Energy Storage and Distributed Energy Resources Phase 3

Straw Proposal

February 15, 2018

Market & Infrastructure Policy

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1 Introduction

The focus of the California Independent System Operator's (CAISO) energy storage and distributed energy resources (ESDER) initiative is to lower barriers and enhance the abilities for energy storage and distribution-connected resources[1] to participate in the CAISO markets. The growing number and diversity of these resources are beginning to represent an increasingly important part of the future grid.

The ESDER initiative is an omnibus initiative with annual phases covering several related but distinct topics. The second phase of ESDER developed enhancements to demand response (DR), non-generator resources (NGR), multiple-use applications (MUA), and station power for storage resources.

The CAISO published an issue paper on September 29, 2017 identifying obstacles that have the potential to impede the effective participation of storage and distributed energy resources in the CAISO markets. Since the release of the issue paper, the CAISO has held one web conference and two working group meetings to identify the scope of the ESDER 3 initiative. This straw proposal provides an overview of issues within the scope of ESDER 3 along with initial proposals on how to address them. The proposed scope and initial set of solutions identified were influenced by comments received through the stakeholder process. The following describes the refined scope of the ESDER 3 initiative:

- Demand Response – Four areas of demand response enhancements will be in ESDER 3: (1) new bidding and real-time dispatch options for demand response resources, (2) removal of the single load serving entity (LSE) aggregation requirement along with the application of a default load adjustment (DLA), (3) development of a load shift product, and (4) recognition of sub-metered electric vehicle supply equipment (EVSE) load curtailment.
- Multiple-Use Application (MUA) - The CAISO will identify potential tariff and market design changes that may be needed to facilitate the MUA framework set forth in the commission's final decision on Multiple-Use Application Issues[2], under proceeding R.15-03-011, and CAISO staff will actively participate in the CPUC's MUA working group meetings to further influence actions to be taken within ESDER3.

[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] http://docs.cpuc.ca.gov/SearchRes.aspx?DocFormat=ALL&DocID=206462341.

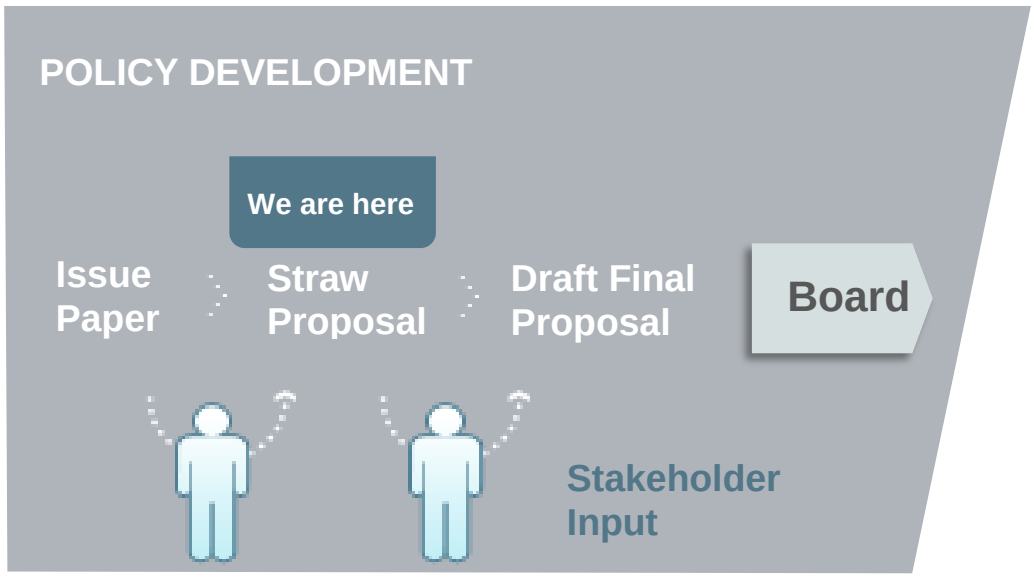
- Non-Generator Resource (NGR) - The CAISO will develop a process to qualify NGRs for use-limited status. In addition, the CAISO will identify policy developed for commitment costs that apply to NGRs. Lastly, the CAISO reiterates its positions on modeling and bidding changes recommended by stakeholders.

2 Stakeholder Process

The CAISO is at the "Straw Proposal" stage in the ESDER 3 stakeholder process. Figure 1 below shows the status of the straw proposal within the overall ESDER 3 stakeholder process.

The purpose of the straw proposal is to present the scope and solutions of issues related to the integration, modeling, and participation of energy storage and DERs in the CAISO market. The CAISO has reviewed stakeholder feedback through comments and working group meetings to identify the priority proposals the CAISO will pursue in this initiative. After publication of the straw proposal and a stakeholder call, the CAISO will continue to hold working group meetings as necessary to refine the proposals. As appropriate, the CAISO may organize focused working groups to address issues of a complex nature or those that have cross-jurisdictional concerns as we move through the initiative process.

Figure 1: Stakeholder Process for ESDER 3 Stakeholder Initiative



3 Energy Imbalance Market Classification

The CAISO is proposing that ESDER 3 should involve the Energy Imbalance Market (EIM) Governing Body's advisory role to the Board of Governors (Governing Body – E2 classification). This initiative affects the day-ahead and real-time market rules where the real-time market rules will affect the EIM entities. These rule changes to ensure consistency and support of an efficient market will be applied across the CAISO market, including the EIM. The CAISO does not anticipate carving out any EIM specific items from the overarching design, ensuring proposed changes are "generally applicable".

4 Straw Proposals

4.1 Demand Response Resources

In the ESDER 3 Issue Paper, the CAISO identified enhancements needed for the Proxy Demand Resource (PDR) and Reliability Demand Response Resource (RDRR) participation models to effectively integrate and enhance market participation for demand response. Generally, stakeholders were aligned with the CAISO's prioritization of DR topics.

