



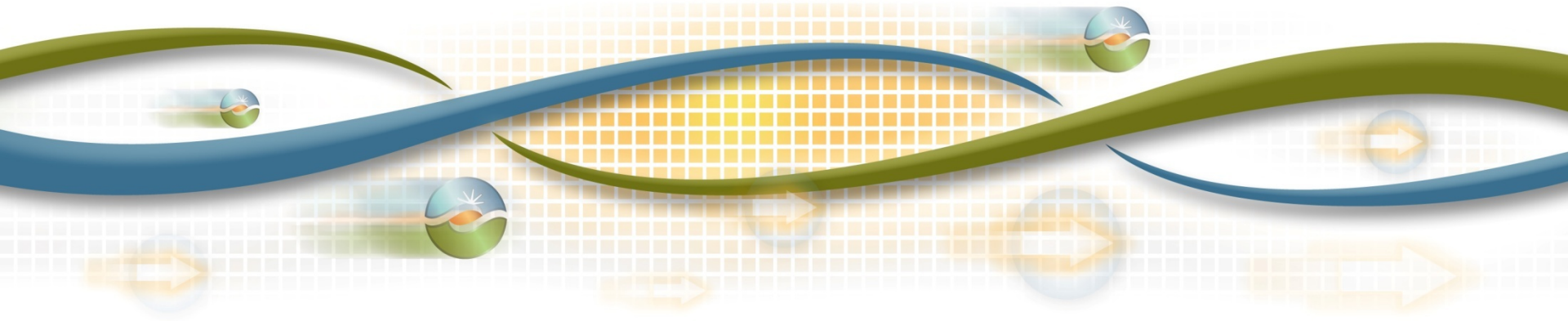
Energy Storage and Distributed Energy Resources Phase 3 (“ESDER 3”)

Issue Paper

Workshop

January 16, 2018

10:00 a.m. – 4:00 p.m. (Pacific Standard Time)

