# Energy Storage and Distributed Energy Resources Phase 2

## Draft Final Proposal

**June 8, 2017**

**Market & Infrastructure Policy**

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# 1 Executive Summary

The central focus of the California Independent System Operator's ("CAISO") energy storage and distributed energy resources ("ESDER") initiative is to lower barriers and enhance the ability of transmission grid-connected energy storage and distribution-connected resources, i.e., distributed energy resources ("DER"), [1] to participate in the CAISO market. The number and diversity of these resources are growing and represent an increasingly important part of the resource mix. Integrating these resources will help lower carbon emissions and add operational flexibility.

The ESDER initiative is an omnibus initiative covering several related but distinct topics. For the second phase of ESDER, i.e., "ESDER 2" these topics include demand response ("DR"), non-generator resources ("NGR"), multiple-use applications ("MUA"), and station power for storage resources. ESDER 2 is taking multiple approaches to pursue and address each topic. For example, in the case of the DR topic, a stakeholder-led working group – the Baseline Analysis Working Group ("BAWG") is discussing and recommending stakeholder-desired enhancements to the proxy demand resource ("PDR") performance evaluation methods. The proposal produced by this working group is not the ISO's proposal, but is the work product of the working group. A working group for the NGR topic is exploring use-limitations for storage resources. A different approach is being used for the remaining two topics of ESDER 2 – MUA and station power for storage resources – wherein the ISO is continuing its efforts to address these two topics in collaboration with the California Public Utility Commission ("CPUC") through its energy storage proceeding.[2]

In this third revised straw proposal, the ISO presents the status of its work in addressing the four topics of ESDER 2. The ISO is preparing to submit three topics – DR enhancements in the form of alternative baselines, distinguishing between charging energy and station power, and a net benefits test for DR resources that participate in the Energy Imbalance market ("EIM") - for approval by the CAISO Board on July 26-27, 2017. The ISO will continue collaborating with stakeholders on the remaining ESDER 2 topics in a phased policy approach that is appropriate in a rapidly evolving market environment that currently does not have a clear end state. In this situation, an incremental approach best serves the CAISO as it observes and learns from the changes occurring and their influence on the diversity and decentralization of resources serving

[1] DERs 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.
[2] CPUC Rulemaking 15-03-011.

grid operations. The ISO will carry forward into a new ESDER Phase 3 ("ESDER 3") stakeholder initiative any topics that are not approved by the ISO Board in 2017. ESDER 3 will start in September 2017 with the posting of an issue paper.

# 2 Stakeholder Process

The CAISO is at the "Draft Final Proposal" stage in the ESDER 2 stakeholder process. Figure 1 below shows the status of the draft final proposal within the overall ESDER 2 stakeholder process.

**Figure 1**
**Stakeholder Process for ESDER 2 Stakeholder Initiative**

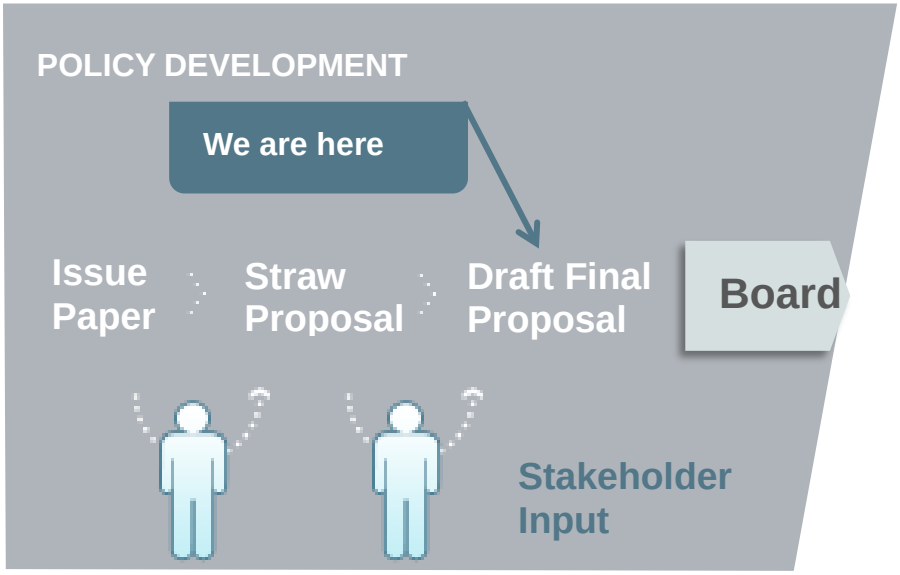



Table 1 below summarizes the major milestones for the ESDER 2 and ESDER 3 stakeholder initiatives. Table 1 does not include implementation steps, including milestones for developing and filing the tariff amendments, changes to CAISO business practice manuals, and changes to implement new market system software and hardware.

The policy issues in ESDER 2 will affect the CAISO's EIM where a participating EIM entity may employ the CAISO's demand response resource and distributed energy resource functionality in its EIM entity area. Therefore, the EIM Governing Body will have an advisory role in approving the policies resulting from this initiative, and the ISO will present its ESDER 2 proposal at the July 13, 2017 EIM Governing Body meeting.

The ISO will present its ESDER 2 proposal to the CAISO Board of Governors for approval on July 26-27, 2017. Stakeholders will have a final opportunity to provide written

comments on the draft final proposal by June 23, 2017 and prior to the Board of Governors meeting.

**Table 1**
**ESDER 2 and ESDER 3 Stakeholder Process Schedule**
**(Shaded Milestones are completed)**

| Milestone | Date | Activity |
|---|---|---|
| ESDER 2 Issue Paper | March 22, 2016 | Post ESDER 2 issue paper |
| | April 4 | Hold stakeholder web conference |
| | April 18 | Stakeholder written comments due |
| Straw Proposal | May 24 | Post ESDER 2 straw proposal |
| | May 31 | Hold stakeholder web conference |
| | June 9 | Stakeholder written comments due |
| Revised Straw Proposal | July 21 | Post ESDER 2 revised straw proposal |
| | July 28 | Hold stakeholder web conference |
| | August 11 | Stakeholder written comments due |
| Second Revised Straw Proposal | September 19 | Post ESDER second revised straw proposal |
| | September 27 | Hold stakeholder web conference |
| | October 11, 2016 | Stakeholder written comments due |
| Third Revised Straw Proposal | April 17, 2017 | Post ESDER 2 third revised straw proposal |
| | May 4 | Hold stakeholder meeting |
| | May 18 | Stakeholder written comments due |
| Draft Final Proposal | June 8 | Post ESDER 2 draft final proposal |
| | June 15 | Hold stakeholder meeting |
| | June 23 | Stakeholder written comments due |
| Presentation to EIM Governing Body | July 13 | Present ESDER 2 proposal at Energy Imbalance Market Governing Body meeting |
| Presentation to Board for Approval | July 26-27 | Present ESDER proposal for approval at ISO Board meeting |
| ESDER 3 Issue Paper | September 29 | Post ESDER 3 issue paper |

The CAISO received comments from stakeholders on all of the topics discussed in the April 17, 2017 Third Revised Straw Proposal.[3] The CAISO incorporates written stakeholder comments and CAISO responses in the sections below by ESDER 2 topic.

# 3 Introduction

The central focus of the ESDER initiative is to lower barriers and enhance the ability of transmission grid-connected energy storage and DER to participate in the CAISO market. The number and diversity of these resources is growing and represent an increasingly important part of the resource mix. Integrating these resources will help lower carbon emissions and add operational flexibility.

In 2015, the CAISO conducted the first phase of ESDER ("ESDER 1")[4], which made progress in enhancing the ability of storage and DER to participate in CAISO markets. The CAISO worked with stakeholders to develop policy proposals. The CAISO Board approved proposals that needed tariff changes – enhancements to the NGR model and enhancements to DR performance measures – at its February 3-4, 2016 meeting. The CAISO filed tariff changes with FERC on May 18, 2016.[5] On August 16, 2016, FERC accepted the tariff revisions effective October 1, 2016.[6]

In 2016, the CAISO began ESDER 2 to explore additional topics of interest to stakeholders.

- In its March 22, 2016 ESDER 2 issue paper, the CAISO proposed the following topics: further NGR model enhancements, further DR enhancements, further

[3] (1) Alta Gas – Pomona Energy Storage (Pomona); (2)California Energy Storage Alliance ("CESA"); (3) California Efficiency and Demand management Council; (4) California Hydrogen Business Council (CHBC); (5) California Energy Storage Alliance ("CESA"); (6) California Large Energy Consumers Association ("CLECA"); (7) Electric Motor Werks, Inc. (eMotorWerks); (8) Independent Energy Producers Association (IEP); (9) Pacific Gas & Electric Company ("PG&E"); (10) Cities of Anaheim, Azusa, Banning, Colton, Pasadena, and Riverside, California (the "Six Cities");(11) Stem Inc.;(12) Tesla; (13) Trans Bay Cable, and (14) Department of Market Monitoring (DMM) submitted written stakeholder comments on the April 17, 2017 third revised straw proposal.

[4] More information about ESDER 1 may be found at: http://www.caiso.com/informed/Pages/StakeholderProcesses/EnergyStorage_DistributedEnergyResourcesphase1.aspx.

[5] The ESDER 1 tariff filing may be found at: http://www.caiso.com/Documents/May18_2016_TariffAmendment_ImplementEnergyStorageEnhancements_ER16-1735.pdf

[6] http://www.caiso.com/Documents/Aug16_2016_LetterOrderAcceptingTariffAmendment_EnergyStorage_DistributionEnergyResourceInitiative_ER16-1735.pdf

work on MUA, clarify station power for energy storage, and review the allocation of transmission access charge to load served by DER.