A majority of stakeholders ranked modeling limitations as their highest priority for ESDER 3 based on market participation experiences of both the utilities' supply side integration efforts and third party Demand Response Auction Mechanism (DRAM) awardees. Another high priority item was removal of the CAISO's single LSE requirement given stakeholders' desire to form demand response aggregations across bundled, unbundled, and community choice aggregation customers. The development of a load shift product, also received broad stakeholder support. Supporters recognized the importance of developing a minimum viable "load shift" product to test the concept that could lead to an expanded "load consumption" product. The CAISO recognizes that certain stakeholders desire a broader load consumption capability in this first iteration, however, as stated in the January 2018 working group meeting, the load shift product under ESDER3 will begin with a narrowly scoped framework for behind the meter storage. Finally, the CAISO will pursue a separate performance measurement to recognize load curtailment from sub-metered electric vehicle supply equipment. Several stakeholders commented on the importance of the inclusion of this topic and its relatively simple implementation. The sections below will explain in detail the scope and the CAISO's proposal on these priority topics.

4.1.1 *Demand response modeling limitations*

DR resources have successfully integrated into the CAISO market and have played an integral role in meeting system reliability. The CAISO is looking to continue market design enhancements to provide DR resources options to inform the CAISO of their costs and constraints so that there is closer alignment in how the market uses and commits these resources in the residual unit commitment (RUC) process for a potential dispatch in real-time. Under the scope of "demand response modeling limitations," the issue can be broken into two sections.

Commitment costs and the impact of a 0 MW Pmin in the RUC process

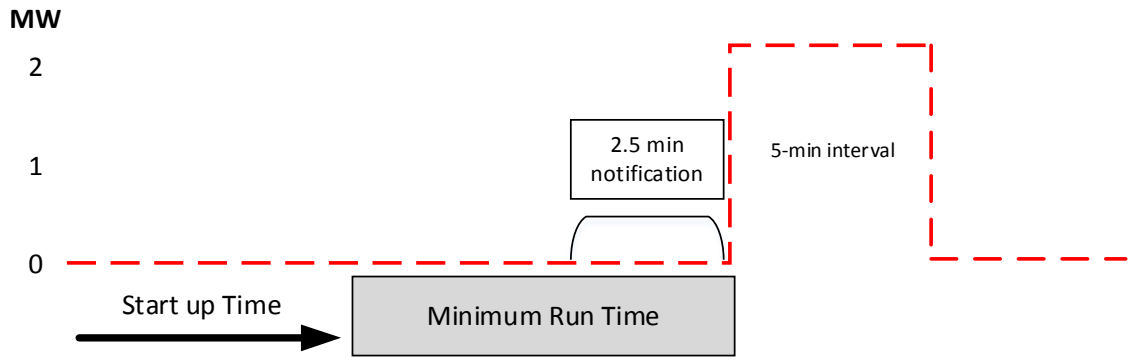
DR resource operators have identified the inability to set use limitations and appropriately define commitment costs as barriers to the effective use and participation of their DR resources. As an example, DR resources often have a Pmin of 0 MW, and a minimum load and start-up cost of $0/MW, which results in the resource having a zero commitment cost. Additionally, RA resources are required to submit $0 availability bids in RUC when it bids into the integrated forward market to meet its availability requirement.[3]. These characteristics make an RA DR resource the "least cost" option in the CAISO's RUC process compared to traditional generation, which have a Pmin > 0 MW, non-zero startup, and minimum load costs. As a result, RA DR resources are rationally committed in RUC to be available for dispatch in real time.

Minimum and Maximum Run-Time Constraints

Continuing the discussion from above, once committed in RUC, the CAISO's market systems will issue a start-up instruction to these "no cost" DR resources to their Pmin, often 0 MW, well in advance of the commitment hour in the real-time market. This commitment ensures both start-up and minimum runtime constraints are met, however, since the resource is now "running" at a Pmin of 0 MW, it is available for dispatch whenever the resource's energy bid is economic. This can result in 5-minute dispatch instructions that have only a 2.5-minute notification time. Certain affected stakeholder's have explained that this notification time is infeasible for many PDRs. Figure 2 below represents this scenario.

[3] CAISO Tariff section 40.8.1.13
http://www.caiso.com/Documents/Section40_ResourceAdequacyDemonstrationForAllSCsInTheCAISOBAA_asof_Mar10_2017.pdf

Figure 2: RUC of DR resource with a Pmin of 0 MW



As described above, for many DR resources, a RUC commitment results in a start-up instruction to a Pmin of 0 MW. The CAISO respects the resource's minimum run-time constraint when committing at Pmin, represented in Figure 2 as the gray horizontal bar. However, the minimum run-time constraint at times may be met while the resource is at a Pmin of 0 MW, which then it is dispatched above its Pmin, represented as the dashed red line above Pmin of 0 MW. [4] Stakeholders have suggested that the PDR participation model does not effectively recognize two constraints:

(1) Recognition of the minimum run time when the resource is dispatched above its Pmin of 0 MW

(2) Limitation in using the maximum daily energy limit instead of a maximum run time to recognize daily use limitations.

Proposal

The CAISO views the DR modeling limitations as having two distinct but related issues. Outside this ESDER 3 initiative, the CAISO is wrapping up the Commitment Cost and Default Energy Bid Enhancements (CCDEBE) initiative.[5] With a projected Fall of 2018 implementation, CCDEBE introduces the ability for resources with a 0 MW minimum operating level, i.e. a Pmin = 0 MW, to reflect minimum load and startup costs. Additionally, the initiative clarifies the definition of start-up costs as those "costs incurred by a resource for bringing a resource online or to a state capable of providing energy." In ESDER 3, the CAISO will inform stakeholders of the status of these pending

[4] Definition of minimum run time
http://www.caiso.com/Documents/Section34_RealTimeMarket_asof_May2_2017.pdf
[5] CCDEBE Initiative Website
http://www.caiso.com/informed/Pages/StakeholderProcesses/CommitmentCosts_DefaultEnergyBidEnhancements.aspx

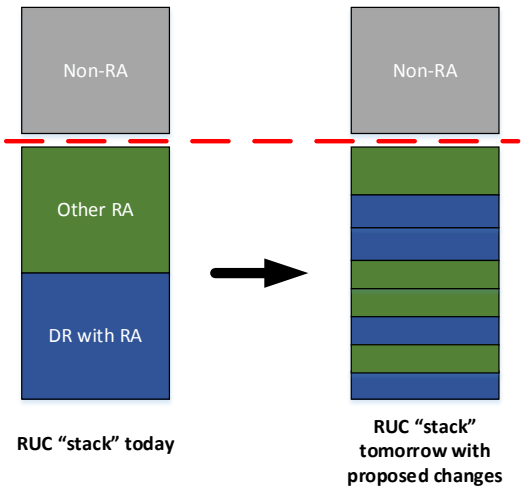
changes affecting commitment costs to support resource operators for the effective management of costs for RUC consideration. Table 1 below represents the pending changes from CCDEBE and the calculation for minimum load and startup costs.

