Market Enhancements for Summer 2021 Readiness: Training – Part 1

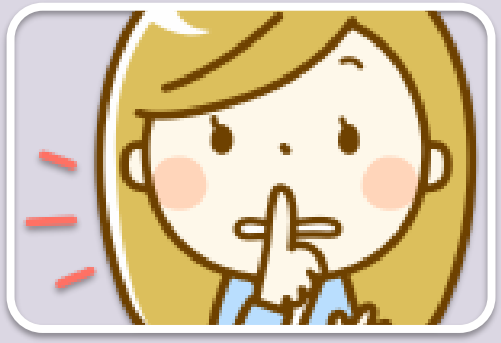
April 27, 2021

Radha Madrigal
Customer Readiness

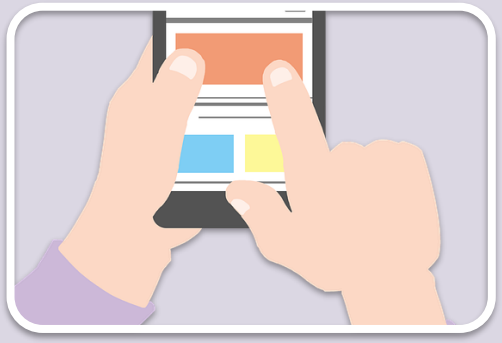
- Updated slide 49
- Added slide 53

Updated 10/28/2021

Housekeeping



Make sure to keep yourself muted unless you have a question



If you have a question, you may either ask over the phone or in the chat

If you want to ask a question, you can virtually “raise your hand” in WebEx

Objectives: Market enhancements for summer 2021 readiness

- Equitably balance the reliability of serving ISO balancing authority area load with the reliability of exports, while providing open access to the ISO transmission system
- Better ensure each balancing authority area participates in the EIM with sufficient resources
- Provide improved incentives for supply to be available during tight system conditions

Agenda

In this training, you will learn about the following elements:

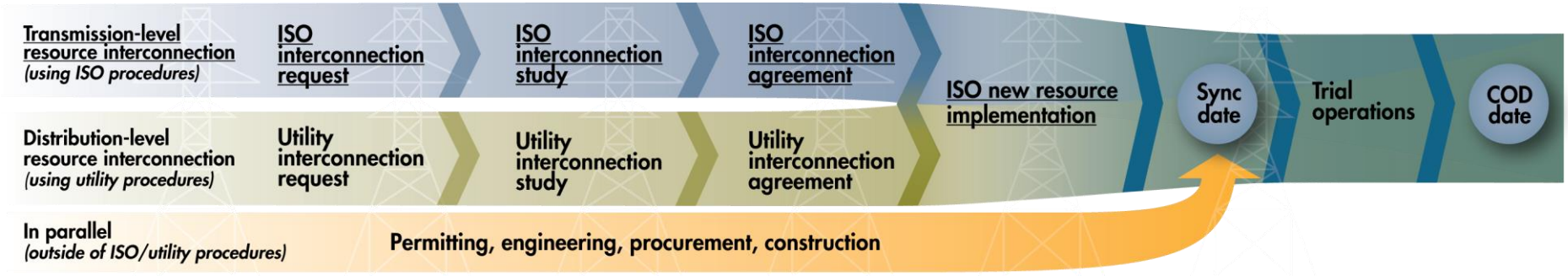
- Interconnection process enhancements
- Reliability demand response dispatch and real-time price impacts
- Management of storage resources during tight system conditions

Acronyms

Abbreviation	Term
ADS	Automated Dispatch System
API	Application Programing Interface
BPM	Business Practice Manual
CMRI	Customer Market Results Interface
DAM	Day-Ahead Market
DOT	Dispatch Operating Target
EIM	Energy Imbalance Market
EOH	End of Hour
FERC	Federal Energy Regulatory Commission
FMM	Fifteen-Minute Market
HASP	Hour-Ahead Scheduling Process
HE	Hour-Ending