- In its May 24, 2016 straw proposal, the CAISO refined the scope of topics for ESDER 2 and clarified its proposed direction on these topics based on stakeholder feedback, i.e., feedback received from both written comments and the joint workshop held with the CPUC.
- In its July 21, 2016 revised straw proposal, the CAISO further refined topics in scope and made progress in developing proposals to address those issues.
- In its September 19, 2016 second revised straw proposal, the CAISO presented the status of its work with stakeholders in addressing the four topics of ESDER 2.
- In its April 17, 2017 third revised straw proposal, the CAISO presented the status of its work with stakeholders in addressing the four topics from the ESDER 2 second revised straw proposal, introduction of a new topic, and developed proposals on three topics that the CAISO proposes to take to the CAISO Board for approval on July 26-27, 2017.
- In this June 8, 2017 draft final proposal, the CAISO provides additional detail on its final proposals for the three topics that will go before the CAISO Board for approval in July and summarizes the status of the remaining ESDER 2 topics, including a discussion of future topics considered in the ESDER 3 initiative.

# 4 Changes from Third Revised Straw Proposal

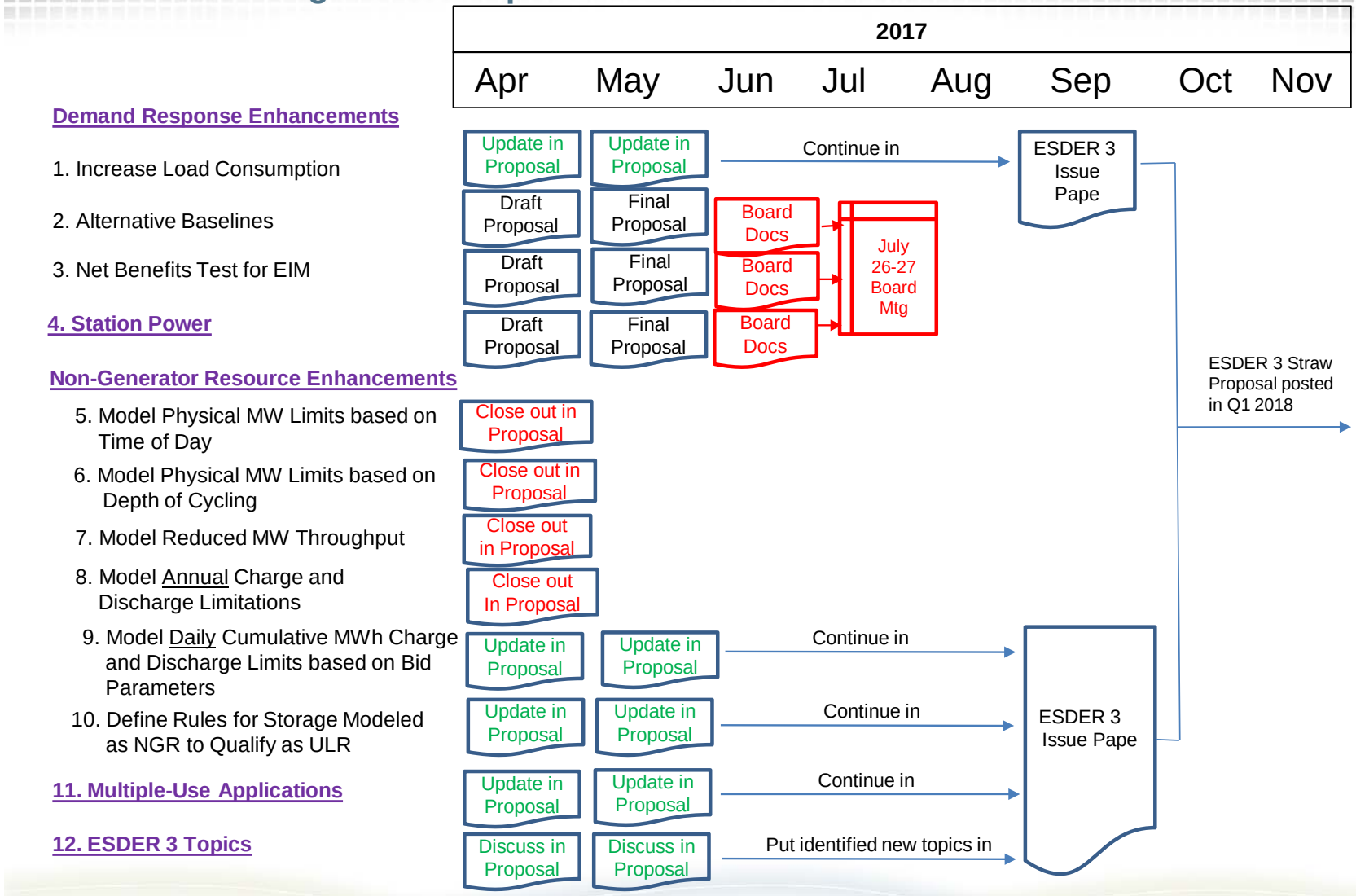
This section discusses the changes in the draft final proposal the CAISO made since the third revised straw proposal. The major changes are:

1. Finalized proposals that are ready for approval by the CAISO Board at the July 26-27, ISO Board meeting, and the topics that the CAISO believes require additional discussion in ESDER 3.
2. Provided a finalized proposal from the BAWG working group on DR enhancements in the form of alternative baselines, which the CAISO plans to present for approval at the July 26-27, 2017 Board meeting.
3. Provided an updated proposal from the ISO on distinguishing between charging energy and station power, which the CAISO plans to present for approval at the July 26-27, 2017 Board meeting.

4. Provided further detail on the proposal introduced by the CAISO in the third revised straw proposal changing how the threshold price for demand response, determined by the net benefits test, is developed to account for EIM participant bidding, which the CAISO plans to present for approval at the July 26-27, 2017 Board meeting.
5. Provided updated discussion on the following three ESDER 2 topics that the CAISO does not plan to take to the July 26-27, 2017 Board meeting: DR enhancement in the form of increased load consumption, NGR enhancements, and MUA.

Figure 2 on the following page shows the breakout of the scope between ESDER 2 and ESDER 3, as well as the general timeline of the ESDER stakeholder process.

## Figure 2 - Scope Breakout - ESDER 2 and ESDER 3



# 5 Proposals for July 26-27, 2017 Board Meeting

The CAISO will seek approval of the following three topics at the CAISO Board meeting on July 26-27, 2017: (1) alternative baselines to enhance DR, (2) distinguishing between charging energy and station power; and 3) changes to the net benefits test for Demand Response. This section of the paper discusses these three topics.

## 5.1 Alternative Baselines to Enhance DR

In this section, the ISO summarizes the written comments received from stakeholders on its third revised straw proposal, the CAISO's response to those written comments, and the CAISO's final straw proposal.

### *5.1.1 Stakeholder Comments to Third Revised Straw Proposal*

A majority of stakeholders were supportive of the work and proposal developed by the BAWG. Stakeholders who supported the proposal stated that the use of additional baselines for residential and non-residential customers would improve the accuracy and reduce bias in the performance calculation in comparison to the 10 in 10 customer load baseline methodology[7] (CLB) option currently available. CLECA commented that the CAISO's proposal to establish an approval process and auditing of a Demand Response Providers ("DRPs") use of an alternative baseline "will be important to provide assurance that these are being performed correctly". Market participants also commented on process impacts to incorporate and calculate their own resource's performance using the new baselines and the existing 10 in 10 CLB calculation, which under this proposal would shift from the CAISO performing the calculation using its demand response system (DRS) [8] to the demand response provider through its scheduling coordinator. Stakeholders request that impacts of shifting the calculation responsibility to the demand response provider and its scheduling coordinator be consider in the timing of the proposal implementation. Stakeholders also commented on the auditing procedures of the SQMD and the importance of incorporating validation provisions within it.

[7] See DRS User Guide for DR Energy Measurement Adjustment for Real Time beginning on page 160 http://www.caiso.com/Documents/DemandResponseUserGuide.pdf

[8] The CAISO plans to retire its legacy Demand Response System once the demand response providers and their scheduling coordinator take responsibility for calculating their resources' performance using the approved baselines.

### 5.1.1 ISO Response to Stakeholder Comments

The CAISO appreciates the overwhelming support of the alternative baseline proposal. In agreement with other stakeholders, the CAISO would like to recognize the tremendous work by the BAWG. The CAISO believes that it has addressed many of the comments through the frequent working group conference calls and multiple releases of the BAWG proposal. In response to comments received requesting additional implementation detail and timeline consideration, the CAISO will ensure consideration of identified impacts when developing the implementation plan. The CAISO believes, supported by stakeholder comments, having both current and newly proposed CLB calculations performed by the DRP, or DRPs SC, provides all parties greater flexibility in the consideration of new baselines and ease of their deployment. In response to stakeholder comments for clarification of auditing of CLB results submitted by the DRP or DRPS SC as settlement quality meter data (SQMD), the CAISO has provided additional insight to the structure of the auditing process. The CAISO is committed to continue working with stakeholders on the provision of additional detail during the implementation phase including further engagement, and opportunity for review and comment, throughout its tariff development and business practice manual (BPM) stakeholder processes.

### 5.1.2 Draft Final Proposal

This section summarizes the alternative baselines proposed by the BAWG. The BAWG focused on three major areas of research and analysis.

- The use of alternative traditional baseline methods to estimate the load impact of current DR resources.
- The option of using control groups rather than traditional baselines to estimate the load impacts of DR resources.
- The impact of frequently dispatched resources in the evaluation of baselines.

The complete BAWG proposal, including detail on multiple baselines accuracy assessments performed in development of this proposal, has been posted to the ESDER Phase 2 Initiative website at:

http://www.caiso.com/Documents/2017BaselineAccuracyWorkGroupFinalProposalNexant.pdf

The BAWG proposal includes updates from its last publication as follows:

- Spreadsheet examples embedded in the proposal are separately posted on the ESDER 2 website
- Inclusion of requirement to zero out calculated demand reductions if they are negative (i.e., load increases) footnoted in the spreadsheet examples.

- Addition of footnote to Section 3 recommendation table clarifying how to use proposed baselines when resource is composed of both residential and non-residential customers.
- Addition of footnote to the Section 3 recommendation table defining residential and non-residential customers.

The CAISO currently provides multiple performance evaluation methodology options for PDR and RDRR [9] however, the only day matching performance evaluation method offered uses a 10 in 10 customer load baseline with a 20% same day adjustment. While research has shown this day matching baseline to be accurate for many medium and large commercial and industrial customers, research has also shown that this baseline is not accurate for all customer types. The objective of the BAWG was to identify additional performance evaluation methodology options, which, when offered in addition to the 10 in 10 customer load baseline, will enable a wider variety of CAISO DR resources to be accurately estimated and settled.

