Energy Storage Enhancements Track 2 Training

Welcome
Our presentation will begin shortly.

Today's Trainer:
Cynthia Hinman, Lead Customer Readiness Trainer

Housekeeping

Keep yourself muted to minimize background noise

Unmute to ask verbal questions or write questions in the chat pod

Raise your hand using WebEx interactivity tools

Energy Storage Enhancements Track 2 has several goals

Co-Located Model Enhancements	RIMS Update	State of Charge (SOC) Exceptional Dispatch

- ACC for pseudo-tie resources

- Option – do not charge from the grid

- New data fields
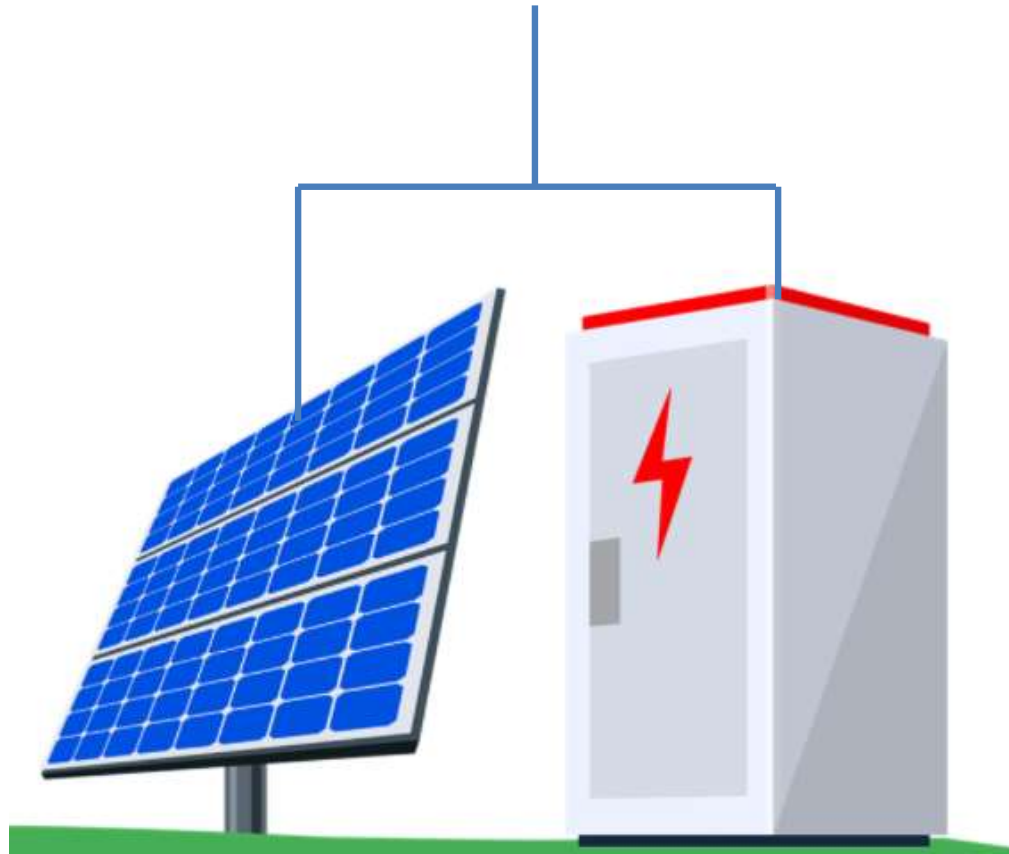
- Calculation
- Settlement