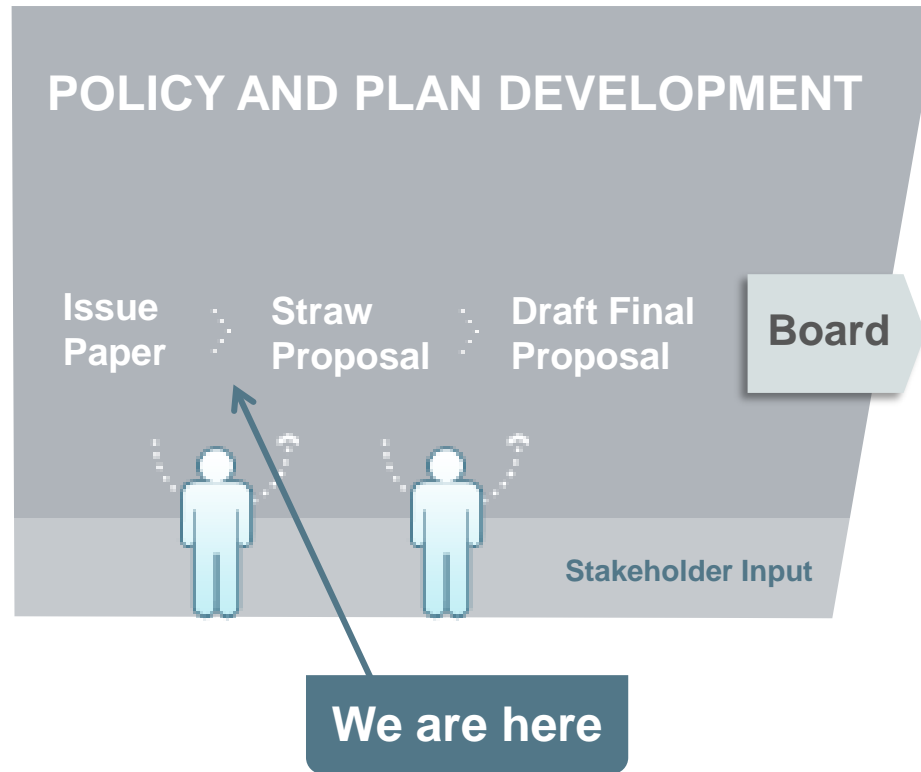


Agenda

Time	Item	Speaker
10:00 – 10:10	Introduction	James Bishara
10:10 – 10:15	Review Agenda and Objectives	Eric Kim
10:15 – 12:00	Review of potential scope items for Demand Response (DR)	Cathleen Colbert, Jill Powers (CAISO) Ted Ko (STEM)
12:00 – 1:00	Lunch	
1:00 – 1:30	Review of potential scope items for Multiple-Use Applications (MUA)	Eric Kim
1:30 – 3:45	Review of potential scope items for Non-Generator Resource (NGR)	Peter Klauer (CAISO) Mike McGuffin (CES) Alva Svoboda (PG&E)
3:45 - 4:00	Next Steps	James Bishara

STAKEHOLDER PROCESS

CAISO Policy Initiative Stakeholder Process



Potential items for scope that were identified in the September 29, 2017 ESDER3 Issue Paper

Demand Response

1. Demand response modeling limitations
2. Weather-sensitive DR
3. Removing single LSE requirement and DLA discussion
4. RDRR economic buy-back of day-ahead awards
5. Recognition of behind the meter EVSE load curtailment
6. Load consumption/shift product

Multiple-Use Application

1. 24x7 CAISO participation requirement for DERs
2. Wholesale market participation model for a micro-grid

Non-Generator Resource

1. Reflecting costs and NGR use limitations
2. Managing SOC and throughput limitations

Comments received after November workshop provided stakeholder priorities

- Demand response modeling limitations
- Variable DR (weather sensitive)
- Removing single LSE requirement and DLA discussion
- Load shift product






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- Recognition of behind the meter EVSE load curtailment
 - 24x7 CAISO participation requirement for DERs
 - Reflecting costs and NGR use limitations
 - Managing SOC and throughput limitations



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- Wholesale market participation model for a micro-grid
 - RDRR economic buy-back of day-ahead awards



Key	High Priority 	Low Priority 	No Consideration 
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Objectives for today

- Review and provide opportunity for additional input on stakeholder positions for ESDER3 scoping
- Provide ISO's point of view on scoping based on comments and parallel efforts
- Enable stakeholders to have final discussion on all topics before straw proposal
 - opportunity for stakeholders to present positions on specific topics and ISO to gain additional clarity

DEMAND RESPONSE (DR)

1. Demand response modeling limitations

- Commitment costs and the impact of a 0 MW Pmin
 - DR resources do not have defined commitment costs
 - DR resources are being committed in RUC and are susceptible to infeasible real time 5-minute dispatches
- Minimum and maximum run-time constraints
 - The existing minimum run-time constraint may not effectively utilize DR operational characteristics when its Pmin is equal to 0 MW
 - Utilization of a maximum run-time is desired over use of maximum daily energy limit parameter

COMMITMENT COSTS

Overview of cost based framework

- Cost based offers include:
 - Mitigated energy price
 - Maximum allowable minimum load cost
 - Maximum allowable start up cost
 - Maximum allowable transition cost
- ISO calculates for gas and uses MF values for non-gas
- ISO generates these cost based offers for RA resources that fall under the bid insertion rule
- ISO exempts select units from mitigation on its energy market based offers to the mitigated price, they are:
 - Participating load
 - Demand response resources
 - Non-generator resources

Supply offer components

	Cost type	Description	Select details
Energy costs	Variable energy cost	\$/MWh for providing each MW segment above minimum load (Pmin)	<ul style="list-style-type: none"> Hourly energy market based bid Can update bids until T-75. Mitigated when fails LMPM to DEB (cost bid)
	Minimum load cost	\$/MWh for operating and providing energy at its minimum load (Pmin)	<ul style="list-style-type: none"> Minimum load cost based bid Daily bid in day-ahead and real-time markets Proxy costs for setting cap and generating bids
Commitment costs	Start-up cost	\$/run hour (event) \$/start (event) of the resource or configuration	<ul style="list-style-type: none"> Start-up cost based bid Daily bid in day-ahead and real-time markets Proxy costs for setting cap and generating bids
	Transition cost	\$/transition (event) of the configuration	<ul style="list-style-type: none"> Transition cost based bid Daily bid in day-ahead and real-time markets Proxy costs for setting cap and generating bids