Table 1: Changes to CCDEBE that apply to DR resources

Cost	Description	Example
Minimum Load Costs	Costs that reflect run hours at minimum load, including costs incurred if sitting at 0 Pmin.	Ex) Identifying costs to keep DR resource at 0 Pmin.
Startup Costs	Cost to bring a resource to a point where it is capable of providing (curtailing) energy.	Ex) Costs incurred to call DR customers and prepare to curtail load.

Currently, the RUC process will only evaluate minimum load and start-up costs and require all RA resources to submit a $0 availability bid. Because most PDRs s have a 0 MW Pmin and may have $0 min load and start-up costs, RUC will issue a binding commitment since this is the least cost resource. By clearly defining its commitment costs, PDRs can be appropriately valued and optimized within the RUC process' "resource stack" as shown in Figure 3 below.

Figure 3 RUC process' "resource stack"



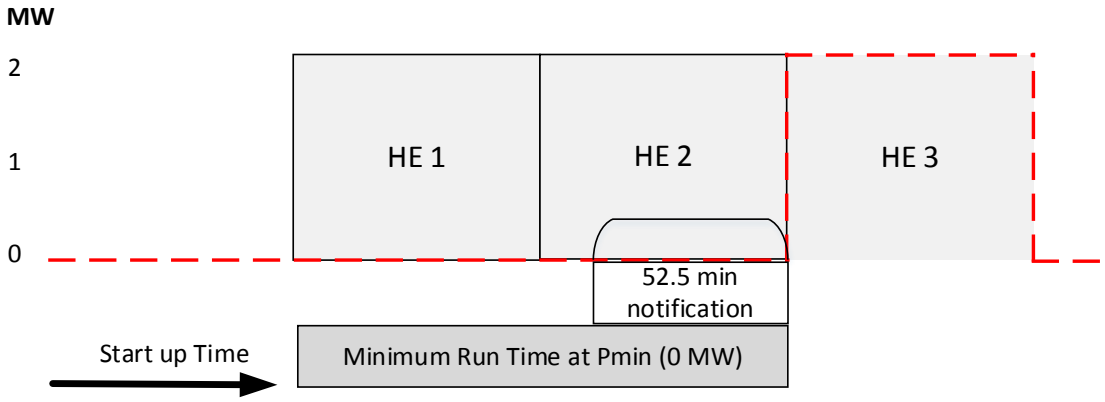
In addition to informing participants on the use of commitment costs in RUC, the CAISO proposes to address the effect a PDR with a Pmin of 0 MW has on real time dispatches it receives when committed. As noted, these resources will be issued a start-up instruction in advance of their commitment hours at their Pmin of 0 MW. If the resource does not submit economic bids for the hours it was committed, the CAISO will insert a $0 energy bid resulting in it being set up as a low cost economic option in the real-time market. While submission of real-time economic bids for these commitment periods may reduce dispatches for 5-minute durations it does not guarantee their elimination. Therefore, the CAISO believes an effective option for PDR resources to mitigate an inability to respond to 5-min dispatches with only a 2.5-minute notification time is to offer a variant of the intertie bidding option to PDRs. Under this "intertie-like" bidding option, PDRs would have longer notification times and extended real-time dispatch intervals. The CAISO introduced this option and its application to PDR in a joint workshop with the CPUC on October 4, 2017.[6]

Under this proposal, PDR resources would have three notification and dispatch options for bids submitted in the real-time market 75 minutes before the hour:

(1) **Hourly block** –the scheduling coordinator (SC) submits self-schedules fixed for the hour and are settled at the four 15-minute prices over the hour. The binding schedule is communicated to the SC at 52.5 minutes before the flow of energy is required. In the example below, the resource is a 2 MW resource that opted to bid an hourly schedule. The CAISO respected the minimum run time parameter (2 hours) in HE 1 and 2. In HE 2, the CAISO sent a dispatch notification 52.5 minutes before the flow of energy for HE 3.

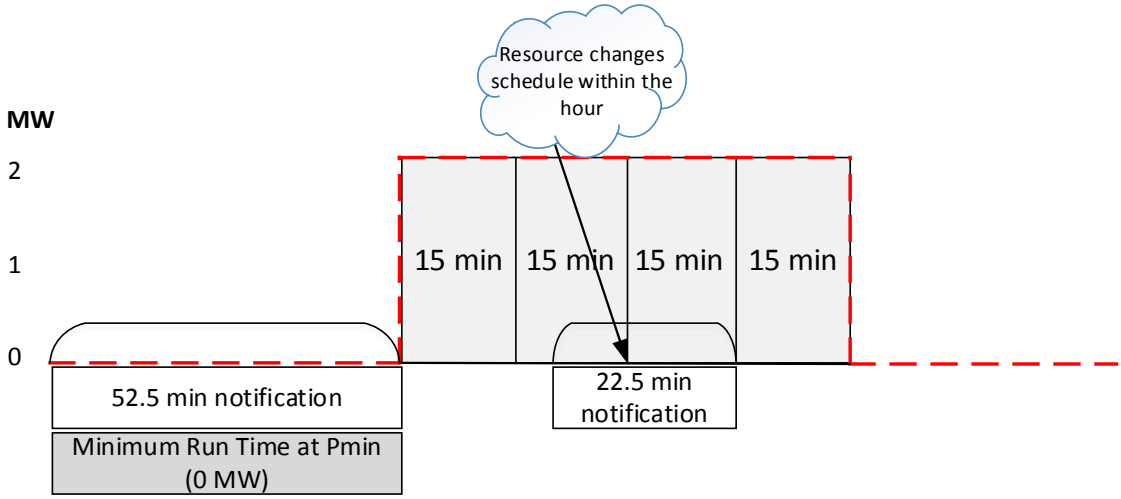
[6] Link to presentation from CAISO-CPUC joint workshop introducing CAISO's 15-minute market and bidding options for real-time imports and exports, slides 51- 59. http://www.caiso.com/Documents/Presentation_JointISO_CPUCWorkshopSlowResponseLocalCapacityResourceAssessment_Oct42017.pdf

Figure 4: Example of hourly bid option



(2) **Hourly block with single change** – Submits self-schedules for the hour but the market participant will have the option to change its schedule once per hour if the 15-minute price does not meet its criteria. If the resource changes its schedule, it will receive a notification 22.5 minutes before the flow of energy.