The BAWG analyzed and proposed the three types of customer load baseline methodologies summarized below.

- **Control Groups**
  A control group performance evaluation method determines a resource's performance by evaluating the energy consumption of a set of similar, but non-participating customers with the energy consumption of the participating customers. A control group should be made of customers who have nearly identical load patterns and experience the same weather patterns and conditions as the customers dispatched. The control group establishes the baseline of what load patterns would have been absent the curtailment event. There are three ways to establish valid control groups: random assignment of customers, random assignment of clusters, and matching.

- **Day Matching**
  Day-matching baselines estimate what electricity use would have been in the absence of a DR dispatch, relying exclusively on the electricity use data from the dispatched customers. The load patterns during a subset of non-event days are used to estimate the baseline for the event day. A total of 13 day matching baselines were evaluated to determine the most accurate and precise of the 13.

- **Weather Matching**

[9] See DRS User Guide for available Performance Evaluation Methodologies beginning on page 149 http://www.caiso.com/Documents/DemandResponseUserGuide.pdf.

Like-day-matching baselines, weather-matching baselines estimate what electricity use would have been in the absence of dispatch by relying exclusively on electricity use data from the dispatched customers. The load patterns with the most similar weather conditions during a subset of non-event days are used to estimate the baseline for the event day. Weather matching baselines do not include information from an external control group. A total of seven weather-matching baselines were evaluated to determine the most accurate and precise of the seven.

The CAISO accepts the following recommended additional performance evaluation methodologies as proposed by the BAWG, summarized in Table 2 below.

**Table 2: BAWG's Recommended Baselines for ISO Performance Evaluation Methodologies[10]**

| Customer Segment[11] | Weekday | Baselines Recommended | Adjustment Caps |
|---|---|---|---|
| Residential | Weekday | Control group | +/- 40% |
| | | 4 day weather matching using maximum temperature | +/- 40% |
| | | Highest 5/10 day matching | +/- 40% |
| | Weekend | Control group | +/- 40% |
| | | 4 day weather matching using maximum temperature | +/- 40% |
| | | Highest 3/5 weighted day matching | +/- 40% |
| Non-residential | Weekday | Control Group | +/- 40% |
| | | 4 day weather matching using maximum temperature | +/- 40% |
| | | 10/10 day matching | +/- 20% |
| | Weekend | Control group | +/- 40% |
| | | 4 day weather matching using maximum temperature | +/- 40% |
| | | 4 eligible days immediately prior (4/4) | +/-20% |

The proposal considered the best performing baselines for residential and non-residential loads. The analysis showed that randomized control groups with sample sizes between 200 and 400 participants were more than twice as precise as day or weather matching baselines. The addition of day or weather matching baselines provides alternative options for DRPs that do not have the proposed minimum size of

[10] In the case of PDR resources that combine residential and non-residential customers, the aggregate baselines for the two customer groups should be calculated separately using the appropriate baseline for residential and non-residential customers, then added together to represent the full resource. This subdivision is not necessary if the baseline method for both residential and non-residential customers is the same, as is the case for the current recommended weather matching baselines.

[11] A customer's rate class, established by their local distribution company LDC, determines the customer's residential or non-residential designation. That is, if a customer is served under a non-residential LDC rate, that customer classification is non-residential customer.

150 participants. Section 3.1-3.3 in the BAWG proposal details the process and rules for each baseline and are included as Appendices A-C in this proposal.

The BAWG recognizes that the proposed performance calculation results provided to the CAISO as SQMD must be in intervals of five minutes when a PDR or RDRR offers real-time or ancillary services (non-spin and spinning reserve) and has concurred with CAISO's proposal on how a 5-minute performance measurement could be derived. Therefore, it is recommending that the current method used by the CAISO, in conjunction with the 10 in 10 customer load baseline methodology, be applied when using any of the BAWG proposed methodologies. In summary, to achieve a 5-minute DR Energy Measurement[12], an hourly baseline is pro-rated to create a 5-minute baseline from which the 5-minute interval actual load, measured during the event, is subtracted. The CAISO would maintain its current requirement that baselines, and measured load during the event, be derived using, at maximum, a 15-minute interval load measurement when the PDR or RDRR is participating in real-time or for PDR ancillary service markets participation. For greater flexibility and timely baseline implementation, the CAISO is proposing to have all baseline calculations, including the current 10 in 10 customer load baseline, performed by the DRP or its SC and submitted to the CAISO by the SC as SQMD. Shifting this responsibility to the SC accelerates the needed retirement of the CAISO's legacy Demand Response System and gives the SC access to the CAISO's Market Results Interface- Settlements ("MRI-S") system to submit, view, export and upload SQMD in batch files. The CAISO believes this change will provide a more consistent and flexible approach to performance calculation management and SQMD processing.

The CAISO will continue to rely on a pre-established approval process for use of a performance methodology that requires the DRP to submit a request with detail on how they will perform calculations in compliance with tariff requirements for the methodology requested. Additionally, the CAISO will continue to leverage auditing provisions including the bi-annual SC self-audit and, on an as-needed basis, selective auditing to ensure accurate development and submission of SQMD to the CAISO.

With the addition of new baselines, the CAISO will establish a three-step registration and auditing process described at a high level below. The CAISO will continue to obtain and review stakeholder feedback on the specifics of the review and audit processes during the development of the Business Practice Manual (BPM) and the DR User Guide language.

[12] The resulting Energy quantity calculated by comparing the applicable performance evaluation methodology of a PDR or RDRR against its actual underlying performance for a Demand Response Event.

The CAISO will establish an internal three-step process to register an SC's requested baseline and monitoring with selective auditing program to ensure accurate development and submission of SQMD.

1. **Baseline Registration**
   The CAISO will collect all registered baseline calculations, required information and justification for the baseline designation for each DR resource. Performance of the monitoring and auditing processes below will utilize this registration database.

2. **Monitor**
   The CAISO will review and monitor SQMD with references to bids and event days of all DR participants.

3. **Audit**
   Using available auditing provisions, the CAISO will audit DR resources to ensure the accurate development and submission of SQMD.

## 5.2 Distinguishing between Charging Energy and Station Power

### *5.2.1 Background*

Throughout this initiative, the CAISO has worked toward resolving potential issues in distinguishing between wholesale "charging energy" and retail station power. The CAISO examined this topic area through its collaboration with the CPUC in Track 2 of the CPUC's energy storage proceeding (CPUC Rulemaking 15-03-011) and through ESDER 2. This dual-track effort recognizes that the CAISO's efforts in re-defining station power from a wholesale perspective could be counter-productive if the CPUC makes different station power determinations from a retail perspective.[13] Without careful consideration between the CPUC and the CAISO, incompatible retail and wholesale station power rules could result in the same energy incurring both wholesale and retail charges, resuscitating the years of litigation that preceded the current station power framework.[14] The CAISO believes it is important that its station power regulations be consistent with the CPUC's, and vice versa.

The CAISO tariff currently defines station power as "energy for operating electric equipment, or portions thereof, located on the Generating Unit site owned by the same

[13] See, e.g., *Southern California Edison Co. v. FERC*, 603 F.3d 996, 1002 (D.C. Cir. 2010)
[14] See, e.g., *id.*; *Calpine Corp. v. FERC*, 702 F.3d 41 (2012); *Duke Energy Moss Landing LLC v. CAISO*, 134 FERC ¶ 61,151 (2011).

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."[15] The CAISO tariff specifically excludes from its station power definition "any Energy used to power synchronous condensers; used for pumping at a pumped storage facility; or provided during a Black Start procedure. Station Power [further] does not include Energy to serve loads outside the CAISO Balancing Authority Area."

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.[16]

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.

### 5.2.1 Stakeholder Comments to Third Revised Straw Proposal

Stakeholders support the CAISO's efforts to clearly distinguish between wholesale and retail energy consumption activities by energy storage devices and conventional generation. Stakeholders focused their comments on two aspects of this distinction: the tariff definition of station power and metering rules for resources.

Regarding the definition of station power, stakeholders either supported expanding the definition to list retail examples and wholesale examples consistent with the CPUC's decision, or supported simplifying the definition. For example, the Six Cities commented that they "are not opposed to the CAISO's proposal to 'reduce the amount of verbiage' in the current definition of station power, the Six Cities are concerned that the proposed definition could result in a lack of clarity." PG&E, however, notes that "the additional modification to exclude specific uses from station power could be inconsistent with the definition and implementation of station power in conventional generation." Other parties offered specific use cases they would like added for clarity.

[15] Appendix A to the ISO tariff.
[16] 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 ISO BAA.

Regarding metering rules, stakeholders supported deference to the local energy provider and the resource, or favored mandating separate metering for wholesale and retail activities (i.e., in lieu of the option for a single meter with a fee or calculation for station power based on agreement, testing, etc.). Other stakeholders suggested that the two may not be mutually exclusive, and that the CAISO should defer to retail authorities while mandating separate metering.

### *5.2.2 Draft Final Proposal*

Stakeholder comments reflect one general theme: station power is a retail issue. As such, the CAISO's efforts to mirror retail rules in its wholesale tariff may be unwise. After all, the CAISO's tariff can be consistent with retail tariffs by reference or adoption instead of copying exact language.

The CPUC's recent decision on station power rules for energy storage resources demonstrates that listing specific use cases of either retail or wholesale functions in the CAISO tariff would prove futile given the extraordinary number of use cases that could exist as systems and technologies evolve. Additionally, the CPUC is not the only local regulatory authority in the CAISO, so its findings are not binding on all CAISO resources. Second, other local regulatory authorities may define station power use cases differently than the CPUC. Third, the need to list use cases as retail or wholesale will not be complete any time soon, as myriad new technologies present themselves each year. As such, the CAISO believes that it is prudent to simplify the definition of station power to energy for operating the electrical equipment of an energy resource subject to a retail tariff, as defined by the Local Regulatory Authority. This definition would allow the CAISO's practices to remain consistent with all local regulatory authority definitions, even as they may change in the future. Put another way, this definition would avoid any conflict with changing or varying station power definitions, which also would obviate the need to change the CAISO's definition in the future if the CPUC or another local regulatory authority revised its rules because of innovation, need, or policy. The CAISO intends to work with stakeholders in the tariff development process to ensure that this approach is sufficiently flexible and clear.