Acronyms

Abbreviation	Term
MSOC	Minimum State of Charge
OASIS	Open Access Same-Time Information System
PDR	Proxy Demand Resource
RA	Resource Adequacy
RDRR	Reliability Demand Response Resource
RTCD	Real-Time Contingency Dispatch
RTD	Real-Time Dispatch
RTM	Real-Time Market
RTPD	Real-Time Pre Dispatch
RTUC	Real-Time Unit Commitment
RUC	Residual Unit Commitment
SOC	State of Charge



INTERCONNECTION PROCESS ENHANCEMENTS

Key points

- The ISO will implement business practice manual (BPM) and tariff changes to enhance the independent study interconnection process to provide ISO additional capacity for summer 2021
- Remove 100MW / 125% cap on behind-the-meter expansion requests
- Enable the ISO to award available deliverability temporarily to online projects until earlier-queued project comes online

Implementation details

- The tariff amendment to implement summer 2021 market enhancements was filed with FERC on March 26, 2021
- ISO has requested that FERC issue an order on this filing by May 25, 2021
- Generator Interconnection and Deliverability Allocation Procedures BPM will be updated after tariff language is approved by FERC

Background

- The ISO has three interconnection request processes for transmission-connected resources:
  - annual cluster study process
  - fast track process
  - independent study process
- The independent study process is designed for interconnection customers that need to come online more quickly than the cluster study process, but for resources larger than the 5 MW limit imposed by the fast track process

Background

- The ISO is aware of two issues that may mitigate independent study interconnection customers' ability to create capacity that load serving entities can procure this summer
- The ISO's behind-the-meter expansion process caps expansions to the lesser of 125 percent of the existing capacity or 100 MW

Background

- The independent study process was designed to prevent “queue-jumping” for deliverability, and as such, requires independent study interconnection customers to participate as “energy only” until they can participate in the next cluster deliverability assessment

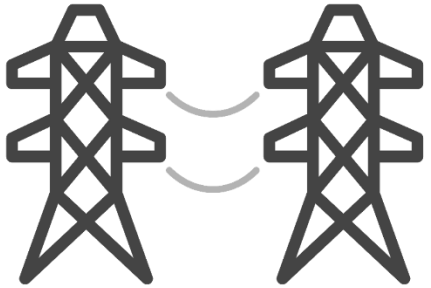
- Even if deliverability is available and unused, the ISO cannot allocate it to independent study interconnection customers on a temporary basis

Interconnection process enhancements

- The ISO has filed with FERC to remove the cap on behind-the-meter expansions
  - The vast majority of expansions today are battery additions on variable energy resources, which are less likely to present the issues the cap was designed for
  - Removing the cap will allow variable energy resources to hold excess energy when demand is low and then discharge that energy during the system peak

Interconnection process enhancements

- The ISO proposes to empower itself to award available interim deliverability on a temporary basis
- This will allow load serving entities to shore up portfolios in tight summer months and it will maximize use of available deliverability capacity



Interconnection process enhancements

- Independent study interconnection customers could avail themselves of the deliverability until the interconnection customer that the delivery network upgrades were constructed for comes online, or until the independent study interconnection customer can participate in the next deliverability assessment, receive its own permanent allocation, and has its delivery network upgrades constructed

- This will ensure independent study interconnection customers can use available deliverability if they come online quickly while preventing queue-jumping for deliverability

Questions

RELIABILITY DEMAND RESPONSE DISPATCH AND REAL-TIME PRICE IMPACTS

Key points

- RDRR enhancements change how the market will use these resources consistent with existing policy
  - RDRR will be dispatched in the fifteen-minute market and the five-minute dispatch
- New bidding options to define RDRR as 60 or 15-minute dispatchable allows resources to better reflect their operational capabilities
- These enhancements result in limited changes for program operators

