not be an available option for storage resources electing to provide regulation using the regulation energy management functionality.

by hour due to weather, temperature, production, occupancy, or day of the week. Demand response resources also often have strict use and availability limitations. However, under current planning and capacity valuation methods, demand response is treated like a generator that can deliver a fixed capacity quantity during all hours the demand response resource is available. Applying this type of a capacity valuation to demand response resources does not match the nature of the underlying resource, which negatively impacts planning and reliability studies. The study is intended to inform the CPUC and other local regulatory authorities on Management's preferred methodology for setting the qualifying capacity value for demand response resources. This item is informational only and does not require approval from the ISO Board of Governors.

Management proposes the following motions:

> ***Moved, that the ISO Board of Governors approves the tariff revisions necessary to implement the energy storage and distributed energy resources phase 4 proposal as described in the memorandum dated September 23, 2020; and***
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> ***Moved, that the ISO Board of Governors authorizes Management to make all necessary and appropriate filings with the Federal Energy Regulatory Commission to implement the proposal described in the memorandum, including any filings that implement the overarching initiative policy but contain discrete revisions to incorporate Commission guidance in any initial ruling on the proposed tariff amendment.***

DISCUSSION AND ANALYSIS

Today, there are about 200 MWs of grid-connected storage resources installed on the system. This number does not include behind the meter storage resources installed in households or businesses that participate under state or local tariffs. Management anticipates that about 1,500 MW of storage generation in the ISO interconnection queue will be installed and active by the end of 2021. Management further anticipates the storage buildout will continue at a high rate over the next few years as CPUC jurisdictional load serving entities meet a near term 3,300 MW procurement order. Given the transforming grid and growing reliance on battery storage, Management believes it is prudent to get in front of this wave of new storage development and implement market participation measures in anticipation of the growing number of energy storage resources that will interconnect to the grid in the very near term.

1) End-of-hour State-of-charge biddable parameter for storage resources

Currently, the only tool storage operators have to manage a battery's state-of-charge is self-scheduling. Self-scheduling is a relatively ineffective method for managing a storage resource's state-of-charge because of the lag between market execution and bid submission deadlines. It also removes operational flexibility from the ISO since the ISO must adhere to, and work around, a self-schedule. To add flexibility and better management of a battery's state-of-charge, Management proposes an end-of-hour state-of-charge

parameter. This parameter will allow more precise real-time state-of-charge management by allowing scheduling coordinators to submit an end-of-hour state-of-charge as a minimum and maximum MWh value with their bids in the real-time market.

The end-of-hour state-of-charge bid parameter will enable the ISO's market systems to dispatch a storage resource as economically as possible to achieve its submitted end-of-hour state-of-charge target. The bid-in end-of-hour state-of-charge must be feasible and respect the upper and lower charge limits stored in the ISO Master File (or the bid-in max and min parameters) and respect the state-of-charge needed to satisfy an ancillary service award.

The end-of-hour state-of-charge parameter requires modifications to a storage resource's real time market bid cost recovery. Bid cost recovery ensures that market participants are made whole up to the bids they submitted into the ISO market by comparing the resource's bid costs to its market revenues over the day. For resources using the end-of-hour state-of-charge parameter, Management proposes to exclude energy bid costs greater than market revenues in the hour of and the hour prior to exercising an end-of-hour state-of-charge bid. On the other hand, if energy bid costs are less than market revenues, then there will be no change in the bid cost recovery calculation. Similarly, Management proposes to exclude these revenue shortfalls in the hour prior to a self-schedule.[3] These revenue surpluses will continue to be included in the daily bid cost recovery settlement and used to offset any bid cost recovery shortfalls that may have been generated during the day. This change to the bid cost recovery rules is necessary because the storage resources that elect to either use the end-of-hour state of charge parameter or self-schedules can force the market to produce uneconomic dispatches.

2) Maximum daily run time parameter for demand response resources

Management proposes a maximum daily run time parameter so that demand response resource program limitations are respected in the market. This proposed parameter represents the maximum number of hours a demand response resource can be committed and dispatched on a daily basis. The parameter components and requirements are:

- The maximum daily run time will be identified in the ISO Master File as a resource specific characteristic representing a daily maximum number of hours the resource can be committed and dispatched;
- The parameter is optional;
- It is applicable to both proxy demand resources and reliability demand response resources; and

[3] Currently storage resources are ineligible for bid cost recovery during the hour they have self-scheduled. This proposal extends excluding revenue shortfalls generated in the hour prior to a self-schedule from the daily bid cost recovery settlement.

- Resources using the parameter must have a minimum 1 MW curtailment capability and register a maximum capacity value of 1 MW or greater.