Supply offer components

		Cost type	Current tariff	CCDEBE tariff changes
Energy costs	Variable energy cost (\$/MWh)		Bid component that indicates the prices and related quantity at which a resource offers Energy in a monotonically increasing (decreasing for Participating Load) staircase function...	No change
	Minimum load cost (\$/MWh and \$/hour)		The costs a Generating Unit, Participating Load, Reliability Demand Response Resource, or Proxy Demand Resource incurs operating at Minimum Load	The costs a Generating Unit, Participating Load, Reliability Demand Response Resource, or Proxy Demand Resource incurs operating at Minimum Load and costs associated with commitment hour costs even for resources with 0 MWh minimum operating level
Commitment costs	Start-up cost (\$/start)		Cost incurred by a particular Generating Unit during Start-Up ...until the time the Generating Unit reaches Minimum Load	Costs incurred by a resource for bringing a resource online or to a state capable of providing energy
	Transition cost (\$/transition)		For a Multi-Stage Generating Resource, the dollar cost per feasible transition ...when the resource is already On...	No change

Evaluation of DR and storage units cost based treatment through the Master File RDT submissions

- SC registers cost values based on relevant costs which could factor in more complex cases such as:
 - Average cost field
 - Start-up cost field
- Restricted to MF approval timeline (up to 7d turn around)
 - Increased uncertainty given the registration process
 - Not able to update with timely information prior to market run
- Currently – no place to include run hour costs for operating at minimum operating level unassociated with providing energy
- CCDEBE will update min load costs to include a second component that includes run hours (unrelated to Pmin)

DR AND STORAGE USE LIMITED TREATMENT

Background on use limitations and opportunity costs

- Use limited capacity that cannot be fully optimized by the commitment processes due to limitations set by statutes, regulatory, ordinances, court orders, or design considerations.
- CCE3 policy revised the definition, clarified supporting justification and provides a methodology to determine opportunity costs for limitations of use-limited resources.
- Under CCE3, use limited status makes resources eligible for:
 - Use limited resources will be exempt from bid insertion rules
 - Use limited resources will have access to use limited outage cards
 - Use limited resources may have a calculated or negotiated opportunity cost included in the bid caps
- ISO worked with demand response and storage community to ensure CCE3 policy meets this communities needs.