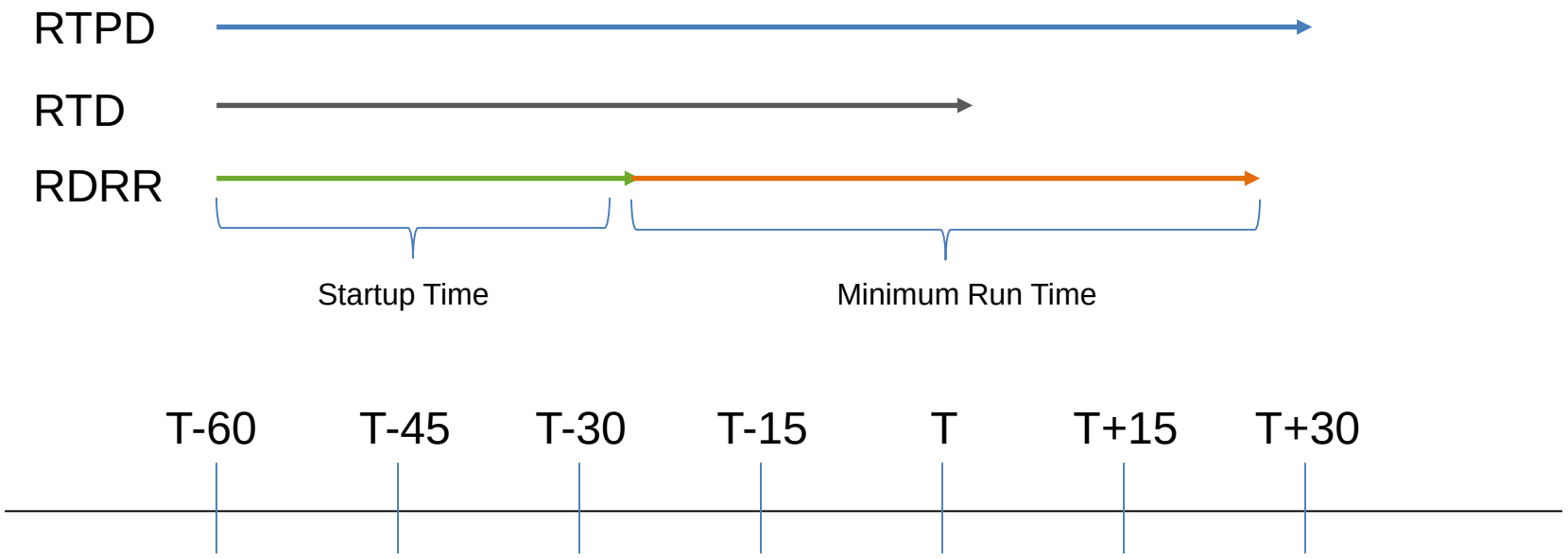
RDRR enhancements change how the market will use these resources consistent with existing policy

- RDRR will be dispatched in the real-time pre dispatch (RTPD/FMM) process and the real-time dispatch (RTD)
- This change will allow RDRR to set the market clearing price in the fifteen-minute market
- This change will reduce the occurrence of RDRR being dispatched due to variations in forecast between RTPD and RTD

Example of the RDRR dispatch horizon

- Optimization horizon looks out up to seven 15-minute intervals in RTPD and thirteen 5-minute intervals in RTD

- RTPD optimization horizon considers the maximum startup time of 40 minutes as well as the minimum run time of no more than 1 hour within more optimization intervals



RDRR enhancements result in limited changes for program operators

- Continue to use ADS application
  - No changes to ADS API
- No change to notification
  - Notification time will continue to be modeled as startup time
- The way resource parameters are treated today will continue

Enhancements to reliability demand response to send appropriate price signals when dispatched

- ISO operator enables RDRR function which allows the market to access these resources
- Dispatch RDRR resources in RTPD and RTD
  - This leads to more efficient market results since the RTPD planning horizon covers the resource's startup + min run time
- Enable 5 and 15-min discrete RDRR to set the price in FMM by treating the resource as **discrete** in the scheduling run but **continuous** in the pricing run
- 60-minute RDRR is price taker
- Adjust load forecast to recognize RDRR and PDR dispatch

60-minute RDRR is a price taker

- Commit and dispatch 60-minute RDRR in HASP in the same way as 60-minute PDR
- Hold the RDRR HASP dispatch in subsequent RTPD and RTD
- 60-minute RDRR is a price taker, cannot set the price in RTPD and RTD

How RDRR can set the price

- Operator must enable the RDRR dispatch function
- RDRR can set the price as follows:
  - Discrete RDRR (15-min or 5-min) shall be treated as on/off at PMax in the scheduling run, but in the pricing run as non-discrete with a zero PMin, and allow RDRR to set the price
  - For non-discrete RDRR, use bid curve submitted by SC in scheduling and pricing runs, and allow RDRR to set the price

When does an RDRR have the ability to set the price?

