BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

Order Instituting Rulemaking to consider policy and implementation refinements to the Energy Storage Procurement Framework and Design Program (D.13-10-040, D.14-10-045) and related Action Plan of the California Energy Storage Roadmap	Rulemaking 15-03-011 (Filed March 26, 2015)

COMMENTS OF THE CALIFORNIA INDEPENDENT SYSTEM OPERATOR CORPORATION ON TRACK 2 ISSUES

Pursuant to the Scoping Memo and Ruling Seeking Party Comments ("Scoping Memo") issued on January 5, 2016 by the California Public Utilities Commission ("CPUC"), the California Independent System Operator Corporation ("CAISO") respectfully submits these comments.[1]

I. BACKGROUND

The CAISO appreciates the opportunity to continue to work with the CPUC and stakeholders to expand and optimize energy storage in California. As the CPUC is aware, the CAISO currently is in the final stages of Phase 1 of its own Energy Storage and Distributed Energy Resource Stakeholder Initiative ("ESDER Initiative").[2] Enhancing the ability of energy storage and distributed energy

[1] Capitalized terms not otherwise defined herein have the meanings set forth in the CAISO tariff, and references to specific sections, articles, and appendices are references to sections, articles, and appendices in the current CAISO tariff and revised or proposed in this filing, unless otherwise indicated.

[2] The ESDER Initiative is the result of a 2013-2014 stakeholder initiative clarifying interconnection rules for storage, and the 2014 CAISO/CPUC/CEC California Energy Storage Roadmap. http://www.caiso.com/informed/Pages/StakeholderProcesses/EnergyStorage_AggregatedDistributedEnergyResources.aspx.

resources to participate in the CAISO wholesale market is the central focus of the ESDER Initiative. Through the ESDER Initiative, the CAISO has worked with stakeholders to identify and consider potential enhancements to existing requirements, rules, market products, and models for energy storage and distributed energy resource ("DER") market participation. On December 23, 2015 the CAISO published its revised draft final proposal,[3] which addressed the following issues for energy storage and DERs:

1. Enhancements to the CAISO market participation model for energy storage resources, called the non-generator resource model or "NGR."
2. Enhancements to demand response performance measures and statistical sampling for the CAISO proxy demand resource ("PDR") and reliability demand response resource ("RDRR") market participation models.
3. Clarifications to rules for non-resource adequacy multiple-use applications (provision of retail, distribution and wholesale services by the same resource).

The CAISO Board of Governors approved the resulting policy proposals requiring tariff changes during its February 3-4, 2016 meeting.[4] The CAISO's work on multiple-use applications will be discussed in detail in Section II, below.

In the second phase of the ESDER Initiative the CAISO intends to continue addressing policy issues to further enhance the ability of energy storage and distributed energy resources to participate in the wholesale market. This will include additional effort to clarify rules for multiple-use applications and for

[3] http://www.caiso.com/Documents/RevisedDraftFinalProposal-EnergyStorageDistributedEnergyResources.pdf.

[4] http://www.caiso.com/Documents/Decision_EnergyStorage_DistributedEnergyResourcesProposal-Memo-Feb2016.pdf.

station power. The CAISO will begin addressing this and other issues in the second phase of the ESDER Initiative in the first quarter of 2016.

II. COMMENTS ON TRACK 2 ISSUES

The CAISO takes this opportunity to comment on several issues identified for Track 2. On the remaining issues, the CAISO takes no position at this time.

A. Eligibility of Previously Excluded Storage Technologies

The Scoping Memo solicited comments to aid the CPUC in considering new or evolving circumstances that pertain to energy storage technologies previously excluded from energy storage procurement targets, particularly controlled electric vehicle charging and pumped storage projects greater than 50 MW. The CAISO therefore reiterates its comments in the CPUC's long-term procurement proceeding ("LTPP"), Docket No. R.13-12-010, and the related November 20, 2015 joint CPUC/CAISO/CEC workshop on bulk energy storage.