Aggregate Capability Constraint for Co-located Pseudo-Tie Resources

Background
How to apply
References

Example: Co-Located Resource

Solar 1
- meter
- resource ID
- telemetry
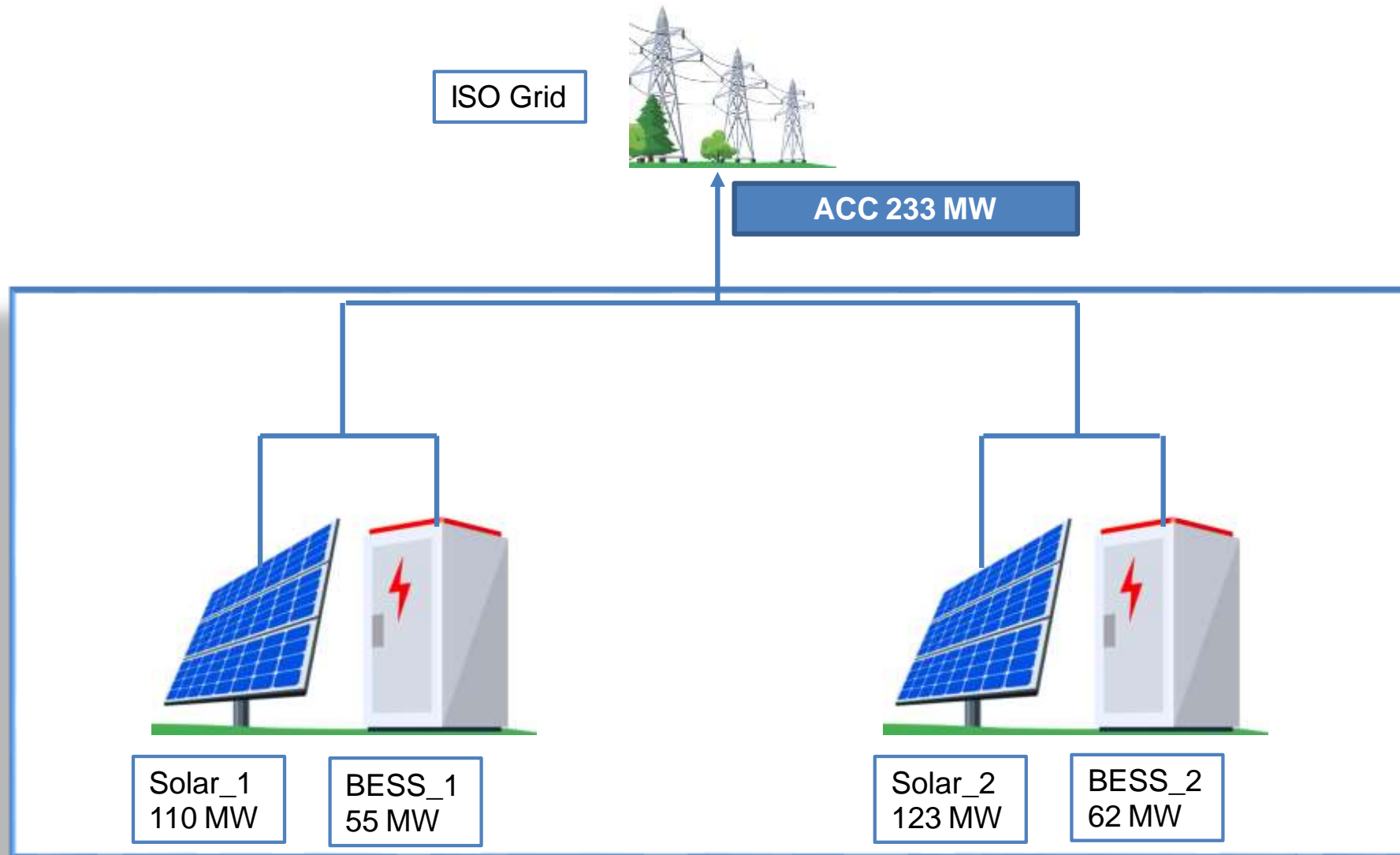- forecast
- bids
- outages
- settlements

BESS_1
- meter
- resource ID
- telemetry
- forecast
- bids
- outages
- settlements

Solar_1
110 MW

BESS_1
55 MW

Example: Aggregate Capability Constraint (ACC)