The CAISO understands that examples and use cases of wholesale and retail uses can provide meaningful guidance to potential and current market participants; however, the CAISO does not believe that the tariff is the best place to do so. The CAISO thus proposes to work with stakeholders to implement Business Practice Manual revisions that provide useful examples.

The CAISO also believes that deference to local regulatory authorities on metering station power is both prudent and required. The CAISO agrees with CESA and others

that "the CAISO should not at this time pursue or establish metering criteria, but should direct principled metering such that wholesale and costs can be reasonably differentiated and calculated as separate from retail costs." PG&E, notes, for example, that it "has concerns when not having separate metering," though others may not. In any case, it is reasonable to rely on the assumption that the local energy providers themselves under the authority of their local regulatory authority will ensure that resources' station power is accurately metered and settled, and as such, the CAISO itself does not need its own detailed rules on doing so. Moreover, it is both the local energy provider's interest and responsibility to ensure that that its customers are not avoiding retail charges. The CAISO thus proposes simply to state in its metering tariff provisions that, as part of the interconnection process, generating units interconnecting to the CAISO will work with their local energy provider to ensure that their metering configurations accurately account for station power, where and as required by local regulatory authorities. The CAISO believes that this approach will avoid interfering with any resource and its local energy provider coming to a mutually agreeable metering configuration consistent with local regulatory authority standards.

## 5.3 Net Benefits Test

### *5.3.1 Stakeholder Comments to Third Revised Straw Proposal*

Stakeholders were either supportive/did not oppose or had no position on the proposal to include additional gas price indices in the net benefits test NBT calculation. PG&E recommended a set of gas price indices for EIM participants.

### *5.3.2 ISO Response to Stakeholder Comments*

The CAISO is currently in the process of updating its Business Practice Manual for the inclusion of the various EIM gas price indices.

### *5.3.3 Draft Final Proposal*

The DR-net benefits test establishes a price threshold above which DR resource bids are deemed cost effective. CAISO staff, along with the Department of Market Monitoring ("DMM"), identified a gap in the DR net benefits test formula as it applies to EIM entities.

Currently, an adjustment is made to the supply curve used in calculating the DR net benefits test to reflect differences in resource availability and fuel prices between the target and reference month. The CAISO tariff explicitly states that significant changes in fuel prices will be determined by using a simple average of the Pacific Gas and Electric

Company Citygate price and the Southern California Edison Company Citygate price.[17] If neither of the prices are available, then the formula will default to the Henry Hub price.[18]

The CAISO is proposing to expand the list of gas price indices available for use in the calculation of the DR net benefits test to represent prices relevant to EIM entities outside of California. The fuel indices will be included in the business practice manual for market instruments rather than hardcoded in the CAISO tariff.[19] The proposal aligns the need for the DR net benefits test to recognize a variety of regional gas price indices, which will accommodate EIM entities outside of California that want to participate as DR in the CAISO market.

# 6 ESDER 2 Topics that require Further Development

This section discusses the following three topics that began development as part of the ESDER 2 effort, but were determined not to be ready for CAISO Board approval in July 2017: increase load consumption as DR enhancements, NGR enhancements, and MUA. The CAISO will further develop the topics discussed in this section over the rest of 2017, obtaining additional feedback from stakeholder during ESDER 2 with continued development occurring in the ESDER 3 stakeholder processes.

## 6.1 Increase Load Consumption as Demand Response Enhancement

In this section, the CAISO summarizes the discussion on this topic that occurred in the third revised straw proposal, the latest written comments received from stakeholders, the CAISO's response to those written comments, and the status of this effort. For completeness of the record, the CAISO begins this section by including prior stakeholder comments and CAISO responses to the ESDER 2 second revised straw proposal. A summary of the Stakeholder comments received on the third revised straw proposal, and the CAISO's responses to those comments begins at section 6.1.2.

[17] Refer to ISO tariff section 30.6.3.1

[18] A natural gas pipeline that serves as the official delivery location for futures contracts on the NYMEX.

[19] Link to the BPM for Market Instruments: https://bpmcm.caiso.com/Pages/BPMDetails.aspx?BPM=Market%20Instruments

### *6.1.1 Prior Stakeholder Comments Received on the Second Revised Straw Proposal and the ISO's Responses*

AMS, SolarCity and Stem - AMS, SolarCity and Stem all participate in the Baseline Analysis and Load Consumption working groups (LCWG) and are highly supportive of these important initiatives under the ESDER Phase II. We encourage the CAISO to adopt the working group's recommendations reflected in the Staff Proposal. In particular, AMS, Solarcity and Stem are encouraging swift extension of frequency regulation to PDR as proposed by the LCWG. AMS, SolarCity and Stem strongly believe that regulation markets should be accessible to BTM energy storage systems.

PG&E - PG&E remains supportive of expanding PDR functionality to include load consumption and regulation services. What remains open is how this conceptual proposal will be operationalized. Turning a concept into reality will require a forum, which does not seemingly exist. Therefore, PG&E recommends that the CAISO consider this topic for inclusion in a Phase 3 of ESDER or possibly another forum that is available for undertaking what could be a significant effort.

SCE - SCE supports the LCWG proposal to maintain the separation of wholesale and retail energy settlement for increased load consumption. In past comments, SCE has supported this aspect of the proposal because, among other purposes, it helps eliminate jurisdictional issues while also maintaining the same relationship between wholesale market payments and retail billing that exists for current load reduction demand response. The stakeholder comments template asks: "The LCWG proposes to maintain the separation of wholesale and retail energy settlement for increased load consumption. This supposes that the value of increased wholesale consumption, perhaps at a negative price, has value to the DRP or customer since the increased consumption would also be charged under retail rates. Under this construct, is this a feasible concept?" SCE believes this is appropriate and, given is how demand response works today, does not understand why it could not be feasible. Retail rates account for more than just wholesale market costs (including distribution costs). Increased load consumption, even when directed by the CAISO through a new DR product, still requires use of the distribution system, transmission system, and other factors and those costs need to be accounted for. This construct also appropriately assumes that there is potential value to increased load from customers. Customers have the choice at which price point to bid increased load consumption. Even if the price a customer is bidding does not completely offset their retail bill, the load consumption product is effectively acting as a discount to their retail bill. There are still multiple details that need to be developed for the load consumption product. In the last set of comments, SCE identified issues surrounding baseline applications and uninstructed imbalance energy. In addition

to these issues, SCE believes the stakeholder process needs to eliminate revenue insufficiency issues created by the load consumption product. Similar to the revenue insufficiency created by traditional DR, load consumption DR will create a need for uplift since both the DR resource and Load Serving Entity (LSE) load are being compensated for the increased load during periods of negative prices. A DR resource will in effect be paid for consuming energy at a negative LMP while the LSE will see an increase in load in the real time market, likely at a discounted DLAP price, and be compensated as well. That means for every 1 MW of load consumption DR dispatched by the CAISO, the CAISO could need to pay for 2 MW of increased consumption. This discrepancy will result in the need for uplift, a market inefficiency, and should be avoided. The CAISO should commit, as part of this process, to work with stakeholders to resolve this issue before finalizing a proposal.

SDG&E - SDG&E is waiting to review the results of the Demand Response Enhancements working group.

The ISO specifically responded to SCE's and PG&E's comments on the ESDER 2 second revised straw proposal.

In the ESDER 2 second revised straw proposal, SCE expressed concern about additional distribution and transmission system costs from increased throughput due to directed load consumption. SCE raises concern that market inefficiencies result when the CAISO pays both the demand response provider and the load-serving entity for consuming negatively priced energy, once as an instructed energy settlement to the DRP for the load consumption, and twice as an uninstructed energy settlement for the excess load consumed above the load-serving entity's scheduled demand (assuming negative priced energy). The ISO responded that SCE's market inefficiency concern has the same analog on the load curtailment side. Addressing this market inefficiency in the original PDR design generated intense debate, which led to the CAISO implementing the default load adjustment settlement mechanism, and, in part, FERC instituting a net benefits test price threshold. Directed load consumption begs these same questions about creating market inefficiencies and double payments and how these issues should be resolved. Resolving these issues is essential to bringing a wholesale bi-directional PDR product to market.

In the ESDER 2 second revised straw proposal, PG&E questions how the conceptual idea of directed load consumption turns into operational reality. PG&E's excess supply pilot is exploring how customers can shift loads to take advantage of renewable energy available in situations of excess supply given new usage patterns from adoption of new technologies, such as EV, battery storage, PV, and appliances. On March 24, 2017, PG&E presented lessons learned from their excess supply pilot, which were informative

to this effort. Two particular challenges PG&E highlighted in their presentation were 1) the impacts of participation on the customer's retail bill (i.e. how demand charges are affected), and 2) how to ensure directed load consumption actions do not create operational and congestion problems on the distribution system. In its ESDER 2 comments, PG&E questioned where the forum is to vet these issues to make load consumption an operational reality. The CAISO responded stating that it believed the forums already exist, including at the CPUC, where fundamental rate design concerns and distribution system impacts must be resolved; the existing load consumption working group where issues can be identified and vetted collaboratively; and importantly, PG&E's own excess supply pilot where information and ideas can be tested and shared about how directed load consumption works, what customer, policy, and technical barriers exist, and how to measure and validate load response.