Figure 5: Example of hourly block with single change



(3) **15 minute dispatchable** – Bid is submitted, and if it is economic in FMM, it will receive a binding schedule at the FMM price and communicated 22.5 minutes before the flow of energy. The 15-minute bids will be the only option that will be offered bid cost recovery.

Figure 6: Example of fifteen minute bid option

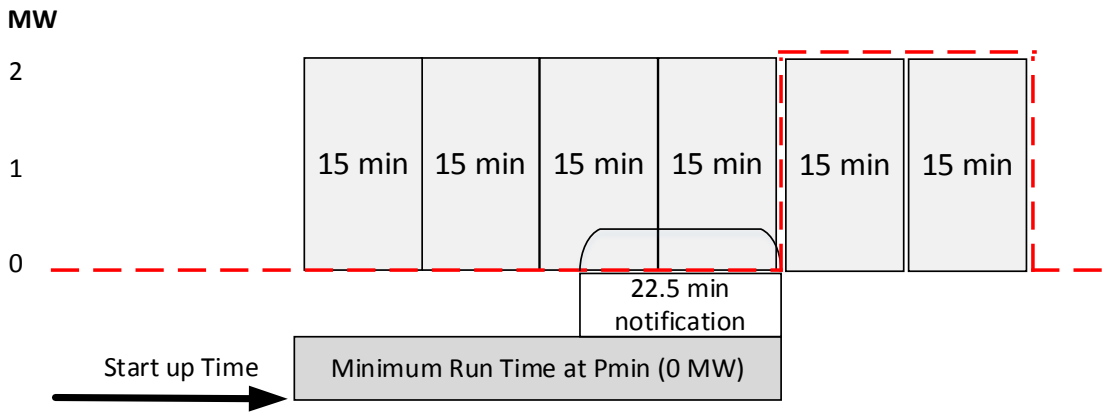
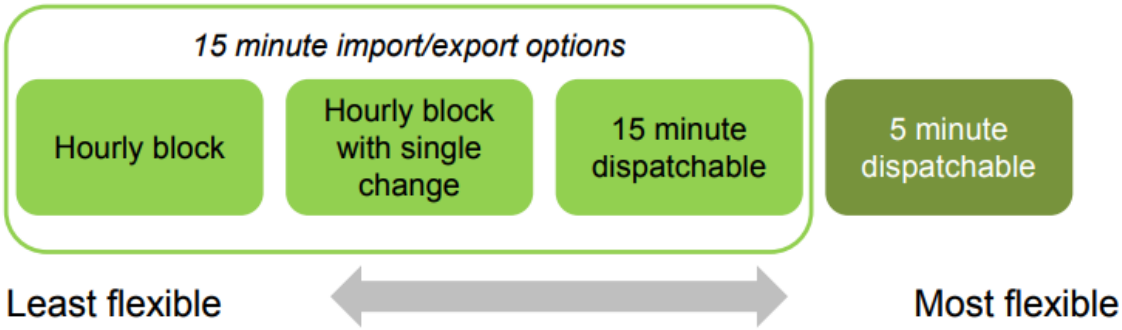


Figure 7: Hourly and 15-minute bidding options[7]



The CAISO believes applying an "intertie-like" hourly economic bidding and real-time dispatch model to proxy demand resources (PDR) will give PDRs, which require longer notification time or cannot respond to 5-minute dispatches, an opportunity to viably participate in the market. The CAISO's goal is to leverage existing market functionality where possible to enable resource like demand response to participate more effectively and efficiently in the market.

4.1.2 *Removal of the single LSE requirement and default load adjustment*

The CAISO currently requires that DR resource aggregations must consist of locations under a single LSE, represented by one demand response provider (DRP), and within a single sub-LAP. This design feature can segment a DR program into different

[7] FERC Order No. 764 market changes http://www.caiso.com/Documents/DraftFinalProposal-FERC-Order764MarketChanges.pdf

aggregations by load-serving entity within a single sub-LAP. The result of this segmentation is the potential to strand some willing customer participants if these requirements, along with the PDR minimum size requirement, are not satisfied. It also creates a larger number of small, PDR resources than what would otherwise be needed if aggregations across LSEs were possible. DRPs that have established new resource aggregations, or are in the process of developing new ones, have expressed difficulty meeting, or maintaining, the 100 kW minimum participation requirement as customers within their resource aggregations are defaulted or move to new LSEs, such as to a CCA. Additionally, DRPs must manage more and smaller resources than needed if aggregations across LSEs were possible within sub-LAPs.

Another limiting factor in addition to the single LSE requirement is the default load adjustment (DLA)[8] which is a settlement mechanism that requires PDR and RDRR resource aggregations to be under a single LSE. The DLA originated from FERC Order 745, which required the CAISO to implement a net benefits test (NBT).[9] The NBT establishes a price threshold at which demand response resources are deemed cost effective. If the real-time market locational marginal price (LMP) is below the threshold, the DLA is triggered, adjusting the metered load used in uninstructed imbalance energy (UIE) settlement of the LSE's default load aggregation point (DLAP).

Proposal

The CAISO proposes to remove the single LSE requirement for DR aggregations and the need for application of a DLA. The CAISO believes that by removing the single LSE requirement, the application of the DLA becomes too complex of a task to implement and manage. Additionally, the settlement implications of the DLA are de minimis relative to the benefits achieved by eliminating the one LSE per PDR requirement (see Figure 8 and Figure 9 below).