Example: Pseudo-Tie Resources

ISO Grid

ISO BAA

ACC 233 MW

Non- ISO BAA

Solar_1
110 MW

BESS_1
55 MW

Solar_2
123 MW

BESS_2
62 MW
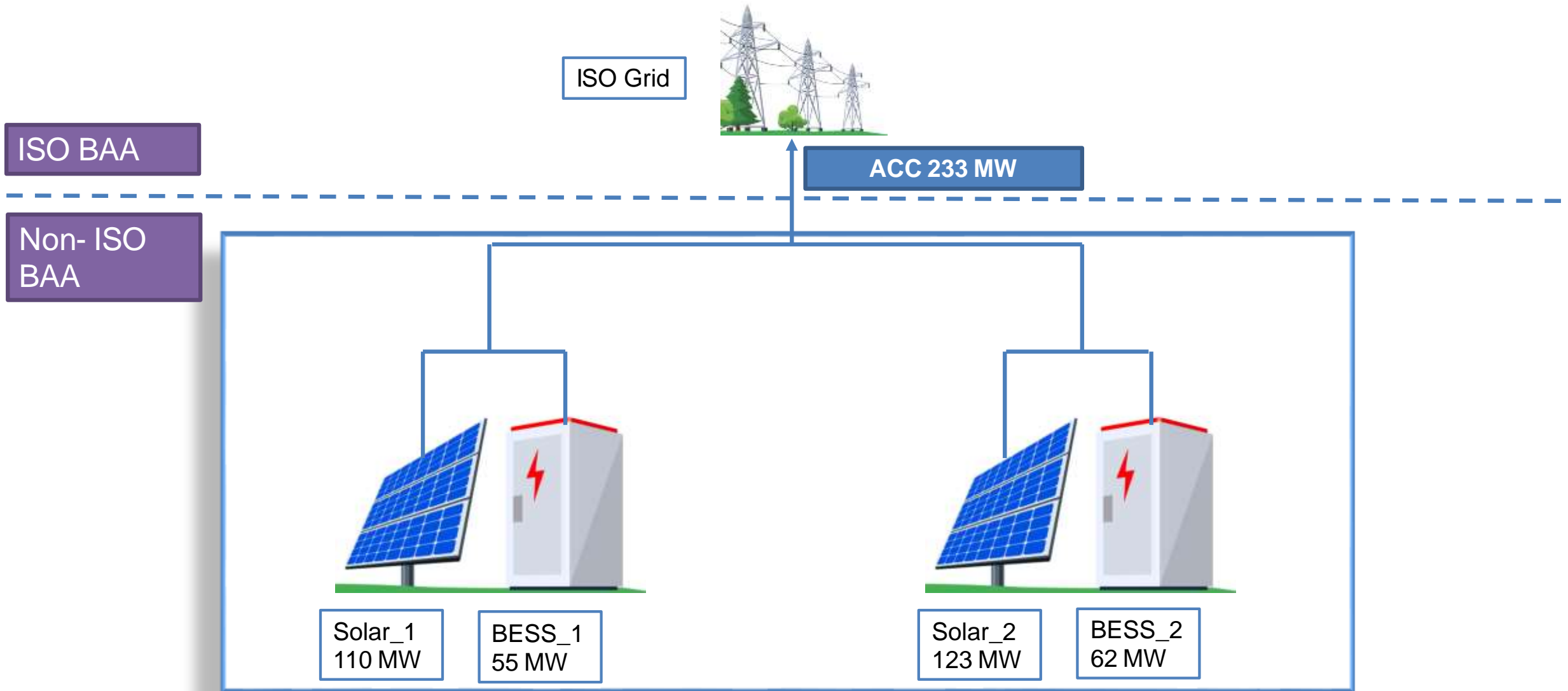
Market Process Review with ACCs

- Each day the IFM and RTM receive model data for all active ACCs and their co-located resources

- For each market run the system will optimize unit commitment and economic dispatch while enforcing the ACC for co-located resources
  - Combined dispatch of co-located resources will not exceed the ACC min or max limits
  - One resource at a co-located facility may produce energy while another consumes energy at the same co-located facility

- Dispatch instructions for all resources are based on submitted bids

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What is the problem?

- Aggregate Capability Constraints (ACCs) ensure that co-located resources' aggregate market awards do not exceed the interconnection service capacity for a particular site.

- This functionality was only approved for internal co-located resources.

Solution:
Allow co-located pseudo-tie resource to apply for Aggregate Capability Constraint (ACC)

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Example: Participating Generator Agreement

SCHEDULE 1

Section 1: Technical Characteristics of Participating Generator Units

ABC Solar LLC

Resource Name(Generating Unit)	CAISO Resource ID	Type Of Unit	Primary Fuel Type	Resource Maximum Operating Value [1,2] (PMax MW)	Resource Minimum Operating Value [1,3] (PMin MW)	Hybrid (Y/N)	Co-Located (Y/N)	ACC ID / ACC Limits (if unit is Co-Located) Maximum & Minimum Operating Value *must* be provided if Co-Located	Net capacity to the CAISO Controlled (MW)	Limitations (That affect technical characteristics and performance of the unit - include those not captured in the GRDT)
ABC Solar:								Master ACC ID: ABC_SOLAR_123 200MW / -50W	200MW / -50W	
ABC Solar 1A	ALPHA_2_A1ASR1	Solar	Solar	100	0	N	Y			
ABC Solar 1B ***ACC ID Controlled Resource***	ALPHA_2_A1ABT1	Battery	Battery	25	-25	N	Y			
ABC Solar 2A	ALPHA_2_A2ASR1	Solar	Solar	100	0	N	Y			
ABC Solar 2B	ALPHA_2_A2BBT1	Battery	Battery	25	-25	N	Y			
Co-tenancy Agreements: List ACC-ID Controlled Resource										