### *6.1.2 Stakeholder Comments to Third Revised Straw Proposal*

CESA, Stem, eMotorWerks, Tesla – The storage community strongly supports development of a bi-directional PDR product, conveying that time is urgent given oversupply and increasing amounts of renewable resource curtailments. These stakeholders also agree that retail rate and retail-wholesale jurisdictional issues should not impede the CAISO's efforts to develop a bi-directional PDR product. Tesla conveys that "[w]hile we recognize CAISO's concerns around retail rate impacts and demand charges, we believe that the burden is on customers to ensure wholesale market activity does not create net charges for the customer when considering wholesale and retail settlements combined."[20] CESA states that "[r]etail rate concerns cannot be controlled by the CAISO and, while important to address in the right forum, do not amount to a basis for no CAISO action."[21] CESA also conveys that ISO leadership is essential to help motivate resolution of retail policies and rate reforms that support a wholesale load consumption capability. Stem and eMotorWerks acknowledge that load consumption capability exists in the CAISO market via the non-generator resource model, but explain the non-generator resource model imposes barriers to behind the meter storage, stating "...although BTM storage could theoretically participate in load consumption using the NGR model, the practical barriers result in a CAISO tariff that unreasonably restricts competition."[22] Finally, these stakeholders urge the ISO to move the load consumption working group forward, stating the ISO should "...immediately re-

[20] Tesla at p. 4.

[21] CESA at p. 6.

[22] Stem and eMotorWerks at p. 4.

constitute the LCWG to work on a minimum viable load consumption product well ahead of the proposed Phase 3 Issue Paper timeline."[23]

CLECA, PG&E, CHBC, IEP- These parties generally acknowledged that important questions and policies need to be addressed and answered by stakeholders at the CPUC, and more time is needed prior to the ISO developing a bi-directional PDR product. Specifically, PG&E questions how such a [bi-directional PDR] product interacts with Time of Use rates and demand charges.[24] CHBC agrees "…that demand charges can be a fundamental barrier and must be addressed before implementing a Bi-Directional Proxy Demand Response (PDR) product."[25] IEP states that first priority issues must be addressed such as "...issues associated with resource configuration and the accurate metering to distinguish between wholesale and retail consumption."[26]

Trans Bay Cable- recognizes the difficulty in the CAISO acting alone to develop a PDR-wholesale load consumption product, and express that "...multiple models could be used for wholesale consumption, such as the NGR model where the Pmax is set to zero and the entity is entirely metered as an ISO resource."[27]

### 6.1.3 ISO Response to Stakeholder Comments

The CAISO appreciates the diverse set of stakeholders that commented on enabling a bi-directional PDR capability. Overall, the submitted comments on load consumption land in two camps, with the storage community expressing strong and urgent support for the CAISO to develop a bi-directional PDR product, and a somewhat countervailing view from a broad cross-section of stakeholders expressing the need for the CAISO to take more time to resolve issues, consider options, and coordinate with the CPUC.

### 6.1.4 Draft Final Proposal

The CAISO and a diverse set of stakeholders recognize there remain outstanding technical and policy issues that impact developing a bi-directional PDR product. The LCWG's discussions largely focused on the technical aspects and design of a wholesale bi-directional product, never formally delving into identifying and resolving some of the deeper policy discussions around retail rate interactions, customer costs and benefits,

[23] Id. at p.3
[24] PG&E at p. 5.
[25] CHBC at p. 3.
[26] IEP at p.4.
[27] Trans Bay Cable at p. 3.

customer interest, demand charges, and technical implementation issues. PG&E's excess supply pilot has delved into these issues and has reported that participants are concerned about rate impacts and ratcheting demand charges. The California Hydrogen Business Council stated in its ESDER 2 comments that it "...agrees with CAISO's concern that demand charges can be a fundamental barrier and must be addressed before implementing a Bi-Directional Proxy Demand Response (PDR) product," and "[r]etail rates coupled with above charges can impede cost competitiveness and hinder adoption of emerging energy storage technologies in California."[28]

The CAISO continues to believe that retail rate impacts and demand charges are fundamental barriers to address, and on a path to resolution, before the CAISO can investment significant time and resources creating a wholesale bi-directional PDR product. Contrary to comments from the storage community, the CAISO does not view these barriers as jurisdictional in nature, but as real impediments to customer interest and robust customer participation in a bi-directional PDR product.[29]

The CAISO appreciates the sentiment that having the CAISO take a leadership role in this area is valued; however, the CAISO's concern is that without resolution of retail issues, the CAISO will expend significant staff time, information technology resources, and money developing a product that will languish until retail rules and or rate reforms are on a path to resolution. Like all demand response products, a bi-directional PDR product has retail impacts and interactions that must be clearly understood and resolved as a first priority.

Contrary to certain stakeholder opinions, the CAISO has been very progressive in the demand response and distributed energy resource space relative to other ISOs and RTOs, and does not believe it is unreasonably restricting competition.[30] In fact, the CAISO has provided multiple pathways for DER wholesale market participation, including under the Distributed Energy Resource Provider (DERP) model, as a Non-

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[28] CHBC at pp. 3-4.

[29] The ISO provided its opinion to the load consumption working group in an email back in December 2016 stating the CAISO believes the risk is low that FERC would reject oversight over wholesale-market directed load consumption (especially in light of FERC Order 745), yet the CAISO acknowledges that this is a matter that will ultimately be decided by FERC and perhaps by the courts.

[30] Stem and eMotorWerks state "[t]hus, although BTM storage could theoretically participate in load consumption using the NGR model, the practical barriers result in a CAISO tariff that unreasonably restricts competition. The FERC NOPR on Energy Storage and Distributed Energy Resource Aggregation issued in 2016 as well as the February ruling on MISO vs Indiana Power & Light both affirm that wholesale market operators should allow and encourage energy storage to provide all the services [sic] that the technology is technically capable of providing. At p. 4.

generator Resource (NGR), and as demand response resource under the Proxy Demand Resource (PDR) model. Both the NGR and DERP models allow a distribution connected storage device to "consume" energy as a wholesale resource. Stem and eMotorWerks detail why these models have limitations in their comments; however, the DERP and NGR models may be a better fit for a storage device given these new models were designed for storage versus the existing PDR model, which was designed for traditional load curtailment response.[31] For instance, under the NGR model, a storage device is a wholesale resource and subject to distribution interconnection rules, and the ISO understands that wholesale distribution access tariffs may impose a barrier to market participation. However, such issues like interconnection are ripe for re-evaluation and a discussion on this topic is warranted given the expansion of DERs on the distribution grid. Encouragingly, the CPUC appears motivated to address load consumption and bi-directional products, and is soliciting formal feedback from parties about their interest in these areas, and, the appropriate forum to address these issues.[32] The CAISO looks forward to reviewing the comments the Commission receives on this subject, and believes these comments will help inform the direction of this particular effort.

As the vetting of load consumption and bi-directional products move forward, and as parties submit comments on this subject at the CPUC, parties should detail issues that need further investigation in their comments. For example, the interconnection issues raised by Stem and eMotorWerks in their comments. The comments PG&E raised about what is the interaction of directed wholesale load consumption and time-variant (time-of-use), and other dynamic retail rate forms. How to avoid creating market inefficiencies given the interaction between rates and directed wholesale load consumption? Additionally, how to address technical issues such as in the future if a customer receives a dispatch instruction from the CAISO to consume more energy, could a load-serving entity turn its retail demand charge settlement off and on in sync with that instruction? Is this feasible, and if so, what information technology would this functionality require and what changes would be needed to legacy billing systems? What is the impact of load consumption on rates, rate designs, and revenue requirements? Is a retail load consumption "program incentive" appropriate, and if so, how is it set and valued since the underlying retail customers participating in a load

[31] See Stem and eMotorWerks comments on ESDER Phase 3 items, at p. 5.

[32] R.13-09-011, Administrative Law Judge's Ruling Requesting Responses to Questions Regarding the Pathway to New Models of Demand Response, Implementation of the Competitive Neutrality Cost Causation Principle, and Remaining Barriers to the Integration of Demand Response Into the CAISO Market, May 22, 2017, Attachment A, p. 2, Item #3.

consuming supply resource are not paid the negative wholesale energy price, but are charged a retail rate.[33] Additionally, how is the value of load consumption determined since load consumption is not a "capacity" or resource adequacy resource in the traditional sense and load consumption is not valued on a traditional avoided generation and transmission and distribution cost basis? How does directed load consumption impact distribution system assets and ensuring dispatches are feasible end-to-end?

The CAISO endorsed two stakeholder led working groups, the Load Consumption Working Group and the Baseline Analysis Working group. The intent of these two working groups was for interested stakeholders to identify and resolve issues around the respective topic areas and bring a fleshed out and working group approved proposals to the ISO for broader stakeholder review and CAISO Board approval. As the ESDER 2 stakeholder initiative concludes, the CAISO is hopeful that stakeholders can reinvigorate the LCWG and develop well-informed solutions that can be introduced into the ESDER 3 initiative in 2018. Moving forward, the LCWG should consider if and how it interacts with any future CPUC load consumption-working group (if such a group assembles under the auspices of the CPUC), and if a single working group is a the most prudent path forward, with the LCWG emerging in the future to work specifically on directed wholesale load consumption issues. The CAISO looks forward to collaborating with the CPUC and the LCWG to help vet and resolve the issues around load consumption and the possibility of developing a bi-directional PDR product.

## 6.2 NGR Enhancements

In this section, the CAISO summarizes the discussion on this topic that occurred in the third revised straw proposal, the written comments received from stakeholders on that discussion, the CAISO's response to those written comments, and the CAISO's draft final proposal.

### *6.2.1 Stakeholder Comments to Second Revised Straw Proposal*

AMS, Solar City, and Stem commented that metering and settlement of resources that do not participate in the wholesale market 24 hours a day, seven days a week, and rules that support metering and settlement of storage resources located behind a retail meter are priority areas of interest. Metering and settlement frameworks that support these

[33] This is the converse of traditional "load curtailment" demand response where the customer benefits by receiving a demand response incentive payment and avoids retail rate charges for energy not consumed.

use cases will be required for Multi Use Application opportunities to provide benefits to multiple customers. They stated that NGR-modeled storage resources should be able to qualify as an ISO designated use-limited resources and that understanding storage performance limitations and non-linear degradation based on state of charge and depth of cycling is important. The ability to reflect opportunity costs and commitment costs in energy bids to manage limitations need to be explored and should reflect economic considerations of multi-use commitments. These commitments may include shifting retail charging from off-peak to on-peak or missing the opportunity to curb peak demand as a result of wholesale market dispatch, increased battery cycling, and multiple transitions to charge and discharge states per day.