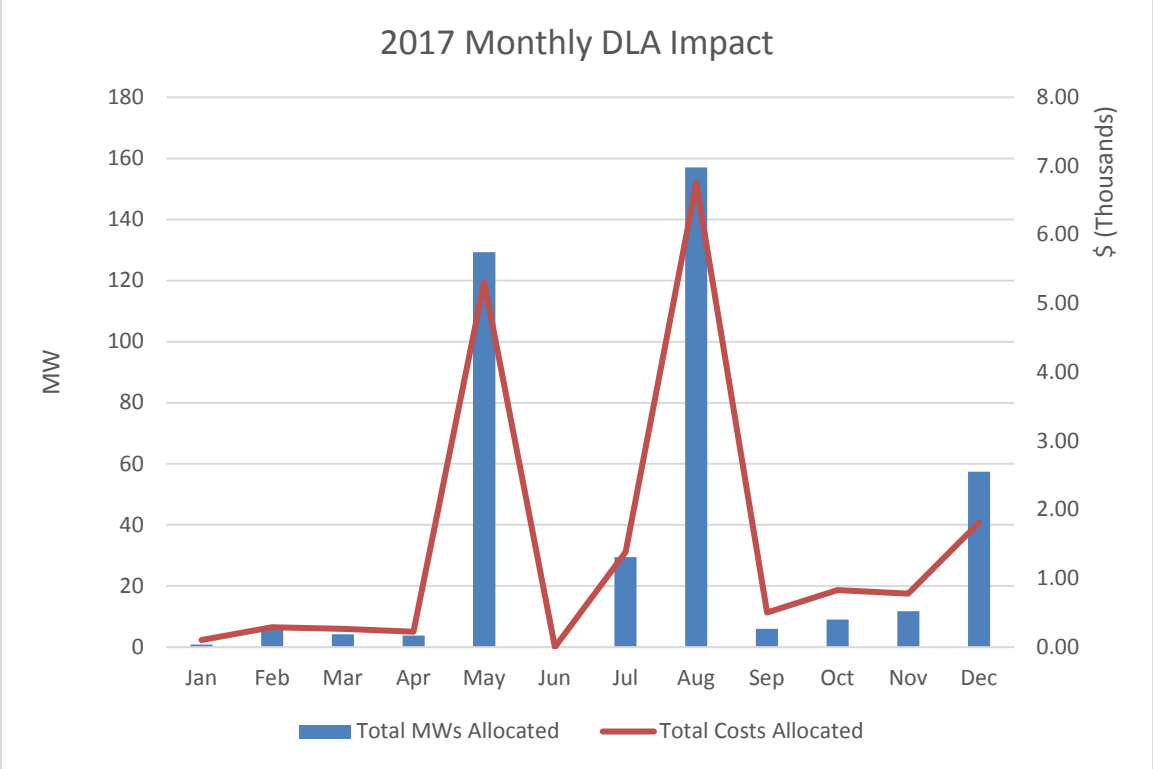
As requested by stakeholders, the CAISO conducted an analysis of the total DLA affected MWs, the settlement impacts, and how frequently the DLA was applied in 2017. The CAISO found that over 2017, the DLA amounted to 414 MWs and allocated costs of $18,264.31 to LSEs to ensure double payment of load curtailment was not received

[8] The DLA represents the amount of load curtailed, based on a PDR or RDRR demand response energy measurement, within a Default LAP specific to the LSE when the real-time LMP is below the threshold price.

[9] FERC Order 745 https://www.ferc.gov/EventCalendar/Files/20110315105757-RM10-17-000.pdf

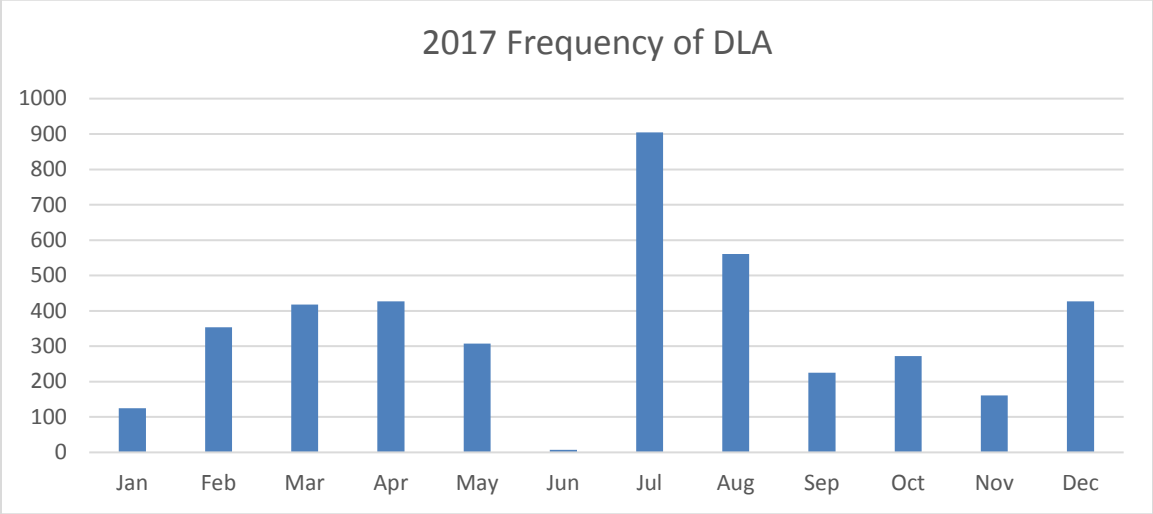
when the net benefits price threshold was not met. In addition, the DLA calculation was triggered, on average, 4% of the time over the course of the year per month.[10] The monthly total of MWs and settlement charges resulting DLAs applied to the LSE's are shown below in Figure 8 and Figure 9.

Figure 8: 2017 Total Monthly DLA Impact



[10] Based on the number of intervals DLA was triggered/ total number intervals in a month

Figure 9: Number of intervals a DLA was triggered per month



The CAISO's DLA settlement impact analysis, in part, supports removal of the calculation and that its removal results in de minimis settlement impact. The CAISO maintains that removal of the DLA is necessary to institute an aggregation requirement allowing multiple LSEs to be represented within a single PDR. Therefore, the CAISO proposes to utilize the NBT threshold price to screen submitted bids from PDR resources through the CAISO's Software Infrastructure Business Rules (SIBR) to comply with FERC order 745 without application of the DLA. By only accepting bids above the established net benefits threshold price, the CAISO will be ensuring that PDR resources are net beneficial to the entire system upfront when awarding bids rather than after-the-fact.

4.1.3 *Load Shift Product*

In approving the ESDER 2 proposal, the CAISO Board of Governors requested staff to continue working with stakeholders on proposals set out by the load consumption working group for enhancing the PDR model to provide additional services in support of the grid during oversupply conditions. Subsequent meetings held with stakeholders focused development on a "load shift" product designated as a priority item under the ESDER 3 initiative.