Co-tenancy Projects: Language will be captured on all co-tenant PGA Schedule 1's

1. Current effective values for purposes of ... lary Services in the CAISO Markets may differ from those set forth in this Schedule 1, depending on the results of CAISO per... K: Ancillary Services Requirements Protocol of the CAISO Tariff. This and other values are subject to certification by the CAISO in accordance with Section 4.3.2 of the Participating Generator Agreement and the CAISO Tariff. More detailed Generating Unit operating data must be provided at a time and in a format specified by the CAISO in response to CAISO requests pursuant to CAISO Tariff Sections 4.6.4 and 4.6.7.1 and 30.
2. The maximum allowable capability when the resource is operating.
3. The maximum allowable charging level when the resource is operating, if applicable. The value will be 0 for non-storage generating type.

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Generator Resource Data Template (GRDT)

	A	B	C	CV	CW	CX	
1	PGA Name	Scheduling Coordinator ID	Resource ID	Forecast Selection	Co-Located Resource	VER NGR	Meter
2	PGA_NAME	SC_ID	RES_ID	FORECAST_SELECTION	CO_LOCATED	VER_NGR	METER_
3							
24							
25							
26							
27							
28							
29							
30							

Instruction | Definition-GRDT | Code | **RESOURCE** | RAMPRATE | HEATRATE | STARTUP | FORBIDDEN OPR REGION

Additional resources

- Co-located Resources and Aggregate Capability Constraint (ACC): Refer to the BPM for Market Operations, Section 2.1.19

- Pseudo-ties: Refer to the BPM for Market Operations, Section 2.1.14

https://bpmcm.caiso.com/Pages/BPMDetails.aspx?BPM=Market%20Operations

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What Questions Do You Have?

Unmute   or   Raise your hand

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Optional - Avoid Charging from the Grid

Background
New SIBR Features

What is the problem?

- The Investment Tax Credit (ITC) strictly limits the tax incentive a developer can receive if it charges a storage resource from sources external to a co-located renewable resource

- Many agreements assume ITC recovery and include requirements to avoid grid charging

Solution:
Create a charging constraint that co-located resources can use to help avoid grid charging

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New! Off grid charge indicator

RUG slide for SIBR

System	Project	UI	API	Data/Comments	Tech Specs	MapStage
SIBR*	ESE2	New Hourly feature on Hourly tab to elect Y/N for Off Grid Charge.	New optional element in xsd for 'offGridCharge' used by designated resource to manage Sub/Stand Alone ACC. RawBidSet, BidResults, CleanBidSet v5 xsd. Version 20231101.	New HourlyParameter for offGridCharge this is a Yes/No type that is optional.	8/10/2023	8/28

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Storage resources will need to submit outage cards in OMS if:

The co-located VER cannot provide the charging energy

AND

The storage resource has depleted its SOC and there is no ability to charge the resource

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What Questions Do You Have?

Unmute   <u>or</u>   Raise your hand

RIMS Update

New Data Fields

RIMS – New Data Fields

RIMS

App & Study

Generation Type and Fuel Type

Generator Type	Fuel Type	Net MW	MWh	Storage Duration (Hours)	Hybrid	Co-Located
Storage	Battery	30	10	10	Y	Y

MPAI>NRI projects

Fuel Type and Megawatt

Fuel Type Index ▲	Fuel Type	Net MW	MWh	PMin	Forecast Election
Fuel 1	Battery	75	5	1	CAISO
Fuel 2	[None]				Select Forecast Election
Fuel 3	[None]				Select Forecast Election
Fuel 4	[None]				Select Forecast Election

IR Forms

Technology

Type	Generation Type	Fuel Type	Megawatt	Energy (MWh) for Storage Systems Only	Expected Hour Duration for Storage Systems Only	Co-location	Hybrid
Select Gen Type		Select Fuel Type	☐ (MW)	☐ (MWh)	☐ (Hour(s))	☐ Co-Located	☐ Hybrid
Select Gen Type		Select Fuel Type	☐ (MW)	☐ (MWh)	☐ (Hour(s))	☐ Co-Located	☐ Hybrid
Select Gen Type		Select Fuel Type	☐ (MW)	☐ (MWh)	☐ (Hour(s))	☐ Co-Located	☐ Hybrid

☐ Other (please describe):

| Enter Gen Type | | Enter Fuel Type | ☐ (MW) | ☐ (MWh) | ☐ (Hour(s)) | ☐ Co-Located | ☐ Hybrid |