ISO Operator Enables RDRR	60-min RDRR	15-min RDRR	5-min RDRR	Continuous RDRR
Yes	No	Yes – RTPD	Yes – RTPD/RTD	Yes – RTPD/RTD
No	No	No	No	No

New bidding options

Bidding

- Required to submit RDRR bids into the real-time market between 95%-100% of soft bid cap
- Unique RDRR bids per program will help to ensure that programs are dispatched together via the optimization to the extent that program components located in different forecast zones cannot respond independently to dispatch instructions
- If discrete dispatch RDRR option is chosen, consider setting your PMin to a value less than the PMax
  - This assists the ISO in treating discrete resources as continuous in the pricing run

New dispatchable bidding options and settlements impact

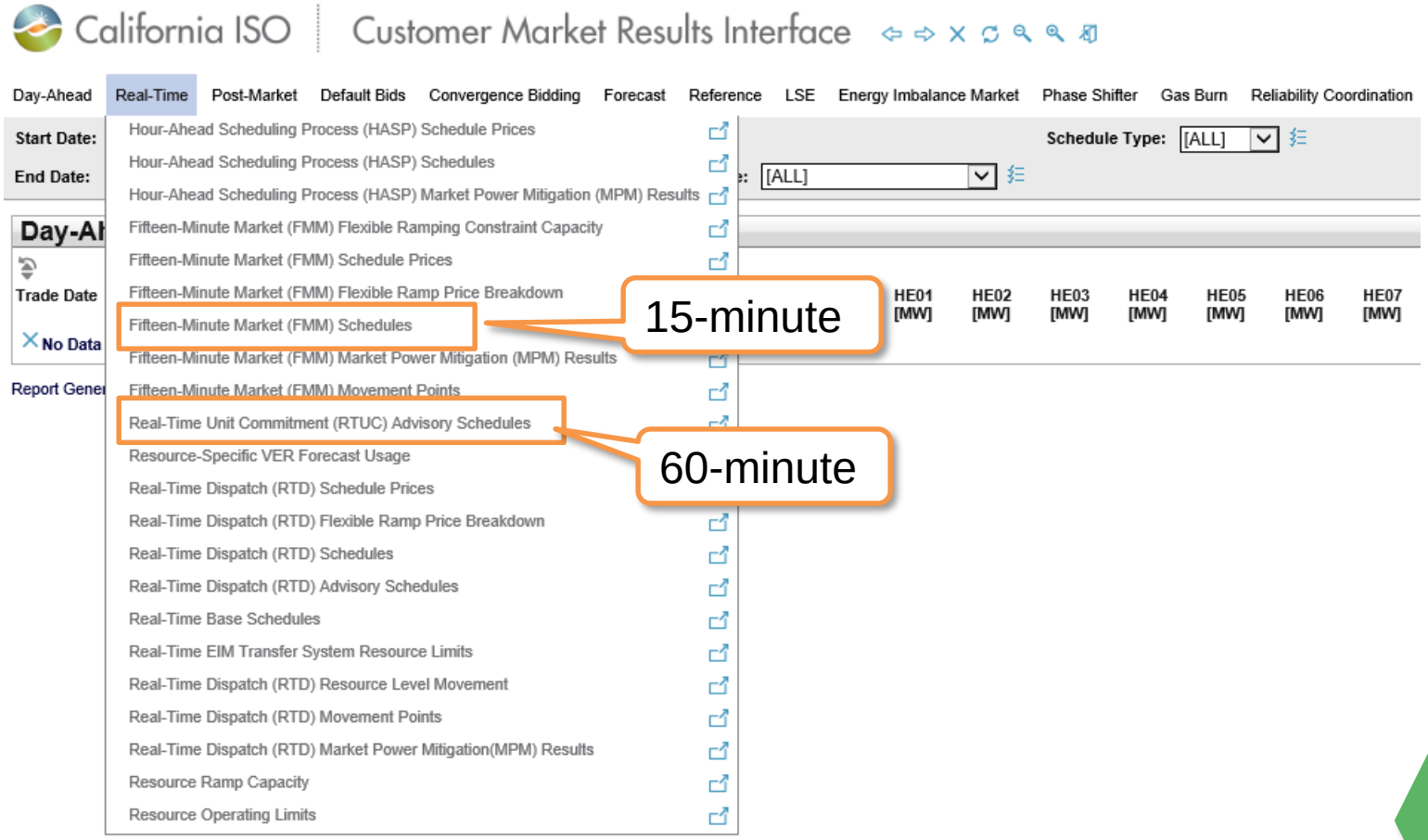
- 60-minute: Energy schedule is committed for the hour and is communicated 52.5 minutes before the flow of energy
  - Resource is a price taker for the full hour
  - Not eligible for bid cost recovery
- 15-minute: Bids submitted in FMM and dispatched at FMM price; dispatches communicated 22.5 minutes before flow of energy
  - Eligible for bid cost recovery