Proposal

The CAISO proposes the development of a load shift product for the participation of a behind the meter (BTM) storage device under the PDR participation model. Although the product will fall under existing demand response policy provisions under the PDR participation model, the product will discriminately utilize available functionalities from the non-generator resource (NGR) model to bid and be dispatched for both load consumption (charging) and generation (discharging), from a single behind-the-meter

storage resource. The initial product will facilitate the provision of both load curtailment and "shift" services while maintaining the PDR policy principle that injection of behind the meter storage discharge of electricity onto the grid will not be part of its wholesale market compensation.

Within ESDER 3, the CAISO will continue shaping development of the load shift product with broader set of stakeholder input on the detailed feature set. This work will include the identification of gaps in tariff provisions and use of NGR modeling capabilities within the PDR policy framework. To resolve open issues identified through the gap analysis, the CAISO will establish working groups as appropriate to propose solutions that fit within identified features of the product as it is developed.

Currently identified specifications of the load shift product proposed are listed in Table 2 below.

Table 2: Specifications of Load Shift Product

Load shift features	Identified issues under the PDR model (if applicable)	Comments
Enables a load shift capability from BTM storage devices participating as PDR		
Load shift capability is not RA capacity	PDR structured only as a load shift resource will not count for RA. Only PDR that provides load curtailment can qualify as RA.	Update CPUC DR program and Rule 24 language to ensure PDR load shift-only is not a RA resource; only PDR that provides load curtailment is RA eligible.
Non-exporting product	None Note: Existing Performance measurement systems already recognize non-exporting for wholesale energy settlement purposes.	Performance measurement recognizes that shift resource is non-exporting and will evaluate performance as such.

PDR bids load consumption and curtailment directly with the CAISO		
Resource manages own state-of-charge (SOC)		
Directly metered load with removal of 'typical use" i.e., non-wholesale use is removed first before performance is compensated	PDR is a curtailment only participation model, therefore MGO does not recognize "negative" generation (intervals in which the storage device is charging and consuming load).	CAISO to evaluate PDR participation use with respect to performance measurements with directly metered load and generation. Develop performance measurement specific to Load Shift participation, including defining "typical consumption" to ensure incremental provision of service.
All load/energy purchased is at applicable retail rate settled by the LSE		
Ability to bid a negative cost for energy services, to ensure dispatch at the "right" price	Participation model must provide ability for bids to be both positive and negative in both quantity and price. Current application of NBT contemplates curtailment services and not provision of consumption services.	CAISO to evaluate and determine applicability of NBT to demand responding to negative pricing signal for consumption.

4.1.4 *Recognition of behind the meter EVSE load curtailment*

FERC approval of the CAISO ESDER 1 initiative tariff filing resulted in the implementation of the metered generator output (MGO) performance measurement, which uniquely

recognized a sub-metered storage device's contribution to a facility's overall load curtailment during a CAISO dispatch event. As part of the ESDER 2 initiative process, comments received from certain stakeholders requested that the MGO concept extend to sub-metered EVSE loads so that load curtailment, achieved by managing the rate of EV charging based on an ISO dispatch instruction, could be recognized and measured distinct from the building load.

Proposal

The CAISO proposes to enable EVSEs sub-metering and extend the MGO performance method for EVSE market participation independent of, or in combination with, its host customer. Sub-metering resolves the lack of fifteen-minute interval metering at the host facility for measurement of curtailment in five-minute intervals, enables direct measurement of the actual EV load curtailment achieved, and creates a more viable market participation model for EVSEs.

4.1.5 *Responses on topics not in scope for ESDER 3*

Weather-sensitive demand response

Stakeholders have also presented to the CAISO that, similar to wind and solar resources, the PMax of certain DR resources can vary due to their weather-sensitive nature. If a weather-sensitive RA-qualifying DR resource bids into the day-ahead market, depending on the weather, it may be unable to deliver its full RA amount, resulting in penalties associated with the CAISO's Resource Adequacy Availability Incentive Mechanism (RAAIM) since the resource could not bid its full RA qualifying capacity amount. This issue will need vetting at the CPUC and with other LRAs since the matter is fundamentally about how resource adequacy qualifying capacity is determined and set for these weather-sensitive DR resource types, similar to how the qualifying capacity is set for other variable energy resources types. The CAISO has been actively involved in the CPUC's RA proceeding (R.17-09-020) and is aware of the commission's decision to move the discussion of weather sensitive DR to track three (2020 RA program requirements). In response, the CAISO will defer this item in ESDER 3, and will work with CPUC energy division staff to move this discussion forward while recognizing when it will be timely to bring this discussion back to the CAISO for further consideration and implementation.

PDR/RDRR hybrid resource

SCE suggested a scope item in which RDRR would have the option to buy back their day-ahead positions in real time. The RDRR product was designed on the premise that all available reliability-triggered MWs that qualify for resource adequacy would bid and be

made available to the ISO in real-time. The CAISO believes that a RDRR buy-back provision goes against the spirit of the RDRR product and the special treatment afforded this resource. The PDR product is the mechanism that allows full economic participation of DR resources. The CAISO encourages DRPs to pursue the PDR option if economic bidding flexibility is desired. Thus, the CAISO is not proposing to discuss a RDRR buy-back provision in ESDER 3.

Recognition of a behind the meter resource in load curtailment

This item was proposed by stakeholders under the item to extend the MGO to EVSEs. Certain stakeholders wanted to extend the sub-metering capabilities to technologies more than just EVSEs. Due to broad stakeholder support for CAISO's request to initialize extension of MGO to EVSE's only within the ESDER3 scope, the CAISO is not proposing to move forward with a broader evaluation of extending the MGO to all sub-metered load-consuming devices at this time. It is the intent of the CAISO to continue to explore and better understand sub-metered load capabilities and potential for under valuation of their contribution to a facilities performance utilizing current baseline methodologies available.

4.2 Multiple-Use Applications

Multiple-use applications (MUA) are when distributed energy resources provide services to and receive compensation from more than one entity (e.g., the CAISO and a UDC). DERs and DER aggregations (DERAs) seek to engage in MUAs in order to "stack" services and revenue streams and thereby optimize their resource's value. Depending on the points of interconnection of the DERs and the specific use-case, the resource may provide services to a combination of end-use customers, the distribution system, and the wholesale market and transmission system.