Over the past several years, the CAISO has identified over-generation and ramping concerns that have resulted and will continue to result due to increased renewable generation in California. Changes to the net load curve in the spring of 2015, for example, outpaced expectations, and significant renewable generation additions in 2016 and 2017 will only expedite the need for fast-ramping and flexible resources to balance the grid and mitigate over-generation.

To meet these growing needs, the CAISO and the CPUC must be prepared to implement solutions that will allow for the reliable operation of a highly dynamic grid. Energy storage, with its unique ability to both consume excess renewable energy and to quickly inject clean energy back onto the grid to

meet ramping and peak demand needs, has the potential to be a cornerstone of the new electric network. Pumped energy storage, in particular, can be constructed at large scale, with characteristics that are necessary to meet the grid's over-generation and ramping needs.

CAISO studies demonstrate that additional bulk energy storage with fast-ramping capabilities is essential to balance California's rapid rise toward a 50% renewable grid. Not only would California benefit from additional bulk energy storage resources such as pumped storage, California could be harmed without them. The CAISO therefore urges the CPUC to consider (a) increasing current procurement targets to allow for the capacity of bulk energy storage resources without subsuming the procurement of smaller and newer technologies, and (b) earmarking capacity within those procurement targets specifically for pumped storage.

B. Multiple-use Applications

(a) What are the energy storage configurations or use-cases that currently exist, or may exist in the future, that provide multiple services at the transmission and/or distribution level (e.g., provide both retail or distribution services and participate in the CAISO wholesale market)? Which of these configurations/use-cases are most likely to occur and should be considered first? Please identify specific regulatory issues under the CPUC's jurisdiction that need to be resolved to enable these multiple-use applications. Explain the "procedural home" where the regulatory issues identified should be resolved.

(b) What cost-recovery issues arise from the identified multiple-use applications? How should the CPUC address these? Are there any double-counting issues, such as double payments, overlapping value streams, or redundant compensation, and wholesale/retail energy charges that arise with multiple-use applications and that should be addressed by the CPUC?

Questions (a) and (b) are interrelated and the CAISO addresses them together. The viable revenue streams available to energy storage resources will

drive the number and variety of energy storage use-cases and configurations that will appear in the evolving DER marketplace. Revenue or "value streams" reflect the energy and capacity services energy storage resources can or will be able to provide and be compensated for, as new markets and energy services evolve across the energy supply chain.

Rocky Mountain Institute ("RMI") published a study on the economics of battery storage to address what services exist or may exist that will drive multi-use applications and the value proposition for energy storage. The study identified 13 services that energy storage can provide to three distinct stakeholder segments or areas of the supply chain, summarized in Table 1 below.[5]

STAKEHOLDER GROUPS	SERVICES
ISO/RTO SERVICES	• Energy Arbitrage • Frequency Regulation • Spin / Non-Spin Reserves • Voltage Support • Black Start
UTILITY SERVICES	• Resource Adequacy • Distribution Deferral • Transmission Congestion Relief • Transmission Deferral
CUSTOMER SERVICES	• Time-of-Use Bill Management • Increased PV Self-Consumption • Demand Charge Reduction • Back-up Power

[5] Rocky Mountain Institute Economics of Battery Storage study found here: http://www.rmi.org/Electricity

The list can be augmented in the future by distribution-level operational services currently being considered in the Commission's Distribution Resources Plan proceeding, services such as local voltage support and power quality that would be additional utility services in the above table. Definition of distribution-level services that can be provided by storage and other DER is also being considered in the More Than Smart working group, which is an ongoing venue for stakeholders interested in the growth of DER and their impacts to discuss related planning and implementation issues.

Although some of these services are not yet fully specified and ready to be turned into revenue streams, the list does reflect existing and potential future revenue opportunities storage and other DERs can provide assuming it has the right characteristics and, importantly, is interconnected at the right place. In particular, a key insight of the RMI study is that it matters where the resource is interconnected, because it affects services and value streams the device will be able to provide across the energy supply chain.