Receive startup instruction via ADS: Commitment field

Set ADS to view RTPD dispatches (via checkbox)

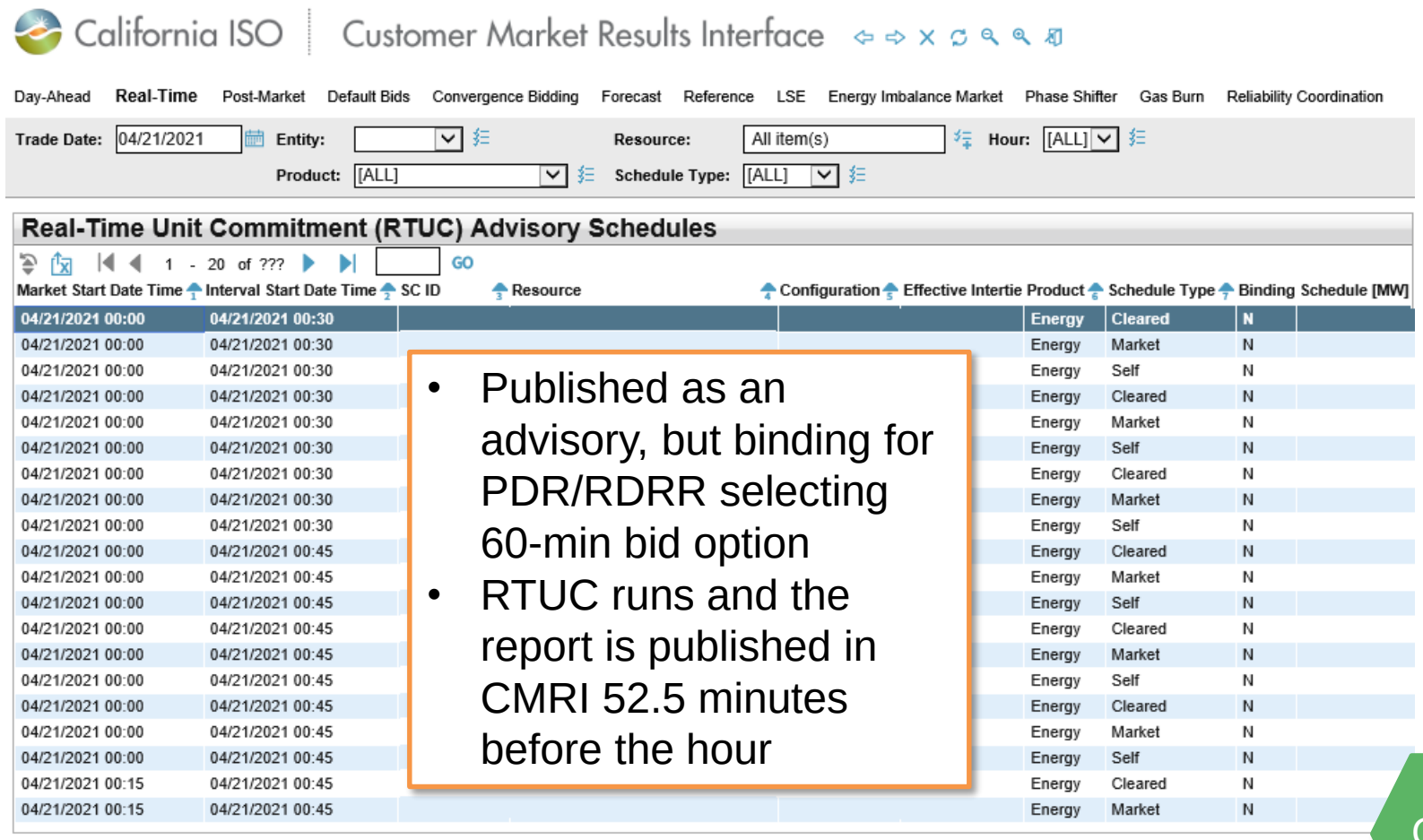
Once the startup instruction is received DOT can be viewed in the same manner as today