Since early 2016, the CAISO has supported the MUA discussion and policy development by collaborating with CPUC staff in its Energy Storage Proceeding Track 2 (R.15-03-011). CAISO and CPUC staff collaborated to produce a report, "Joint Workshop Report and Framework – Multiple-Use Applications for Energy Storage," which the CPUC issued on May 18, 2017 as part of an ALJ ruling seeking comments. The report was discussed at a CPUC workshop on June 2, 2017, followed by two rounds of stakeholder comments submitted in July 2017. The CPUC issued a ruling on January 11, 2018 with subsequent working group meetings scheduled for 2018.

Proposal

The ISO proposes to continue working collaboratively within the CPUC addressing remaining topic needing further solution development identified in their Final Decision D.18-01-003. This includes active participation in all workshops where further discussion and additional rules will be developed and recommended on outstanding issues. The CAISO will monitor and evaluate the emerging recommendations to determine if they can be taken up in ESDER 3 or warrant consideration as a separate CAISO initiative. The CAISO will assess the adopted MUA rules and recommendations that emerge from the working groups against changes to tariff and/or market design that can be facilitated as part of the ESDER 3 initiative and those that cannot.

The CAISO acknowledges the comments of several parties[11] recommending the CAISO amend the NGR model to allow for these resources the discretion to choose the market intervals in which they want to participate in the CAISO market. Currently, NGRs are 24x7 wholesale market resources comparable to all other supply resources except DR. This means that an NGR is subject to financial settlement through the CAISO market settlement system for its consumption or production in each settlement interval, irrespective of whether the resource submitted a market bid or received a dispatch instruction. This treatment is the same for generators, and is irrespective of whether a generator or NGR provides RA capacity and has a must-offer obligation. The CAISO understands stakeholders' desire to allow NGRs to be able to opt out of CAISO metering and settlement at some intervals in order to provide services to other entities. As stated above, the consideration of the non-24x7 rule for NGRs will be evaluated as the CAISO participates in the MUA working groups.

The CAISO believes that the "non-24x7" topic is just one of many potential areas that will need to be included in an assessment of the CPUC's ruling. Throughout the ESDER 3 process, the CAISO will evaluate tariff and market changes needed and keep stakeholders informed on what those changes entail.

4.3 Non-Generator Resources

Under this topic, the CAISO will provide an overview of issues that NGRs face while participating in the wholesale market. The goal in the sections below is to clearly identify the CAISO's understanding of stakeholders' issues and present the CAISO's position on those issues.

[11] CESA, AMS, Sunrun, and SDG&E

4.3.1 *Throughput management and use limitations*

Based on stakeholder feedback, battery storage participating as an NGR is used frequently in the CAISO market, and more specifically in regulation, due to its fast ramping capabilities. Stakeholders have expressed that at certain times; the CAISO dispatch cycles the resource too frequently due to its "fast ramping capabilities", causing issues with manufacturer warranties. Stakeholders have tried to alleviate this issue by inputting slower ramp rates but argue that it misrepresents the full capability of the resource. Additionally, at the CAISO's January 2018 working group meeting, PG&E presented to stakeholders its ability to manage excessive cycling through energy bids. Stakeholders have responded to the presentation, stating that there are limitations to the bidding option to prevent excessive cycling.

In addition, within the same working group meeting, Powin Energy presented a specific scenario in which its actively participating NGR was receiving infeasible automatic generation control (AGC) signals as well as low accuracy scores based on the CAISO's pay for performance calculation.[12]

The CAISO would like to separate the issues described above into two sections:

(1) Storage resources, which by design have high ramp rates, participate in regulation but have issues with excessive cycling during participation.

(2) Some resources such as Powin Energy are facing infeasible AGC signals, which in turn affects their accuracy scores.

Proposal

The CAISO understands the stakeholders and the various scenarios that battery storage resources are facing in the market. The CAISO is tasked with the difficult job of balancing system needs with the integration of fast ramping capabilities of battery storage. The CAISO does agree with stakeholders that an artificial "slower" ramp rate is not the right approach since it does not accurately represent the resource's capabilities. However, the CAISO agrees with PG&E that, "throughput cannot be perfectly managed on a daily granularity, but can be managed over time."[13] To go further, the CAISO

[12] Link to Powin Energy's presentation http://www.caiso.com/Documents/Presentation-BlakeRector-MikeMcGuffinCustomizedEnergySolutions.pdf

[13] Slide 3 of PG&E's Jan 16, 2018 presentation "What Are the Capabilities of the NGR and REM Market Models for Batteries?" http://www.caiso.com/Documents/Presentation-AlvaSvobodaPG-E.pdf

believes that throughput limits can be expressed through the market's bidding parameters as PG&E demonstrated with its battery storage resources.

The CAISO has also heard from stakeholders that battery storage resources should qualify as a use-limited resource to help manage excessive cycling. The CAISO understands that a manufacturing warranty may limit the number of battery storage resource cycles, but the CAISO has not been provided specific contract provisions that battery storage resources must adhere to and how those provisions may translate into use-limitations. Saying this, the CAISO desires to explore this issue further with the storage community and is open to developing the process and qualifications for NGRs to qualify as a use-limited resource under the CAISO's Commitment Cost Enhancements 3 (CCE3) and Commitment Cost Default Energy Bid Enhancements (CCDEBE) stakeholder initiatives. The CAISO requests that impacted stakeholders submit comments that provide potential use-limited qualifying factors and the types of documents a resource owner should provide to the CAISO to justify receiving use-limited status.

To address the second issue on infeasible AGC signals as well as the regulation performance accuracy measurement being set too low, the CAISO staff is working with individual stakeholders to understand and resolve these issues. If a problem with the AGC signal surfaces based on affected stakeholder feedback and engagement, the CAISO would consider modifications to AGC and regulation performance in a separate initiative since such modification would have market wide implications. However, based on discussions and review of known customer issues to date, the CAISO found incorrect AGC signals were related to resource programming errors.