CESA commented that NGR's should be eligible for ISO Use Limitation status and that NGRs should be able to represent commitment costs and throughput or other limitations. CESA stated that the development of a 'MWh-throughput limitation' tool or constraint to help manage NGR resources in line with use-limitations, contractual restrictions, or physical parameters of the resource would be helpful. CESA stated that the Commitment Costs for NGRs remain poorly understood and the CAISO should address this dearth of information through accommodating rules that clarify how resources may economically or administratively reflect their preferences for dispatch. CESA stated that the CAISO should not regulate or limit use-limited resources or access to this status based on planning capacity views, which they understand are currently out of scope for ESDER.

PG&E, SCE, and SDG&E commented that a MWh constraint would help them manage battery cycling that is in accordance to battery contracts and performance guarantees and would allow the ISO to best optimize the resources based on overall system needs as opposed to having the SC do this in their bidding strategy. PG&E added that this daily limit should be managed in a way that does not expose resources providing RA to RAAIM penalties once the daily throughput limit is exhausted through regulation or energy dispatch. Participants should have flexibility not to bid the resource in real time if the resource has reached its throughput limit in order to ensure the limit is respected.

SCE commented that that they would like to pursue the ability to represent use limitations for energy storage resources as Non-Generating Resource model enhancements while also open to defining storage as Use Limited Resources. SCE would also like to investigate opportunities to utilize a Major Maintenance Adder, multiple bid stacks, or multi-stage capability for storage resources.

SDG&E commented that they do not support extensive changes to CAISO market mechanisms to accommodate the specific attributes of specific NGRs. The existing CAISO market mechanisms are adequate to allow NGRs to express their economic

preferences in the form of start-up costs and price/quantity offers that internalize the opportunity costs of dispatching the NGR during day-ahead and real-time market intervals. SDG&E stated that NGRs, like generating resources, should be allowed to reflect opportunity costs in their price/quantity offers submitted into the day-ahead and real-time markets, allowing the NGR scheduling coordinator to control, on an economic basis, when the NGR will be dispatched to supply or consume energy, or to provide ancillary service capacity. SDG&E provided examples of opportunity costs of foregone profits where a limited energy NGR is dispatched at intervals where clearing prices are lower than later intervals and commitment costs that include increases or decreases in work force and inventories depending on whether the price/quantity offer submitted by the NGR scheduling coordinator results in an increase or decrease in load.

### 6.2.2 ISO Response to Third Revised Straw Proposal Stakeholder Comments

The ISO received valuable comments and feedback, which continue to shape the discussion on expressing storage limitations through resource modeling, market optimization, and the ability to identify and represent explicit costs and use limitations. In addition, several new enhancements were proposed by stakeholders for consideration as ESDER 2 transitions to ESDER 3.

In the area of managing physical use limitations, stakeholders continue to express the need to have new tools to manage throughput limitations and State of Charge. The ISO clarified in the third revised draft proposal that current modeling and bidding practices allow the resource to be represented to the ISO market in a way to meet the resource's physical limitations, including the use of the ISO Outage Management System to reflect true physical resource limitations. The ISO also continued to suggest that there could be a need to further utilize resource outages for managing adverse cell degradation and battery health as a physical limitations as well as the potential for the ISO to manage cumulative MWh charge and discharge values to help manage depth and frequency of cycling and facilitate contractual limitations or performance guarantees. Stakeholders comment that these limitations should apply daily or even hourly and implemented in a way to protect the resource from RAAIM penalties when these energy throughput limits are reached.

After reviewing all stakeholder input, the ISO would like to clarify in this revised third draft proposal that using the ISO Outage Management System, or utilizing MWh limitations to facilitate contractual or economic based limitations is not a physical limitation. As emphasized in the comments by the Department of Market Monitoring:

> "The limitations imposed by contractual obligation, while expressed for a defined period of time, appear to have little physical relationship with the period of time beyond ensuring a particular level of battery life and cell health for an agreed upon period of time, or delaying maintenance activities for as specified period of time. These limitations are not exogenous to the resource operator, and indeed may be made more restrictive in exchange for more favorable terms in capacity acquisition. For this reason particularly, it is not appropriate to exempt NGR storage resources from RAAIM penalties when contractual use limits are exhausted. Under this construct, entities contracting with energy storage resource owners may have greater financial incentive to minimize capacity procurement costs at the expense of market availability. This maximizes profits on resource adequacy capacity sold from energy storage resources while simultaneously working to undermine the intent of resource adequacy capacity by limiting its availability."

The ISO will move the discussion to ESDER 3 with the goal to further clarify and understand physical limitations and representation of costs of storage resources. For example, where the costs of operating a storage resource increase due to increased depth and frequency of cycling, the discussion should not be based on contractual warranty but could be better reflected as an explicit cost in the market optimization as a cost per cycle or cost per MWh.

While this may be a longer-term solution to implement, in the near term, the ISO would stress that these costs and limitations can be reflected in energy bids today to limit use in the ISO market at times when participating may increase degradation or void contractual requirements.

Several stakeholders re-emphasized the need for a less than 24x7 settlement to allow for multi-use applications of resources modeled as NGR. As CESA commented, "the concept of 'less than 24 hour a day metering for NGR resources' is a priority and should be in scope…this functionality is key to NGR resources acting in MUAs, including in potential transmission applications which may be related to Aliso Canyon solutions."

As stated in the ESDER 2 Third Revised Straw Proposal, the ISO continues to work with the CPUC to develop policy on this topic. Please refer to the MUA section of this paper for further information.

Stakeholders continue to support allowing NGR resources to be qualified for Use Limited Status. The ISO is open to consideration of use-limed status for NGR resources provided the basis of the use-limitation is consistent with those of other generation resources and complies with the use limited definition in the CCE3 Stakeholder Initiative. Use-

limited status could exempt resources with resource adequacy capacity from RAAIM penalties when the use limitations are exhausted. This topic will move to ESDER 3 for further development.

### *6.2.3 Draft Final Proposal*

After reviewing all stakeholder feedback, and in particular the comments from the Department of Market monitoring, the topic of modeling daily cumulative MWh charge and discharge limits based on bid parameters for the purpose of managing economic based limitations will no longer be carried forward to ESDER 3. However, the ISO will continue the topic of reflecting costs and modeling physical limitations for NGRs in ESDER 3.

Several stakeholder provided feedback on additional enhancements they would like to see for NGRs. Suggested enhancement include:

- Tools to restrict over-utilization or frequent cycling due to the fast ramping in excess of warranty rules.
- A 'cycling limit' that may be calculated similar to the calculation of 'mileage' in pay for performance regulation to represent mileage costs.
- The ability for SCs to provide multiple bid stacks for optimization by the ISO based on the resource's state of charge.
- The ability for SCs to provide hourly throughput or mileage limitations
- The ability to provide multi-point or multi-segment Ancillary Service bids, suggesting allowing a NGR to bid higher costs if all of its available capacity is used for AS and greater control of SOC.
- An ability to include a bid cost similar to the use of Variable O&M to allow resources to price maintenance and warranty costs into their bids based on SOC.
- Enhancements to address 'regulation dispatch divergence from RTD price signals'

As stated in the previous section, the ISO is not in support of establishing MWh throughput limitations based on economic factors such as warranty or performance guarantees. The ISO does support understanding how to reflect limitations as explicit costs based on NGR operation, which can be optimized in the ISO market. This includes an ability to reflect maintenance costs and other operational costs as a function of participation. As stated above, this discussion will move forward in ESDER 3.

The topic of providing multiple bid stacks to better optimize a resource based on SOC had been addressed in the ESDER 2 paper. This enhancement was discussed earlier as a

potential approach to better optimize batteries that incurred reduced MW throughput at high and low states of charge. It is the ISO's understanding that these specific SOC based MW throughput limitations are, for the most part, removed by the battery manufacturer and battery management and control systems.

The proposed ideas for SCs to provide multi-point or multi-segment AS bids is a topic the ISO supports for further discussion in ESDER 3.

Comments from Alta-Gas – Pomona Energy Storage highlighted an enhancement to address a perceived issue of a 'Regulation Dispatch Divergence from RTD price signals'. They observed several instances where Regulation Down was called during intervals of high LMP. It should be noted that AGC is based on area control error, not on individual resource economics. In Addition, any resource participating under NGR-Regulation Energy Management signals a preference for the ISO to operate their resource at 50% SOC. This incurs increased AGC movement to maximize the ability for the resource to provide regulation capacity in the ISO market.

## 6.3 Multiple-Use Applications

In this section, the CAISO summarizes discussion on this topic that occurred in the second and third revised straw proposals, the written comments received from stakeholders on that discussion and the CAISO's final draft proposal.

The September 19, 2016 second revised straw proposal stated that the CAISO has not yet identified specific MUA issues or topics that require treatment in ESDER 2 and the CAISO proposes to continue its collaboration with the CPUC in this topic area through Track 2 of the CPUC's energy storage proceeding (CPUC Rulemaking 15-03-011).

Since publication of the April 17, 2017 third revised straw proposal, no issues have been identified that needed to be addressed within ESDER 2, and therefore the CAISO has not amended the scope developed since the last proposal publication.

### *6.3.1 Stakeholder Comments to Second Revised Straw Proposal*

AMS, SolarCity and Stem - As we continue to work with the CAISO, the CPUC and utilities in resolving MUA-related issues, it is important to set the market participation rules and incentives, as well as the performance requirements for specific grid services needed to allow energy storage providers to optimize their technologies and operational characteristics. Stacking the values associated with multiple uses increases the resource value and economic viability of energy storage systems, while improving wholesale market efficiency and reducing costs to the electric grid. With this in mind, AMS, SolarCity and Stem support the CAISO's continued collaboration with the California

Public Utilities Commission in Rulemaking 15-03-011 to develop appropriate standards and guidance for MUAs. MUAs reflect DER owners offering a combination of the thirteen value streams identified by the Rock Mountain Institute to the three identified stakeholders: the ISO, UDC and end-use customers.

CLECA – CLECA supports the current CAISO approach.