CMRI can be used as a backup method to determine demand response dispatch instructions



CMRI

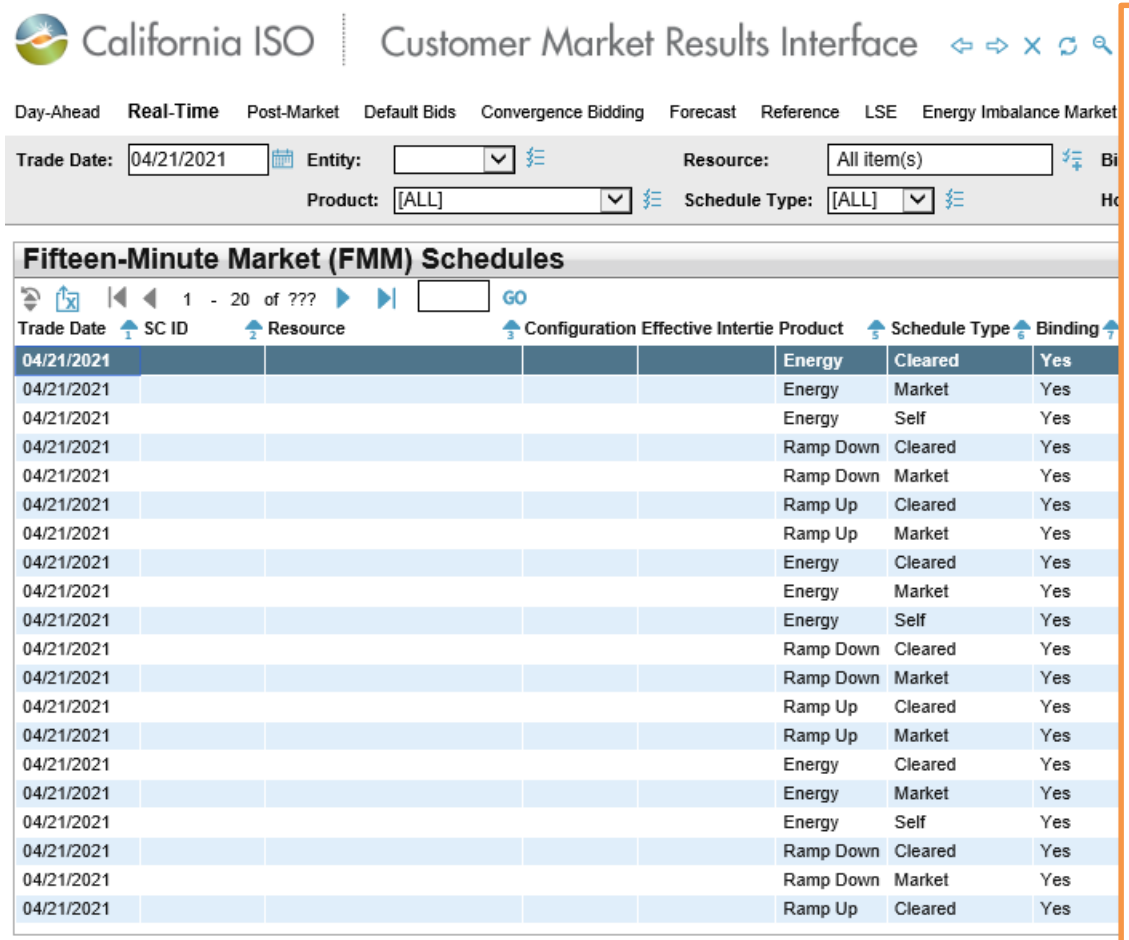
Real-time unit commitment (RTUC) advisory schedules