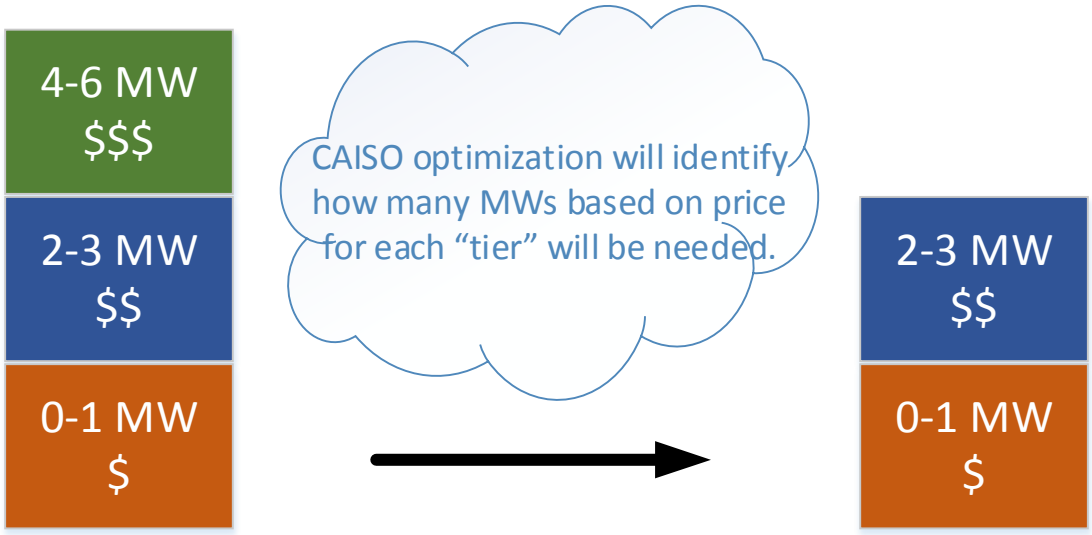
The CAISO stresses the importance of actual data to help demonstrate both throughput issues described above and state of charge management issues. The CAISO requests that storage resource operators present data to the CAISO to help CAISO staff understand their specific issues and concerns and to get to the root cause. Such data and specific instances investigated will help the CAISO to determine if issues are isolated to operator or resource errors or are issues that warrant market design changes.

4.3.2 *State of charge management*

Stakeholders have expressed difficulty in managing state of charge (SOC). Stakeholders have stated that the requirement to submit a real-time bid 75.5 minutes before the operating hour does not give resource owners sufficient knowledge to alter or correct their bidding strategy to manage a resource's SOC. Stakeholders state that resource owners would like to have a high degree of certainty about how the CAISO will use the resource between bid submission and market dispatch (or AGC control). As shown in Figure 10, stakeholders have suggested the option to submit multi-segment AS bids

where the participant would be able to have more control over the amount of regulation service provided to the CAISO based on economic bidding per regulation segment.

Figure 10 Multi-segment AS bid stack



To expand on stakeholders' suggestion on a multi-segment bid stack for AS bids, the resource owner can use a multi-segment bid to clear a specific amount of AS at various price levels and then utilize energy bids for the remaining capacity to manage the real-time SOC. Stakeholders' reasoning is that resource owners do want to provide ancillary services as a portion rather than the entire capacity of the resource. Another reason for the need is the must offer obligation for RA resources. As stated by a stakeholder, "Today, an energy storage resource that is flagged as RA and certified for ancillary services is challenged to price efficiently the desire to get the desired mix of energy and ancillary services awards in the day-ahead market because it's required to offer its full ancillary service capacity for each product at one price."[14] In response, the CAISO disagrees with the justification above for developing a multi-segment AS bid product. CAISO believes that it is the resource owner's responsibility and not the CAISO's to submit the most efficient and competitive price with the resource owner's desired mix of energy and AS into the wholesale market.

The last topic under SOC management is stakeholders' requests to consider the variable operating costs that differentiate certain batteries from traditional generators. The

[14] Comments from Boston Energy from January 16, 2018 workshop. http://www.caiso.com/Documents/BostonEnergyComments-EnergyStorage-DistributedEnergyResourcesPhase3WorkingGroup-Jan162018.pdf

CAISO's understanding from stakeholders is the concept that certain battery technologies may degrade with use, and may be non-linear with use. Battery storage resources with a deeper charge cycle will degrade faster than if it is discharged in shallow cycles. Stakeholders are asking for an option to represent these opportunity costs through multiple bid offers from which the CAISO could select based on the resource's SOC at the time of dispatch. The CAISO would like to note that, this request is different from the multi-segment AS bid stack, presented above.

Proposal

In response to the multi-segment AS bid stack, the CAISO understands the concept that a resource owner would segment a single AS bid into multiple "tiers" where the CAISO identifies which portion of the resource's capacity it is willing to award based on system needs and economics. As stated in response to Boston Energy's comment, the CAISO believes that it is the market participant's responsibility under the current bidding structure, to submit the most economically efficient and competitive bid with the corresponding energy and AS amount into the wholesale market. Similar to the section above on "throughput management," the consideration of a multi-segment AS bid stack would be a fundamental real-time market change that is out of scope under ESDER 3 because it will need to apply to all resources and not just those participating under the NGR model. If stakeholders determine this to be an important change needed in the CAISO market, the topic will need to be submitted in the annual stakeholder catalog process.

In response to stakeholders' request to consider how to best capture the marginal cost of energy storage due to the "non-linear degradation"[15] of its battery storage resources, the CAISO believes that the current NGR model gives a battery storage resource operator the ability to reflect opportunity costs in its bid. The CAISO believes that it is the responsibility of the resource owner/scheduling coordinator, to bid the resource with consideration of its opportunity costs and availability in a competitive marketplace. As proposed under the throughput management section, the CAISO is proposing to provide a path for NGRs to seek use-limited status. Use limitation will not only provide the necessary outages to pull the resource from the market once limits have been reached, but also, enable additional opportunity costs for the resource. Through the ESDER 3 process, the CAISO will be detailing the various policy changes established in

[15] LS Power comments from CAISO ESDER 2 straw proposal. http://www.caiso.com/Documents/LSPowerComments-EnergyStorageandDistributedEnergyResourcesPhase2-RevisedStrawProposal.pdf

CCE 3 and CCDEBE that will help NGRs utilize existing functionalities to manage throughput limitations and state of charge.

5 Next Steps

In this straw proposal, the CAISO identified the scope of issues it will take on for ESDER 3. The CAISO will hold a stakeholder call on February 21, 2018 to review the straw proposal and receive comments from stakeholders by March 7, 2018. In addition to the web conference, the CAISO is planning to hold working group meetings to work out further details of the individual proposals. In addition to comments on the proposal, the CAISO specifically requests stakeholders from the storage community to provide suggestions for potential documents that can justify and qualify storage resources for use-limited status under the CAISO's commitment cost provisions.