PG&E - PG&E supports the approach the CAISO outlines in the straw proposal. There are no new MUA-related issues that need to be addressed at this juncture, although issues will likely arise as the Energy Storage OIR (R.15-03-011), Track 2 unfolds. Furthermore, PG&E commends the CAISO, stakeholders and working groups for recognizing and addressing potential issues that arise with MUA, including the mutual exclusivity of energy and capacity, and the issue of selling the same energy twice. PG&E echoes its previous comments and adds that energy stored for later retail usage should always have a retail rate for charging, compensation should not occur if an action would have otherwise been taken, and that a resource should not be paid twice inadvertently for the same service. The CAISO has been following these principles thus far in the PDR enhancements; a great example of these principles applied to PDR is the clarification that retail rates apply to an end customer for load consumed even when this load is bid into a PDR Load1 Consumption product. PG&E looks forward to working with the CAISO and the CPUC to further develop guiding principles and eventually develop rules for MUA storage.

SCE - SCE agrees that the CPUC's energy storage proceeding is the correct place to address multiple-use applications at this time. SCE is particularly interested in the CPUC and the CAISO developing rules for resources that provide both distribution reliability and resource adequacy.

SDG&E - SDG&E believes the CAISO needs to address the MUA in the context of Energy Storage Phase 2.

### *6.3.1 Stakeholder Comments to Third Revised Straw Proposal and CAISO Response*

Comments received after discussion on the third revised straw proposal continue to support the CAISO's collaborative efforts with the CPUC and continuation of these efforts for establishment of multi-use application (MUA) development in the R.15-03-011 proceedings. Additionally, comments suggest that there be consideration of the inclusion of MUA topics within ESDER 3 scoping to "fully enable DERs to participate in

wholesale markets at the CAISO" [34] while other comments request assurance when topics are included that "concerns about double-counting and/or double-compensation" are addressed[35].

The CAISO appreciates the comments received and believes that they continue to support the current approach and joint regulatory activities underway to address multi-use application development.

### 6.3.2 Draft Final Proposal

At this time, the CAISO proposes to continue its collaborative efforts with the CPUC in the context of the CPUC's energy storage track 2 proceeding, and not to pursue an ISO initiative on MUAs unless and until the collaborative efforts identify an issue that would be most appropriately addressed in a CAISO initiative.

CAISO and CPUC staff finalized the "Joint Workshop Report and Framework – Multiple-Use Applications for Energy Storage", issued on May 17, 2017[36], summarizing the efforts on MUA thus far and providing a framework for addressing the issues identified. Following the release of the report, the CPUC and CAISO jointly hosted a workshop on June 2, 2017 to discuss the report and invited a round of written comments on the report and the workshop. The CAISO expects to continue working with CPUC staff to resolve the remaining issues as far as possible. If these activities identify issues that need addressing in a CAISO initiative, the CAISO will include them in the scope of ESDER 3 when that effort begins in September 2017.

The CAISO requests stakeholders to provide comments to the CAISO/CPUC joint workshop to best inform the scoping efforts for ESDER 3.

# 7 ESDER Phase 3

The CAISO is planning to continue the ESDER initiative in ESDER 3, which will continue to refine and address enhancements to DR, NGR and MUA. Specifically, the CAISO will continue to address:

[34] See Tesla comments on ESDER Phase 3 items, at p. 5.

[35] See IEP comments on ESDER Phase 3 items, at p. 5.

[36] Joint workshop material available through ESDER2 initiative webpage http://www.caiso.com/Pages/documentsbygroup.aspx?GroupID=BC43DF40-778E-4AC7-B266-2A52281B8E68 .

- The development, if feasible, of a load consumption product for DR resources and participation in the regulation market;
- Defined rules for storage modeled as NGR to qualify as a use-limited resource;
- Reflecting costs and modeling of physical limitations of storage as NGR; and
- Any issues identified in the Track 2 of the CPUC's energy storage proceeding (CPUC Rulemaking 15-03-011) on MUA.

The CAISO appreciates all of the topics suggested by stakeholders. The CAISO is planning to release an issue paper in September 2017 that will address all potential scope items mentioned above along with stakeholder suggested topics for the ESDER 3 initiative.

# Appendix A Control Group Baseline Process and Rules

The following table summarizes the control group process and rules. The process and baseline rules are identical for residential and non-residential customers and for weekdays and weekends.

| Component | Explanation |
|---|---|
| Baseline process | 1. Determine the method for developing the control group<br>2. Identify the control group customers<br>3. Narrow data to hours and days required for validation checks (see validation options)<br>4. Calculate average customer loads for each hour of each day<br>5. Drop CAISO event days and utility program event days for programs the resource or control customers participate in.<br>6. Validate on the schedule described in 'Validation Options' below. Conduct validation checks and ensure all of the following requirements are met for:<br>a. Sufficient sample size – 150 customer or more<br>b. Lack of bias - see Section 6<br>c. Precision – see Section 6<br>7. Submit information about which sites designated as a control group and which sites will be dispatched to CAISO in advance.<br>8. Submit the validation checks to CAISO.<br>9. For event days:<br>a. Calculate the control group average customer load for each hour of event day<br>b. Calculate the dispatch group average customer load for each hour of the event day<br>c. Subtract the control group load (a) from the treatment group load (b) for each hour of the event day. The difference is the change in energy use for the average customer attributable to the event response, known as the load impact.<br>d. Multiply the load impact for each hour by the number of customers controlled or dispatched.<br>10. Submit summary results to CAISO and store code, analysis datasets, and results datasets.<br>11. Update control group validation for changes in the resource customer mix of more than +/-10% or to remain compliant with seasonal or rolling window validation requirements. |
| Event period | Per CAISO, the event period includes any phase-in or phase-out ramp defined by the schedule coordinator, in addition to hours where the resource is dispatched. |
| Method for control group development | List the method used to develop the control group – random assignment of site, random assigned of clusters, matched control group, or other. For random assignment, please retain the randomization code and set a random number generator seed value. |
| Replication and Audit | Control group equivalence and event days calculation are subject to audit. The results must be reproducible. The underlying customer level data, randomization files, and validation code, and event day analysis code must be retained for 3 years and be made available the CAISO within 10 business days of a request. In the case where the California ISO deems it necessary, DRPs will be required to securely provide the control and treatment group's interval data to recreate the bias regression coefficient and CVRMSE to ensure they meet the criteria |
| Validation options | Validation is performed by the DRP and subject to audit by CAISO. The validation method uses 75-day lookback period with a 30-day buffer. Validation is required as described in note e, below. The 75 days selected for |

| Component | Explanation |
|---|---|
| | validation should be chosen such that the validation is complete prior to finalizing the control group to act as the designated baseline method for that resource.<br>a. 30 days used to collect and validate the groups<br>b. Prior 45 days used for the validation (t-31 to t-75)<br>c. Candidate validation days used to establish control group similarity are either non-event weekdays (if the resource is dispatched only on weekdays) or all non-event days (if the resource can be dispatched on any day)<br>d. A minimum of 20 candidate days are required to be in the validation period. If there are not 20 non-event validation days, extend the validation period backwards (t-76 and further) until there are 20 candidate days in the validation period.<br>e. Requires validation check updates every other month if the number of accounts in the resource does not change more than ± 10%. If the number of accounts changes by more than ± 10%, the control group must be validated monthly.<br>f. If the validation fails, the control group method is unavailable for that resource unless the control group is updated and revalidated. Control groups may be updated monthly.<br>g. 90% of the population must be in both the validation period and the active period |
| Aggregation of Control Groups across Sub Load Aggregation Points (subLAPs) | Aggregation of control groups is permissible across different subLAPs; however the same performance on intra-subLAP equivalence checks must be demonstrated. While sourcing a control group from a region with similar weather and customer mix conditions is not explicitly mandated, considerations for these attributes that affect load may help in developing an appropriate control group. |
| Rotation of control groups | The assignment to treatment and control groups can be updated on a monthly basis; however this assignment must be completed prior to any events. Validation of new control groups must also be completed prior to any events in concurrence with any new control group development. The assignment cannot be changed once set for the month and cannot be changed after the fact |

# Appendix B Weather Matching Baseline Process and Rules

The following tables summarize the weather matching rules separated between residential/non-residential and weekday/weekend.

## B.1 Residential

| | Weekday Baseline<br>4 Day Matching Using Daily Maximum Temperature | Weekend Baseline<br>4 Day Matching Using Daily Maximum Temperature |
|---|---|---|
| Baseline calculation process | 1. Identifying eligible baseline days that occurred prior to an event<br>2. Calculate the aggregate hourly participant load on the event day and on each eligible baseline day during the event period hour.<br>3. Calculate the resource's participant weighted temperatures for each hour of each event day and eligible baseline day<br>4. Select the baseline days out of the pool of eligible days<br>5. Average hourly customer loads across the baseline days to generate the unadjusted baseline.<br>6. Calculate the same-day adjustment ratio based on the adjustment period hours.<br>7. If the same day adjustment ratio exceeds adjustment limit, limit the adjustment ratio to the cap.<br>8. Apply the same day adjustment ratio to the overall unadjusted baseline to produce the adjusted baseline. Application of the baseline adjustment is not optional. It must be employed to calibrate the unadjusted baseline.<br>9. Calculate the demand reduction as the difference between the adjusted baseline and actual electricity use for each event hour | |
| Eligible baseline days | Weekdays, excluding event days and federal holidays, in the 90 days immediately prior to the event. | Weekends and federal holidays, excluding event days, in the 90 days immediately prior to the event |
| Baseline day selection criteria | Rank eligible days based on how similar daily maximum temperature is to the event day | Rank eligible days based on how similar daily maximum temperature is to the event day |
| Number of days selected to develop baseline | 4 days with the closest daily maximum temperature | 4 days with the closest daily maximum temperature |
| Calculation of temperatures | 1. Map the resource sites to pre-approved National Oceanic Atmospheric Association weather station based on zip code and the mapping included as Appendix B<br>2. Calculate the participant-weighted weather for each hour of each event and eligible baseline day. That is the weather for each relevant weather station is weighted based on the share of participant associated with the specific weather station.<br>3. Calculate the average temperature or daily maximum temperatures across all 24 hours in both the event day and eligible baseline days. | |
| Event | Per CAISO, the event period includes any phase-in or phase-out ramp defined by the schedule coordinator, in addition to hours where the resource is dispatched. | |
| Unadjusted baseline | The hourly average of the resource's electric load during baseline days. The unadjusted baseline includes all 24 hours in day. | |
| Adjustment hours | Two hours immediately prior to the event period with a two hour buffer before the event and two hours after the event with a two hour buffer. For example, if an event went from 1pm to 4pm, the adjustment hours would be 9am-11am and 6-8pm. | |
| Same day adjustment ratio | Calculate the ratio between the resources load and the unadjusted baseline during the adjustment hours.<br><br>**Adjustment ratio=(Total kWh during adjustment hours)/(Unadjusted baseline kWh over adjustment hours)** | |

| | |
|---|---|
| Adjustment Limit | Cap the ratio between +/- 1.4x. If the ratio is larger than 1.4, limit it to 1.4. If the ratio is less than 1/1.4 = 0.71, limit it to 0.71 |
| Adjusted baseline | Apply the capped same day adjustment ratio to the unadjusted baseline to calculate the final adjusted baseline. The ratio is applied to all 24 hours of the unadjusted baseline |