RMI points out that if a resource is interconnected to the ISO/RTO operated transmission system, it can offer only the ISO/RTO services, i.e., five of the thirteen services. However, if interconnected on the distribution system, in front of the customer meter, it can offer all four utility services, plus all five ISO/RTO services. Finally, a resource located behind the customer meter can offer all 13 services, four of the customer services and the other nine utility and ISO/RTO services. In other words, a resource's potential value and service offerings increase when it interconnects further out at the edge of the grid. This means we should expect to see use cases and configurations involving storage

devices located behind the customer meter that are designed to provide services directly to the customers where they are located and to the distribution and transmission systems. Moreover, because some of the distribution-level services that have been identified in concept have not yet been specified in sufficient detail for implementation, we should expect configurations that serve end-use customers and participate in the ISO/RTO markets to dominate the multi-use arena in the near term.

In response to the question posed, the multi-use scenarios reflect distributed energy resource owners offering combinations of these thirteen (or perhaps more) services to the three identified stakeholders: the ISO, UDC, and end-use customer. As an industry, we need to clearly define each service, its rules, performance requirements, measurement, etc., so that the incremental value each service provides is fairly paid to each resource that provides the service while safeguarding against fraud, manipulation, and unearned value.

For instance, interconnecting a device at the edge of the grid enables the resource owner to try and capture multiple value streams, between the customer and ISO/RTO. Two problematic multi-use scenarios emerge, including variations on these scenarios, which include offering services that are mutually exclusive, and selling the same energy or capacity twice without adding incremental value.

Mutually Exclusive Capacity and Energy

The offering of capacity and energy services can be mutually exclusive. An example from the CAISO market is a successful bidder in the ancillary services market cannot resell the energy behind the ancillary services capacity

award. For a spinning or non-spinning reserve award, the energy must be bid into the CAISO market and must remain available so that the CAISO can dispatch it if and when needed in a contingency. The CAISO has a means to monitor such activity and employs a no-pay settlement rule to subtract the ancillary services capacity payment if it finds that the energy behind an ancillary services capacity award was unavailable.

Another example of this mutual exclusivity between energy and capacity is when the capacity of a storage resource located behind a customer's meter is sold as resource adequacy capacity to an LSE, making that resource's capacity subject to a must-offer obligation. Because a storage resource has limited energy production capability, conflict can raise if the same capacity is also used to manage its host customer's demand charges and perform retail rate arbitrage. Because resource adequacy capacity comes with a must offer obligation, the energy is dedicated to the CAISO, but if the resource exhausts its charge before the CAISO needs to dispatch it, it will have violated its resource adequacy obligation to the CAISO.

Selling the Same Energy Twice

The sale and export of energy sourced in the distribution system and sold into the bulk power system via a Wholesale Direct Access Tariff ("WDAT") is an approved and acceptable means of providing energy services. The WDAT enables the safe and reliable interconnection of a distribution connected resource to sell its energy into the wholesale market. Other scenarios may exist that do not require a WDAT, but still allow resources behind the meter to export energy

onto the grid, such as with Net Energy Metering ("NEM"). What must be avoided is a resource getting paid two or more times for the same energy delivered, capturing unearned value by simultaneously selling and banking the same energy.

For example, a resource owner sells energy to the ISO/RTO from a large solar resource behind its facility meter, while the facility is enrolled under a utility's NEM tariff. The owner of the resource sets the resource up for participation in the CAISO market and bids the excess energy from the resource into the wholesale market. Simultaneously, the owner "banks" the excess energy from the resource under the NEM tariff to be withdrawn and consumed by the facility at a different time. In this simple example, the resource owner would receive a double value or compensation. Paid once by the CAISO for wholesale energy and a second time for the value of energy withdrawn and consumed at a later time via the NEM tariff, receiving two value streams for the same energy.