Revised use-limited definition

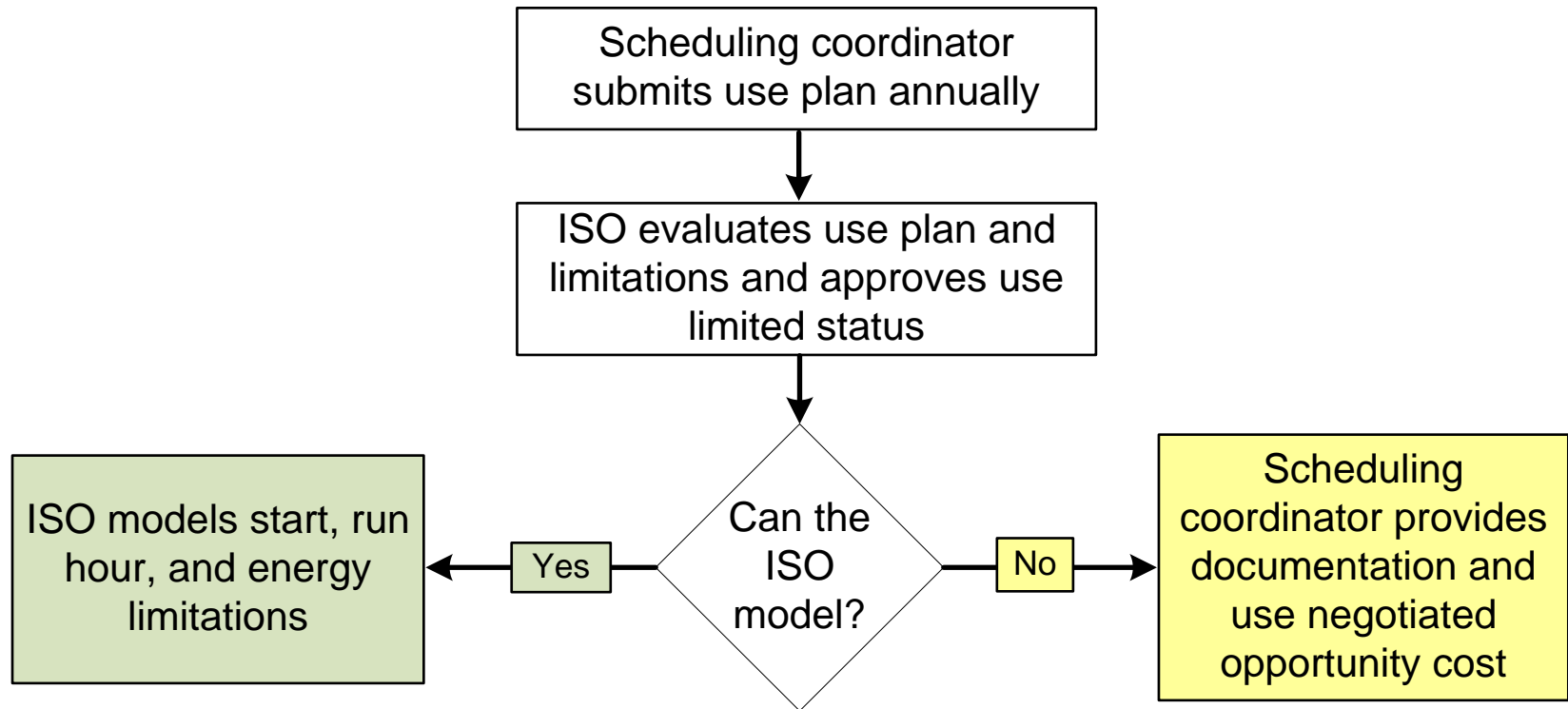
- Use limited definition ensures that resources that need increased flexibility to manage resource gain access to outage cards and are exempt from bid insertion
- Use-limited definition identifies resources that *need the ability* to reflect an opportunity cost in commitment cost bids and/or DEBs due to acceptable limitations that *extend beyond market optimization* horizon.
- Resources will no longer default to use-limited status.
 - Hydro, PDR, RDRR, and participating load
 - Continue to be exempt from bid insertion and bid mitigation
- All resources, including PDR resources, can obtain use-limited status per revised definition by registering the resource through use-limited registration process.

CCE3 policy - demand response and storage treatment regardless of use limit status

Use limited and non-use limited DR and storage resources will:

- Be exempt from mitigation
- Be exempt from bid insertion
- Have access to outage cards (e.g. short-term use-limited reached)
 - Can use short-term use limited reached card for “fatigue breaks”
 - If use limited then can use monthly, annual, or other use limited reached cards if their usage is depleted (subject to outage cards substitution requirements)

Background on the opportunity cost model



Background on the opportunity cost model

- Opportunity cost model will calculate an opportunity cost for resources and limitations that are able to be modeled
- For limitations not able to be modeled, market participants will submit proper documentation and a negotiated opportunity cost.
- Calculated or negotiated opportunity cost will be added to the bid cap of the corresponding commitment cost as calculated by the proxy cost calculation.
 - Targeted implementation: Fall 2016
 - Bidding rules initiative is exploring modifications to bidding rules for commitment costs with Fall 2016 as targeted implementation date.

Opportunity costs in CAISO markets

- When committing a resource today means it is not available for a higher valued interval later, there is an associated opportunity cost.
 - Acceptable environmental or design limitation that extends beyond the ISO optimization.
 - LRA approved DR programs/contracts that set the availability parameters of PDR resources are considered a design limitation.
 - e.g., 24 hours per month and/or 100 starts per year
- Reflecting the opportunity cost in market bid components will enable the ISO market optimization to ration the availability of the resource over the limitation horizon.
 - Start limitation => start-up cost bid
 - Run-hour limitation => minimum load cost bid
 - MWh limitation => energy cost bid
- CAISO believes PDR or NGR might prefer negotiated option as their limitations might not be a robust approximation under the OCC