Technology Comments: ☐

PDF

C	Configuration, Fuel Type(s) and MW(s):	Configuration: Select One

Fuel Type 1:	Select One		Additional Fuel Type 2:	Select One
MW:			MW:	
MWh:			MWh:	
PMin:			PMin:	
Forecast Election:	Select One		Forecast Election:	Select One

If project type is Load, choose Fuel Type of Load
MWh & PMin required when Battery fuel type is selected

Choose Additional fuel type(s) for a mixed fuel resource
MWh & PMin required when Battery fuel type is selected

Additional Fuel Type 3:	Select One		Additional Fuel Type 4:	Select One
MW:			MW:	
MWh:			MWh:	
PMin:			PMin:	
Forecast Election:	Select One		Forecast Election:	Select One

Choose Additional fuel type(s) for a mixed fuel resource
MWh & PMin required when Battery fuel type is selected

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RUG Slide for RIMS

System	Project	UI	API	Data	Technical Specifications
RIMS	ESET2	Existing: Existing > App & Study > Equipment Configuration tab > Generation as Modeled and Implemented grid	NA	> Pull storage resource MWh from MF > Add new field for calculated MWh > Add new field for storage resource duration in hours	NA

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What Questions Do You Have?

Unmute   or   Raise your hand

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Counterfactual Opportunity Cost Methodology for Hold SOC Exceptional Dispatches

Background
Examples
Market Sim Scenarios

What is the problem?

- The ISO may need to issue exceptional dispatches (ED) to storage resources to hold their state of charge (SOC) when we are concerned that real-time price signals may inadvertently drain storage resources and make them less available when we need them most

- Existing ED settlements are based on "bid or better" methodology which does not work for instructions to hold state of charge, essentially a 0 MW instruction

Solution:

Implement new counterfactual opportunity cost methodology to settle EDs that instruct resources to hold SOC.

Storage resources may be exceptionally dispatched to charge and then hold the state of charge
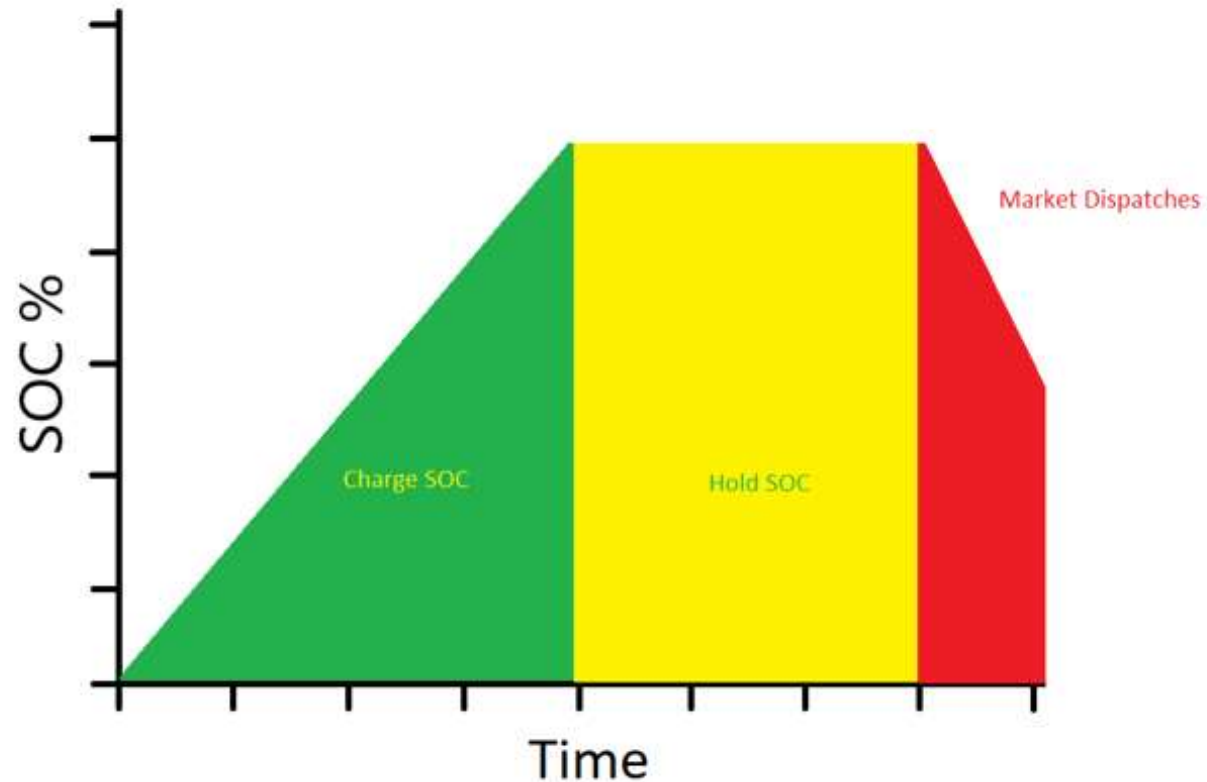
Scenario

The operator initially charges a storage resource because it will be needed in future intervals. This will be covered by a SYSEMR ED as it is today.