As next steps, the CAISO recommends the CPUC staff:

1. Refine and assess the list of energy and capacity services: Start with the 13 services identified by RMI and the distribution-level services being considered in the DRP proceeding, and then refine the list in ways meaningful to the CPUC and the market structures in California. Each service type can then be evaluated against different use-cases to test for new rules, incompatibilities, and requirements, ensuring every identified service delivers incremental value when bundled with other energy and capacity services under a multi-use scenario.

2. Identify energy and capacity services already compensated: The CPUC should identify what incentives, tariffs, and rates exist that already compensate for certain energy and capacity services as identified in the RMI study and refined in this proceeding. If a multi-use scenario emerges where one or more of these services are already compensated, then such multi-use applications should be modified or rejected to account for the services already compensated.
3. Establish guiding principles: The CAISO recommends CPUC staff work with interested parties to develop a set of principles that can be used to test the validity of different multi-use scenarios. For example, does each service in a multi-use scenario provide incremental value, or is the same energy or capacity service being sold twice with no added benefit. Questions like these can be turned into guiding principles and are instructive to evaluating myriad different multi-use scenarios that will emerge over time.

(c) Are existing interconnection requirements adequate to enable configurations/use cases involving behind-the-meter or in-front- of-the-meter energy storage to both provide retail and/or distribution services and participate in the CAISO wholesale market? If not, what is the applicable interconnection process that needs to be modified (i.e., Rule 21 or the Wholesale Distribution Access Tariff), and what specific modifications are needed to interconnect and enable multiple uses?

The CAISO suggests thinking about these questions in terms of use-cases and identifying where there may be a lack of certainty with regard to the applicable interconnection process, that is, identify where gaps may exist. To assist in this regard, the CAISO offers the following table illustrating what may be

the relevant spectrum of use cases in this context. Acronyms used in the table are defined as follows: "PDR/RDRR" refers to proxy demand resource and reliability demand response resource; "NGR" refers to non-generator resource, which is the market participation model for storage; and, "PG" refers to participating generator. All of these use-cases may include storage.

	Applicable interconnection process			
	Non-exporting		**Exporting**	
	PDR/RDRR	**NGR**	**PG**	**NGR**
In front of the end-use customer meter	N/A	N/A	WDAT	WDAT
Behind end-use customer meter	Rule 21?[6]	Rule 21?	N/A	?

As this table suggests, there are questions as to the applicable interconnection for behind-the-meter resources other than PDR/RDRR. In particular, clarity may be lacking on the applicable interconnection process for exporting distribution-connected resources located behind the end-use customer meter that seek to participate in the CAISO market. It is the CAISO's view that such resources will need to comply with utility distribution company tariffs and requirements of the CPUC. But those tariffs and requirements may require further enhancements.

[6] In the PDR/RDRR case where a behind-the-meter generation device exists, it may be less clear that Rule 21 is the appropriate interconnection process.

(d) What jurisdictional metering and sub-metering requirements are relevant to BTM and IFOM multi-use configurations? Are existing metering and sub-metering requirements adequate to enable configurations/use cases involving BTM energy storage to both provide retail and distribution services and participate in the CAISO wholesale market? If not, what specific modifications are needed to metering and sub-metering requirements to enable multiple-use applications?

The CAISO would look to the CPUC to establish the minimum requirements on accuracy, safety and security for participation of distributed energy resources – both in front of and behind the end-use customer meter – in accordance with the CAISO's Scheduling Coordinator Meter Entity provisions. Such provisions look to the local regulatory authority for definition of revenue quality metering and processes (i.e., validation, estimation and editing) required in the development of settlement quality meter data ("SQMD") submitted to the ISO for settlement of wholesale participation.