Opportunity costs in CAISO markets

	Conventional gas-fired generator	Use-limited conventional gas-fired generator	Demand response (Proxy Demand Response)
Availability	24/7	Based on use-limitations	<ul style="list-style-type: none"> Based on CPUC DR requirements (3 consecutive days, 4 hours/day, 24 hours/month) Other limitations?
Commitment costs?	Start-up and minimum load costs	Start-up and minimum load costs	Start-up and minimum load costs (<i>available but CAISO has not seen registration of these costs</i>)
Commitment cost subject to market power mitigation?	Yes, bid up to 125% of proxy cost calculation	Yes, bid up to 125% of proxy cost calculation	No
Method of proxy cost calculation	Formulaic with explicit cost components.	Formulaic with explicit cost components	Less formulaic, may have ability to reflect opportunity cost under current construct
Energy costs subject to market power mitigation?	Yes	Yes	No
CAISO to calculate opportunity cost?	No, not use-limited.	Yes, for commitment and energy bids because resource is subject to mitigation and opportunity cost is not included in proxy cost and/or DEB calculations.	To be determined based on discussion at workshop . . .

Opportunity costs in CAISO markets

- PDR resources' energy bids
 - Not subject to mitigation, can currently reflect opportunity cost in energy bids.
- PDR resources' commitment costs
 - If resource does not have commitment costs: No cost bids submitted, therefore no need for bid cap to be increased by an ISO calculated opportunity cost.
 - If resource has commitment costs:
 - Current flexibility to potentially reflect opportunity costs under proxy cost methodology, and would then not require an ISO calculated opportunity cost.
 - If a more formulaic proxy cost methodology determined for PDR with specific cost components, may require an ISO calculated opportunity cost similar to gas-fired resources.

2. Weather-sensitive demand response



- Weather-sensitive PDR/RDRR cannot deliver a fixed resource adequacy qualifying capacity amount since its capability depends on weather conditions
- The ISO believes this issue requires coordination with the CPUC in the RA proceeding and through working group
 - CPUC commented that the RA working group process will complete its work by mid-2018

3. Removing single LSE requirement/ DLA discussion

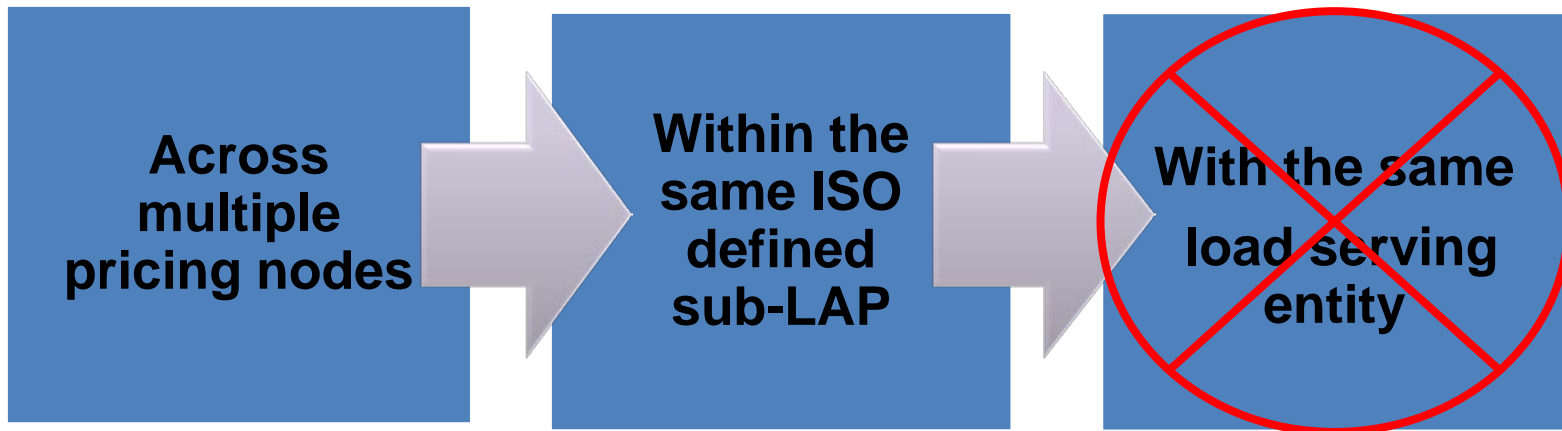
- Currently, PDR/RDRR design requires aggregations must be located under a single load serving entity (LSE), represented by one demand response provider (DRP), and within a single sub-LAP
 - Stakeholders have expressed difficulty in meeting or maintaining the 100 kW minimum participation requirement
 - Removal of the default load adjustment requires stakeholder consideration and agreement.