Once the resource is a the desired state of charge, the operator issues the Hold ED and this will be settled using the lost opportunity cost uplift.

Tip: If a co-located resource receives an ED to charge and hold, off-grid charging will not be observed.

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Charge Codes

Number	Name	Version	Description of Change
Settlement			
6485	*New!* Exceptional Dispatch Hold SOC Uplift Settlement	5.0	Payment for Hold SOC
Allocation			
6486	Real-Time Excess Cost for Instructed Energy Allocation	5.7	First tier of cost allocation.
6480	Excess Cost Neutrality Allocation	5.4	Second tier of cost allocation (if there are remaining costs that were not allocated above)
Other			
Pre-calc	RTM Net Amount	5.38	Includes Exceptional Dispatch Hold SOC payment in the Real-time Market Net Amount. This is used in RTM BCR settlement

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Key points of Exceptional Dispatch Hold SOC Uplift Settlement (CC 6485)

- Hold SOC is a System Emergency ED reason type (SYSEMR ED)

- Represents lost revenue that could have been made if resource had not been exceptionally dispatched to hold

- Upstream calculation of opportunity cost based on Hold SOC instruction until the end of the trade date

- This revenue is considered in the real-time bid cost recovery calculation

Billing Determinant: BA_5M_RSRC_ED_HOLD_SOC_AMT
Variable name: ExceptionalDispatchHoldSOCAmt BrtOmdhcif

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New counterfactual opportunity cost methodology accounts for the maximum revenues the resource would have received had it participated optimally in the market

- For each Hold ED the market will compute two counterfactual values
  - Revenue maximizing energy dispatch the resource would have received if <u>there was no Hold ED in place</u>
  - Revenue maximizing energy dispatch the resource would have received if <u>the Hold ED remains in place</u>

- ISO will compare these values
  - If resource could have made additional revenue if the Hold ED was not in place, then the resource would receive the difference between the two as an additional uplift payment for the day
  - If it would have not received additional revenue, then it would receive no additional uplift

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How are counterfactuals determined?

- The ISO will calculate the resource's opportunity costs based on its master file and real-time characteristics
  - Includes SOC limits, real-time SOC, and real-time bids

- Economic dispatches will be determined by comparing the resource's real-time bids with the real-time LMPs

- Bid cost recovery (BCR) will now account for this new type of Hold ED compensation

Examples

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Inputs to Lost Opportunity Cost

BRS Item	Location	Notes
SOC Hold ED, Start Time	ADS and CMRI	ADS: ED instructions, ED Type will be SYSEMR Constraint will be 'Fixed", GOTO MW will be 0 CMRI New Report Name: "Exceptional Dispatch Hold State of Charge" Report will contain: Trade Date, SCID, Resource, ED Start Time, ED End Time, SOC Hold Instruction (Y/N), Counterfactual Dispatch with Hold (MW) and Counterfactual Dispatch without Hold (MW)
RTD Resource Bids	SiBR and CMRI	SIBR (SC Submitted bid) or Clean Bid CMRI will have Mitigated Bids: "Real-Time Dispatch (RTD) Market Power Mitigation (MPM) Results"
RT SOC	Request via CIDI	Actual 5-minute RT SOC. New item with this project.
Upper and lower market energy capacity limits	Existing Calculation	These are the MEC limits calculated during the Expected Energy and Allocation process, as detailed in Market Operations BPM Appendix C, Item C.3. (Operating range once Operating Limits, Economic Limits, and AS capacities are applied.)
Minimum and maximum SOC levels	Master File	Submitted by market participant
PMin/PMax	Master File	Submitted by market participant
OMS Cards, RT Operating Limits	OMS	Submitted by market participant
RT Min and Max SOC	OMS	Submitted by market participant
Other EDs	ADS and Operations Procedure	2330C
AS Awards	CMRI	"Fifteen-Minute Market (FMM) Schedules"
RTD Resource Specific LMP	CMRI	"Real-Time Dispatch (RTD) Schedule Prices"
RT Economic Dispatch (RTL/UED)	Existing Calculation	These are the economic dispatch levels during the Expected Energy and Allocation process, as detailed in Market Operations BPM Appendix C, Item C.2.1. Essentially it's the intersection of the RTD Final Bid Curve and the RTD Resource Specific Price.
DEB for discharge	CMRI	"Default Energy Bid Curves " Select 'Storage' Default Bid Type
Efficiency Factor - Discharging	Master File	Submitted by market participant