Management proposes setting the 1 MW minimum size threshold due to concerns about market system performance degradation. The maximum daily run time parameter will add another market constraint to the market optimization process that could potentially be used by a significant number of small, fractional megawatt resources. Management proposes the 1 MW size threshold to mitigate the risk of the new constraint having significant impact on market system performance. If the ISO allowed use of a maximum daily run time parameter to all demand response resources regardless of size, the resulting impact on performance could result in the inability to complete the market run optimization by the 1:00 p.m. day-ahead market publishing deadline.

3) Streamlining contracts for non-generator resource participants

Management proposes a simple administrative fix to streamline the participation agreement process when bringing new non-generator resources into the market. Currently, non-generator resources must execute two distinct participation agreements: a Participating Load agreement and a Participating Generator agreement. With this proposed change, depending on the non-generator resource's participation capabilities, which can be either as load, a generator, or both, the ISO will only require one of these two participation agreements be executed. This administrative change will not affect non-generator resources' treatment in the ISO market and will not require resources with current agreements to execute new ones.

Capacity valuation and operational processes for variable-output demand response

As California transitions to a decarbonized grid, the ISO will rely more heavily on both variable and energy limited resources. Therefore, it is critical to assess the ability of the resource fleet, including preferred resources like demand response, to maintain system reliability by meeting energy needs every hour of the year. Most demand response resources exhibit a variable load curtailment nature and have strict energy limitations that affect the resource's ability to provide the energy associated with the resource's capacity. The qualifying capacity valuation methodology applied to demand response must consider its characteristics and nature to reflect demand response's contribution to system reliability and system resource adequacy needs.

Management contracted with Energy and Environmental Economics, Inc. (E3) to perform an Effective Load Carrying Capability study on demand response resources. Through this initiative, Management solicited stakeholder input to help form its recommendations to the CPUC and other local regulatory authorities regarding the appropriate methodology for establishing qualifying capacity values for variable-output demand response resources. Management also developed a methodology to operationalize and accommodate variable-output demand response as a resource adequacy resource in the ISO market if the CPUC and local regulatory authorities were to adopt such a methodology.

POSITIONS OF THE PARTIES

The stakeholder process provided significant education and information about energy storage technologies and demand response programs over the course of the ESDER 4 initiative. The proposed policies reflect this learning and understanding. Stakeholders shared market participation experiences and technology constraints and costs, along with insight into how resource availability decisions are made when participating in the market. This collaborative information exchange began with a stakeholder web conference held in February 2019 and ended with a last conference in August 2020. In total, six stakeholder web conferences and six on-site stakeholder working groups were held with 10 sets of stakeholder comments received and considered in the refinement of the ESDER 4 final proposal. Management expresses its thanks to the market participants that gave their time, attention, and experience to this stakeholder process and the valuable feedback they provided along the way that shaped the final version of the proposal. The following summarizes stakeholder comments received on the proposal providing optional energy storage and demand response resource market parameters and changes to required market participation agreements for non-generator resources.

Stakeholders were generally supportive of the optional end-of-hour state-of-charge parameter. Stakeholders were supportive of designing the parameter to include a minimum and maximum state-of-charge target for the end of the specified operating hour, and that the market optimization would respect the state-of-charge needed to meet an ancillary service award. While some stakeholders were supportive of excluding the resource from recovering costs if the market uneconomically dispatched the resource to meet the end-of-hour state-of-charge target, the CPUC and DMM raised concerns that this might lead to potential gaming opportunities, and that by excluding resources for the whole hour could hide profits as well as costs. Based on this feedback, the bid cost recovery element of the proposal was refined in the draft final proposal to incorporate a determination between costs and revenues during the ineligibility hours, including only surplus revenues generated during these two hours in the resources' final daily bid cost recovery settlement.

The proposals for reducing the number of market participation agreements required for non-generator resource participants and the addition of the maximum daily run time constraint for proxy demand and reliability demand responses resources received broad stakeholder support.

Demand response stakeholders expressed concern with applying an effective load carrying capability methodology for demand response, stating this would be a fundamental shift in how demand response is treated, that it may reduce the qualifying capacity of demand response resources as resource adequacy resources, and that additional details need to be developed. This shift to an effective load carrying capability methodology is important and timely given the needs of the transforming grid. The ISO plans to continue to work with stakeholders and the CPUC to refine further a demand

response-specific effective load carrying capability methodology to better understand and assess demand response's contribution to reliability.

CONCLUSION

The ESDER 4 proposal will further advance the efficient and effective use of energy storage and distributed energy resources in the wholesale markets. Management requests the Board approve the proposed items included in the proposal: 1) end-of-hour state-of-charge biddable parameter for storage resources; 2) establishing parameters to better reflect demand response resource operational characteristics; and 3) streamlining market participation agreements for non-generator resource participants.