LSE AGGREGATION REQUIREMENT WITH DEFAULT LOAD ADJUSTMENT

PDR and RDRR aggregation requirements have been established

Unlike traditional generation, demand response resources are comprised of an aggregation of locations, aka “sub-resources”, potentially geographically disbursed, to meet minimum participation capacity requirements.

Aggregations are therefore permissible:



Unique settlement rules for demand response may impact the LSE for the PDR or RDRR

LSE's for PDR or RDRR resources that have DR energy measurement when the real-time dispatch LMP is below the NBT are subject to a default load adjustment

- FERC Order 745 required the ISO to implement a net benefits test (NBT)
- NBT establishes a price threshold above which demand response resource bids are deemed cost effective
- The NBT price is compared against the real-time dispatch LMP to determine if a default load adjustment DLA might be applicable

On a monthly basis the NBT threshold price is established

Year	Month	Peak Type	Threshold Price
2017	12	ON PEAK	\$32.35
2017	12	OFF PEAK	\$33.92

- When *applicable*, a DLA will be used to adjust the metered load used in uninstructed imbalance energy UIE settlement of the LSE's default LAP (DLAP)
- This quantity represents the total DR energy measurement (DREM) delivered by all DR resources served by that LSE that do not meet the real-time NBT

Example of LSEs UIE settlement with application of a DLA due to associated DLAP PDR/RDRR dispatch response

PDR/RDRR Activity HE18 (intervals 1-6)

NBT threshold price = \$32.35

Resource	RTD Interval	RTD LMP price	NBT met ?	DR energy measurement (MW)	DLA Qty (MW)
NOCA_1_PDRP01	1	\$29.00	N	1.10	1.10
EBCA_1_PDRP02	1	\$29.00	N	2.05	2.05
NOCA_1_PDR01	2	\$35.00	Y	1.10	0
EBCA_1_PDRP02	2	\$35.00	Y	2.05	0
NOCA_1_PDRP01	3	\$35.00	Y	1.10	0
EBCA_1_PDRP02	3	\$35.00	Y	2.05	0
NOCA_1_PDR01	4	\$35.00	Y	1.00	0
EBCA_1_PDRP02	4	\$35.00	Y	2.00	0
NOCA_1_PDRP01	5	\$35.00	Y	1.00	0
EBCA_1_PDRP02	5	\$35.00	Y	2.00	0
NOCA_1_PDR01	6	\$35.00	Y	1.00	0
EBCA_1_PDRP02	6	\$35.00	Y	2.00	0

Total DLA for interval 1 = **3.15 MW**

Metered quantity used in the UIE settlement for associated LSE = NCAL

Example (continued) - DLA Quantity applied to LSE Load ID in UIE settlement

LSE = NCAL

DLAP Load ID = NORCAL_1_LD1

DLA for total PDR performance

LSE DLAP settlement HE 18 interval 1

Resource	DA Qty	RTD Qty	Actual metered Qty	Total DLA Qty	Adjusted metered Qty
NORCAL_1_LD1	10	0	7	3.15	10.15

Metered quantity used in the UIE settlement for NORCAL_1_LD1

UIE = DLAP (adjusted) metered load - day-ahead schedule

$$\text{UIE} = (-10.15) \text{ MW} - (-10 \text{ MW}) = -.15 \text{ MW}$$

6475 = (-1) * (UIE) * (hourly real-time lap price)

$$6475 = (-1) * (-.15 \text{ MW}) * \$ 26.00^{**} = \$ 3.90$$

Total UIE Settlement = \$ 3.90 Charge to LSE

****Assuming hourly real-time lap price = \$26.00**

Where, hourly real-time lap price = the load deviation weighted average of the hourly average of the dispatch Interval LMPs for the LAP in the relevant trading hour used for the settlement of UIE

Request was made for ISO to provide financial impact of removing the default load adjustment.

- Analysis still in progress, sampled most recent and summer settlement month to provide some preliminary perspective
- Full year of impact analysis will be performed prior to straw proposal

Year	Trade Month	Number Of Intervals/Trade Dates triggered	Total DLA (QTY)	Total DLA impact (\$)
2017	December	496 / 23	57.71 MWH	\$1,779
2017	June	4 / 5	.0613 MWH	\$1.30

4. RDRR economic buy-back of day-ahead awards

- Stakeholders requested RDRR to adjust bids in real-time market to leverage economic buy-back of their day-ahead awards
 - All reliability-triggered MWs that qualify for RA under RDRR must be available to the ISO in real-time
 - RDRR participation model excludes this capability due to special treatment of reliability-triggered capacity
 - ISO prefers to pursue capabilities available with PDR.