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Suggestions for Settlements Market Simulation Scenario 1

- Submit day-ahead energy schedules

- Submit ancillary service bids

- Change RT SOC limits (SIBR) and RT operating limits (OMS)

Structured Simulation Trade Dates:
September 19
September 20
September 21

New! Report for Exceptional Dispatch Hold State of Charge

CMRI

California ISO | Customer Market Results Interface ⇦ ⇨ ✕ ⟳ 🔍 🔍 ⊠

Day-Ahead   Real-Time   **Post-Market**   Default Bids   Convergence Bidding   Forecast   Transmission Constraints   Intertie Flow Information   Reference   LSE   Energy Imbalance Market   Phase Shifter   Gas Burn   Reliability Coordination

Trade Date: 08/29/2023 📅   Entity: [▼]   Resource: 1 item(s)

Exceptional Dispatch Hold State of Charge

⇅ 📑 |◀ ◀ 221 - 240 of 288 ▶ ▶| [ ] **GO**

ED Start Time	ED End Time	SC ID	Resource	Hold ED Applicable	SOC Hold Instruction (MW)	Counterfactual Dispatch With Hold (MW)	Counterfactual Dispatch Without Hold (MW)	Revenue Amount
08/29/2023 18:20:00	08/29/2023 18:25:00			4 No			0.00	0.00	0.00000
08/29/2023 18:25:00	08/29/2023 18:30:00			4 No			0.00	0.00	0.00000
08/29/2023 18:30:00	08/29/2023 18:35:00			4 No			0.00	0.00	0.00000
08/29/2023 18:35:00	08/29/2023 18:40:00			4 No			0.00	0.00	0.00000
08/29/2023 18:40:00	08/29/2023 18:45:00			4 No			0.00	0.00	0.00000
08/29/2023 18:45:00	08/29/2023 18:50:00			4 No			0.00	0.00	0.00000
08/29/2023 18:50:00	08/29/2023 18:55:00			4 No			0.00	0.00	0.00000
08/29/2023 18:55:00	08/29/2023 19:00:00			4 No			0.00	0.00	0.00000
08/29/2023 19:00:00	08/29/2023 19:05:00			4 Yes	0.00		-100.00	-100.00	0.00000
08/29/2023 19:05:00	08/29/2023 19:10:00			4 Yes	0.00		-100.00	-100.00	0.00000
08/29/2023 19:10:00	08/29/2023 19:15:00			4 Yes	0.00		-100.00	-100.00	0.00000
08/29/2023 19:15:00	08/29/2023 19:20:00			4 Yes	0.00		-100.00	-100.00	0.00000
08/29/2023 19:20:00	08/29/2023 19:25:00			4 Yes	0.00		-100.00	-100.00	0.00000
08/29/2023 19:25:00	08/29/2023 19:30:00			4 Yes	0.00		-100.00	-100.00	0.00000
08/29/2023 19:30:00	08/29/2023 19:35:00			4 Yes	0.00		-100.00	-100.00	0.00000
08/29/2023 19:35:00	08/29/2023 19:40:00			4 Yes	0.00		-97.00	-97.00	0.00000
08/29/2023 19:40:00	08/29/2023 19:45:00			4 Yes	0.00		-10.67	-10.67	0.00000
08/29/2023 19:45:00	08/29/2023 19:50:00			4 Yes	0.00		-1.17	-1.17	0.00000
08/29/2023 19:50:00	08/29/2023 19:55:00			4 Yes	0.00		-0.13	-0.13	0.00000
08/29/2023 19:55:00	08/29/2023 20:00:00			4 Yes	0.00		-0.13	-0.13	0.00000

Report Generated: 09/11/2023 10:43:19

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RUG Slide for CMRI

CMRI

| CMRI* | ESET2 | **New** report to display Exceptional Dispatch Hold State of Charge

New: Post-Market > Exceptional Dispatch Hold State of Charge | **New:**
RetrieveStorageUpliftData_CMRIv1
RetrieveStorageUpliftData_CMRIv1_DocAttach | | 7/17/23 |

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New Reason! Energy>System>Operator-Initiated Commitment