## B.2 Non-Residential

| | Weekday Baseline<br>4 Day Matching Using Daily Maximum Temperature | Weekend Baseline<br>4 Day Matching Using Daily Maximum Temperature |
|---|---|---|
| Baseline calculation process | 10. Identifying eligible baseline days that occurred prior to an event<br>11. Calculate the aggregate hourly participant load on the event day and on each eligible baseline day during the event period hour.<br>12. Calculate the resource's participant weighted temperatures for each hour of each event day and eligible baseline day<br>13. Select the baseline days out of the pool of eligible days<br>14. Average hourly customer loads across the baseline days to generate the unadjusted baseline.<br>15. Calculate the same-day adjustment ratio based on the adjustment period hours.<br>16. If the same day adjustment ratio exceeds adjustment limit, limit the adjustment ratio to the cap.<br>17. Apply the same day adjustment ratio to the overall unadjusted baseline to produce the adjusted baseline. Application of the baseline adjustment is not optional. It must be employed to calibrate the unadjusted baseline.<br>18. Calculate the demand reduction as the difference between the adjusted baseline and actual electricity use for each event hour | |
| Eligible baseline days | Weekdays, excluding event days and federal holidays, in the 90 days immediately prior to the event. | Weekends and federal holidays, excluding event days, in the 90 days immediately prior to the event |
| Baseline day selection criteria | Rank eligible days based on how similar daily maximum temperature is to the event day | Rank eligible days based on how similar daily maximum temperature is to the event day |
| Number of days selected to develop baseline | 4 days with the closest daily maximum temperature | 4 days with the closest daily maximum temperature |
| Calculation of temperatures | 4. Map the resource sites to pre-approved National Oceanic Atmospheric Association weather station based on zip code and the mapping included as Appendix B<br>5. Calculate the participant-weighted weather for each hour of each event and eligible baseline day. That is the weather for each relevant weather station is weighted based on the share of participant associated with the specific weather station.<br>6. Calculate the average temperature or daily maximum temperatures across all 24 hours in both the event day and eligible baseline days. | |
| Event | Per CAISO, the event period includes any phase-in or phase-out ramp defined by the schedule coordinator, in addition to hours where the resource is dispatched. | |
| Unadjusted baseline | The hourly average of the resource's electric load during baseline days. The unadjusted baseline includes all 24 hours in day. | |
| Adjustment hours | Two hours immediately prior to the event period with a two hour buffer before the event and two hours after the event with a two hour buffer. For example, if an event went from 1pm to 4pm, the adjustment hours would be 9am-11am and 6-8pm. | |

| | |
|---|---|
| Same day adjustment ratio | Calculate the ratio between the resources load and the unadjusted baseline during the adjustment hours.<br><br>Adjustment ratio=(Total kWh during adjustment hours)/(Unadjusted baseline kWh over adjustment hours) |
| Adjustment Limit | Cap the ratio between +/- 1.4x. If the ratio is larger than 1.4, limit it to 1.4. If the ratio is less than 1/1.4 = 0.71, limit it to 0.71 |
| Adjusted baseline | Apply the capped same day adjustment ratio to the unadjusted baseline to calculate the final adjusted baseline. The ratio is applied to all 24 hours of the unadjusted baseline |

# Appendix C Day Matching Baseline Process and Rules

The following tables summarize the Day matching process and rules separated between residential/non-residential and weekday/weekend.

## C.1 Residential

| | Weekday Baseline<br>Highest 5 of 10 | Weekend Baseline<br>Highest 3 of 5 weighted |
|---|---|---|
| **Baseline calculation process** | 1. Identifying eligible baseline days that occurred prior to an event<br>2. Calculate the aggregate hourly participant load for the event day and for each eligible baseline day<br>3. Calculate total MWh during the event period for each eligible baseline day<br>4. Rank the baseline days from largest to smallest based on MWh consumed over the event period<br>5. Select the baseline days out of the pool of eligible days<br>6. Average hourly customer loads across the baseline days to generate the unadjusted baseline. Apply weighted average, if appropriate.<br>7. Calculate the same-day adjustment ratio based on the adjustment period hours.<br>8. If the same day adjustment ratio exceeds adjustment limit, limit the adjustment ratio to the cap.<br>9. Apply the same day adjustment ratio to the overall unadjusted baseline to produce the adjusted baseline. Application of the baseline adjustment is not optional. It must be employed to calibrate the unadjusted baseline.<br>10. Calculate the demand reduction as the difference between the adjusted baseline and actual electricity use for each event hour. | |
| **Eligible baseline days** | 10 weekdays immediately prior to event, excluding event days and federal holidays | 5 weekend days, including federal holidays, immediately prior to the event |
| **Baseline day selection criteria** | Rank days for largest to smallest based on MWh over the event period, pick the top 5 days | Rank days for largest to smallest based on MWh over the event period, pick the top 3 days |
| **Application of weights (if needed)** | Not applicable | 1. 50% - Highest load day<br>2. 30% - 2nd Highest load day<br>3. 20% - 3rd Highest load day |
| **Event** | Per CAISO, the event period includes any phase-in or phase-out ramp defined by the schedule coordinator, in addition to hours where the resource is dispatched. | |
| **Unadjusted baseline** | The weighted hourly average of the resource's electric load during baseline days. The unadjusted baseline includes all 24 hours in day. | |
| **Adjustment hours** | Two hours immediately prior to the event period with a two hour buffer before the event and two hours after the event with a two hour buffer. For example, if an event went from 1pm to 4pm, the adjustment hours would be 9am-11am and 6-8pm. | |
| **Same day adjustment ratio** | Calculate the ratio between the resources load and the unadjusted baseline during the adjustment hours.<br><br>**Adjustment ratio=(Total kWh during adjustment hours)/(Unadjusted baseline kWh over adjustment hours)** | |
| **Adjustment Limit** | Cap the ratio between +/- 1.4x. If the ratio is larger than 1.4, limit it to 1.4. If the ratio is less than 1/1.4 = 0.71, limit it to 0.71 | Cap the ratio between +/- 2x. If the ratio is larger than 2.0, limit it to 2.0. If the ratio is less than 1/2 = 0.50, limit it to 0.50 |
| **Adjusted baseline** | Apply the capped same day adjustment ratio to the unadjusted baseline to calculate the final adjusted baseline. The ratio is applied to all 24 hours of the unadjusted baseline | |

## C.2 Non-Residential

| | Weekday Baseline<br>Highest 10 of 10 | Weekend Baseline<br>Highest 4 of 4 |
|---|---|---|
| **Baseline calculation process** | 11. Identifying eligible baseline days that occurred prior to an event<br>12. Calculate the aggregate hourly participant load for the event day and for each eligible baseline day<br>13. Calculate total MWh during the event period for each eligible baseline day<br>14. Rank the baseline days from largest to smallest based on MWh consumed over the event period<br>15. Select the baseline days out of the pool of eligible days<br>16. Average hourly customer loads across the baseline days to generate the unadjusted baseline. Apply weighted average, if appropriate.<br>17. Calculate the same-day adjustment ratio based on the adjustment period hours.<br>18. If the same day adjustment ratio exceeds adjustment limit, limit the adjustment ratio to the cap.<br>19. Apply the same day adjustment ratio to the overall unadjusted baseline to produce the adjusted baseline. Application of the baseline adjustment is not optional. It must be employed to calibrate the unadjusted baseline.<br>20. Calculate the demand reduction as the difference between the adjusted baseline and actual electricity use for each event hour. | |
| **Eligible baseline days** | 10 weekdays immediately prior to event, excluding event days and federal holidays | 4 weekend days, including federal holidays, immediately prior to the event |
| **Baseline day selection criteria** | Keep all 10 eligible days | Keep all 4 eligible days |
| **Application of weights (if needed)** | Not applicable | Not applicable |
| **Event** | Per CAISO, the event period includes any phase-in or phase-out ramp defined by the schedule coordinator, in addition to hours where the resource is dispatched. | |
| **Unadjusted baseline** | The weighted hourly average of the resource's electric load during baseline days. The unadjusted baseline includes all 24 hours in day. | |
| **Adjustment hours** | Two hours immediately prior to the event period with a two hour buffer before the event and two hours after the event with a two hour buffer. For example, if an event went from 1pm to 4pm, the adjustment hours would be 9am-11am and 6-8pm. | |
| **Same day adjustment ratio** | Calculate the ratio between the resources load and the unadjusted baseline during the adjustment hours.<br><br>**Adjustment ratio=(Total kWh during adjustment hours)/(Unadjusted baseline kWh over adjustment hours)** | |
| **Adjustment Limit** | Cap the ratio between +/- 1.2x. If the ratio is larger than 1.2, limit it to 1.2. If the ratio is less than 1/1.2 = 0.83, limit it to 0.83 | Cap the ratio between +/- 1.2x. If the ratio is larger than 1.2, limit it to 1.2. If the ratio is less than 1/1.2 = 0.83, limit it to 0.83 |
| **Adjusted baseline** | Apply the capped same day adjustment ratio to the unadjusted baseline to calculate the final adjusted baseline. The ratio is applied to all 24 hours of the unadjusted baseline | |