5. Recognition of behind the meter Electric Vehicle Supply Equipment load curtailment



- Stakeholders have expressed the need to extend the MGO concept to the sub-metered EVSE
 - Would provide an option for recognition of a EVSE sub-meter for direct performance measurement of load curtailment
- Stakeholders expressed in comments wanting to expand beyond just EVSEs
 - ISO does not support expanding the scope beyond EVSEs

6. Load shift capability

- The concept of load consumption capability was originally introduced in the ESDER 2 initiative, but required more work after ESDER 2 concluded
- Discussions with the storage community ensued to consider a load shift capability where excess, negative priced energy could be stored and later released for productive purposes
 - Initial focus on BTM storage whose energy charge and discharge can be directly metered and monitored
- Consider a load shift capability from conventional load management, which is not directly metered, as a potential future effort in collaboration with the CPUC

*Presentation from Ted Ko
(Stem)*

MULTIPLE-USE APPLICATIONS (MUA)

Multiple-use applications are when DER provides services and receives compensation from more than one entity.

- Since early 2016, the ISO has collaborated with the CPUC staff in its Energy Storage Proceeding Track 2
 - A report was released on May 18, 2017 and a workshop was held on June 2, 2017
 - Proposed Decision was released in November 2017
- January 11, 2018 Proposed Decision (with revisions) signed

Next steps for Multiple-Use Applications

- The ISO will actively participate in working groups established by the MUA ruling
- Throughout this initiative, ISO staff will review potential tariff changes and present it to stakeholders

Non-24x7 ISO participation

- Currently, DERs utilizing the NGR model or participating as generators are settled 24x7 as a wholesale market resource
- These resources are subject to financial settlement for consumption or production in each interval
 - Regardless of market award or a dispatch
- Stakeholders desire to opt out of ISO market participation and settlement in some intervals in order to provide services to other entities

Wholesale market participation model for a micro-grid





- Stakeholders have asked how micro-grids could provide wholesale energy and ancillary services
- Several sub-issues were identified in the issue paper
 - Can a micro-grid aggregate internal facilities and participate under NGR?
 - Can the entire micro-grid participate as an NGR?
 - If the NGR model does not work what other models?
 - How to distinguish between wholesale consumption for ISO grid services versus retail consumption for internal load?

NON-GENERATOR RESOURCE (NGR)

Discussion points on NGR

The ISO listed the following two topics in the issue paper:

1. Reflecting costs and NGR use limitations 
2. Managing SOC and throughput limitations 

Presentation from Mike McGuffin (CES)

Presentation from Alva Svoboda (PG&E)

NEXT STEPS

Next Steps

Milestone	Date
Post issue paper	September 29, 2017
Stakeholder call	October 12, 2017
Stakeholder comments due	October 18, 2017
Stakeholder workshop - Issue Paper	November 6, 2017
Stakeholder comments due - Nov. 6 workshop discussion and presentations	November 20, 2017
Stakeholder comments due - Jan. 16 workshop	Jan 26, 2018



Request written stakeholder comments on the workshop be submitted by COB January 26 to initiativecomments@caiso.com

The **comments template**, as well as all materials related to the ESDER Phase 3 initiative, are available at:
http://www.caiso.com/informed/Pages/StakeholderProcesses/EnergyStorage_DistributedEnergyResources.aspx

Acronyms

Acronyms

1. DER - Distributed Energy Resource
2. PDR - Proxy Demand Resource
3. RDRR - Reliability Demand Response Resource
4. DRP - Demand Response Provider
5. EVSE - Electric Vehicle Supply Equipment
6. NGR - Non-Generator Resource
7. SOC - State of Charge
8. MUA - Multiple-Use Application
9. MGO - Meter Generator Output
10. RUC - Residual Unit Commitment
11. LRA - Local Regulatory Authority
12. LSE - Load Serving Entity
13. DLA - Default Load Adjustment
14. A/S - Ancillary Service