OASIS

New Reason Codes
SOC Hold
SOC Charge

Downloaded CSV file

Operator-Initiated Commitment

RESOURCE_ID	TAC_AREA	INTERVAL_START_GMT	START_DATE_TIME_GMT	END_DATE_TIME_GMT	MKT_TYPE	EXECUTION_TYPE	COMMITMENT_MW	CONSTRAINT_TYPE	REASON	CLARIFIED_REASON
1005138481	TAC_ECNTR	2023-01-01T08:00:00-00:00	2023-01-01T14:00:00-00:00	2023-01-01T15:00:00-00:00	DAM	RUC	0.52	Capacity	System Wide Capacity	Optimization
1005138481	TAC_ECNTR	2023-01-01T08:00:00-00:00	2023-01-02T00:00:00-00:00	2023-01-02T01:00:00-00:00	DAM	RUC	0.52	Capacity	System Wide Capacity	Optimization
1005138481	TAC_ECNTR	2023-01-01T08:00:00-00:00	2023-01-01T23:00:00-00:00	2023-01-02T00:00:00-00:00	DAM	RUC	0.52	Capacity	System Wide Capacity	Optimization
1005138481	TAC_ECNTR	2023-01-01T08:00:00-00:00	2023-01-01T22:00:00-00:00	2023-01-01T23:00:00-00:00	DAM	RUC	0.52	Capacity	System Wide Capacity	Optimization

RUG slide for OASIS

System	Project	UI	API	Data/Comments	Tech Specs
OASIS*	ESET2	Existing: Energy > System > Operator-Initiated Commitment report	Existing: System > Operator-Initiated Commitment report	New ED type Reason Code: "SOC Hold" and "SOC Charge"	7/17/23

What Questions Do You Have?

Unmute   <u>or</u>   Raise your hand

Market Simulation Preparation

Provide logistics
Review scenarios

Participate in Market Simulation

Register to participate in the simulation at MarketSim@caiso.com mailbox as soon as possible

Attend Market Simulation Forum calls to stay informed on timing of activities for this and other Fall 2023 release initiatives
- Monday and Thursday 2pm PPT

Submit questions to the ISO via the CIDI application

*Functional Environment

--None--

--None--
Production
Market Simulation
Parallel Operations
RC Integration
RC Shadow Operations
Market Simulation Spring 2023
Market Simulation Summer 2023
Market Simulation Fall 2023
Market Simulation Independent 2023
Market Simulation Summer 2024
Market Simulation Fall 2024
Market Simulation Independent 2024

Scenario 1 (Structured): Demonstrate proper settlement for energy storage resources for different ED types

Title	Action
ISO Operators will:	1. Issue Exceptional Dispatches (ED) for two storage resources to hold SOC 2. Issue another ED for one storage resource with a HOLD ED to move SOC
Market participants should see:	Different ED types for storage resources are being settled properly
Settlements validation:	When an energy resource receives a HOLD SOC ED, it's anticipated that there will be a settlement for: • Real-time excess cost for instructed energy settlement (charge code 6486) • Exceptional dispatch Hold SOC uplift settlement (charge code 6485) There could also be a settlement for: • Excess cost neutrality allocation (charge code 6480)

What Questions Do You Have?

Unmute   or   Raise your hand

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Scenario 2 (Unstructured): Verify hourly do not charge from the grid bidding functionality for standalone or sub-ACC constraints

Title	Action
Market participants should:	• Submit hourly bid attribute type in SIBR to not charge from the grid in the real-time market • Submit economic bids for all resources behind the ACC; for storage resources, submit economic bids to charge/discharge
Expected outcome:	The market will enforce a withdrawal line of 0 MW for the ACC

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What Questions Do You Have?

Unmute   <u>or</u>   Raise your hand

Wrap Up

Summary, Q&A

Recap: Here's what you need to do

❑ Participate in the Market Simulation and the Market Simulation Forums

❑ Participate in the Release User Group (RUG) meetings

❑ If you have a pseudo tie co-located resources and would like to have an ACC work with ISO Contracts department to update the PGA

❑ If you have a co-located resource and wish to opt out of charging from the grid

– Work with ISO Contracts department to update the PGA

– Use the Off Grid Charging Indicator on the Hourly tab in SIBR to indicate if a resource should not charge from the grid

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What Questions Do You Have?

Unmute   or   Raise your hand

Thank you for your participation!

For clarification on anything presented in this training, send an email to: CustomerReadiness@caiso.com

For any other questions or stakeholder specific questions or concerns, please submit a ticket.

CustomerReadiness @caiso.com

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