The CAISO is currently unclear as to whether or not there are sufficient local regulatory authority provisions and requirements for all multi-use configurations. Where such provisions exist, the CAISO recommends that these be further vetted for applicability to current and emerging use cases. There appears to be limited provision for recognition of any measurement devices other than current utility grade metering, and for the use of separate meters on devices such as battery storage located behind the customer meter. Alternative metering configurations and newer measurement technologies must be explored to determine and develop their acceptability in the provision of retail distribution services and for wholesale market services.

(e) Explain how dispatch coordination and prioritization should work for resources that have agreed to provide services to more than one entity (e.g. a contract to provide distribution asset deferral and resource adequacy capacity)? How should settlement be handled?

In the recently completed phase 1 of the ESDER Initiative the CAISO addressed dispatch prioritization for DERs that bid into the CAISO market and provide services to the end-use customer or the distribution system, for the situation where the resource is *not* also providing resource adequacy capacity. Thus the focus for this proceeding should emphasize dispatch prioritization for the resource adequacy case, where the resource is obligated to be available to the CAISO per the terms of the resource adequacy requirements.

(f) Should the CPUC hold one or more joint workshop(s) with the CAISO to address any of the topics outlined above?

The CAISO agrees that holding one or more joint workshops would be beneficial and looks forward to collaborating with the CPUC to plan and conduct the workshop(s).

C. Station Power

The CAISO takes this opportunity first to clarify its existing station power definition before discussing how station power can be enhanced for the unique technological characteristics and energy use of energy storage resources (e.g., regulating the temperature of batteries).

The CAISO tariff defines station power as “energy for operating electric equipment, or portions thereof, located on the Generating Unit site owned by the same entity that owns the Generating Unit, which electrical equipment is used exclusively for the production of Energy and any useful thermal energy

associated with the production of Energy by the Generating Unit; and for the incidental heating, lighting, air conditioning and office equipment needs of buildings, or portions thereof, that are owned by the same entity that owns the Generating Unit; located on the Generating Unit site; and used exclusively in connection with the production of Energy and any useful thermal energy associated with the production of Energy by the Generating Unit."[7] The CAISO tariff explicitly states that station power includes, for example, the energy associated with motoring a hydroelectric generating unit to keep the unit synchronized at zero real power output to provide regulation or spinning reserve.[8] Importantly, because the CAISO tariff allows for netting of consumption against output within a five-minute interval, station power under the CAISO tariff is only measured as the amount of consumption that exceeds output within a five-minute interval.[9]

As part of the CAISO's new resource implementation process, the CAISO verifies that new resources have a load serving entity in place to meet station power needs prior to commercial operation. Similarly, an energy storage facility owner should consult with its load serving entity to determine how retail charges may apply to its station power consumption.

[7] Appendix A to the CAISO tariff.

[8] Station power does *not* include any energy used to power synchronous condensers; used for pumping at a pumped storage facility; provided during a black start procedure; or to serve loads outside the CAISO Balancing Authority Area.

[9] *See* Sections 10.1.3, 10.2.9.2, and 10.3.2.2 of the CAISO tariff.

As mentioned above, the CAISO recognizes the need to further evaluate methods to distinguish between wholesale charging energy and station power, which the CAISO plans to do early this year as part of the second phase of its ESDER Initiative. The CAISO therefore welcomes comments in this proceeding and the ESDER Initiative on, for example, the merits and drawbacks of treating battery regulation as wholesale charging or station power; possible metering and battery configurations that would enable distinguishing among traditional station power uses, charging, and battery regulation; and any other areas where additional clarifications or enhancements to CAISO rules are warranted. Revising the definition of station power to allow for energy consumed to regulate batteries could require revision to the CAISO tariff's definition of station power, which would require FERC approval. Moreover, the Federal Power Act requires equal treatment of similarly situated customers, so there would have to be a compelling difference between, for example, energy consumed to regulate battery temperature and energy consumed to start a combustion generator in order to consider one wholesale and the other retail.

Although the CAISO will evaluate this topic through its own initiative, the CAISO will continue to coordinate with the CPUC and stakeholders in this proceeding as well.

Respectfully submitted,

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