- Published as an advisory, but binding for PDR/RDRR selecting 60-min bid option
- RTUC runs and the report is published in CMRI 52.5 minutes before the hour

CMRI

Fifteen-minute market (FMM) schedules



- Published as binding for PDR/RDRR selecting 15-minute bid option
- 60-min bid option will also see FMM awards consistent with the hourly schedule
- FMM runs 37.5 minutes before the start of the binding interval
- Report is published 22.5 minutes before the start of the binding interval

CMRI

Questions

MANAGEMENT OF STORAGE RESOURCES DURING TIGHT SYSTEM CONDITIONS

Elements vary based on participation model

Updated State of Charge Requirement When Storage Provides Regulation

- ISO market will ensure that resources have sufficient state of charge that can maintain their Regulation Up and Regulation Down awards
- These requirements apply whenever storage is awarded regulation

Implementation:
Market Enhancements for Summer 2021 Readiness

Minimum State of Charge Requirement

- Applies to RA resources only
- Will only be applied on days where needs are critical
- Temporary requirement with 2-year sunset provision
- ISO operators can cancel requirement in real-time if conditions are different

Implementation:
Resource Adequacy Enhancements: Track 1

What about non-RA storage?

- Traditional exceptional dispatch process can be used for non-RA storage resources if necessary
  - No change to existing functionality
- A new energy storage enhancements initiative will begin in Q2 2021 to develop a market-based tool to procure state of charge from storage resources and provide compensation for that product

UPDATED STATE OF CHARGE REQUIREMENT WHEN STORAGE PROVIDES REGULATION

Key points

- Updated state of charge (SOC) requirement applies to all storage resources that are awarded regulation
- ISO control room operators will have new screens to visualize storage fleet

Updated SOC requirement when storage provides regulation

- In scheduling and awarding storage resources, the market ensures resources will have SOC that can maintain the awarded Regulation Up and Regulation Down for at least “x” minutes
  - This applies to RTPD, RTD, and RTCD passes
  - The configurable “x” time parameters is independent for each market pass for each regulation type

- RTPD = Real-Time Pre Dispatch/Fifteen-Minute Market
- RTD = Real-Time Dispatch/Five-Minute Dispatch
- RTCD = Real-Time Contingency Dispatch

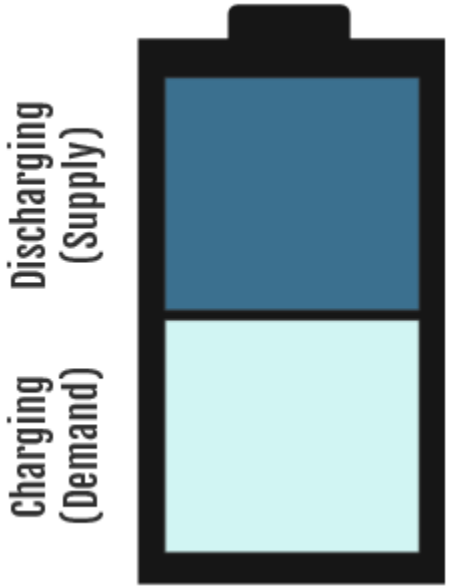
Updated SOC requirement when storage provides regulation

For each of the Regulation Up and Regulation Down intervals, the configurable “x” minutes will default to:

Market Process	Duration
RTPD	30 minutes
RTD	30 minutes
1st RTCD	20 minutes

- For the 1st RTCD we reserve 20 minutes and release 10 minutes.
- For the 2nd and beyond we release all.

Questions



MINIMUM STATE OF CHARGE REQUIREMENT

Key points

- Restrictions on state of charge managed through a new tool called the minimum state of charge (MSOC) requirement
  - Applies to RA resources only
- MSOC requirement is a temporary solution with a sunset date of two years after implementation to be replaced by a market-based solution
- Will only be used under certain conditions
  - Residual Unit Commitment (RUC) under-gen infeasibility

Background

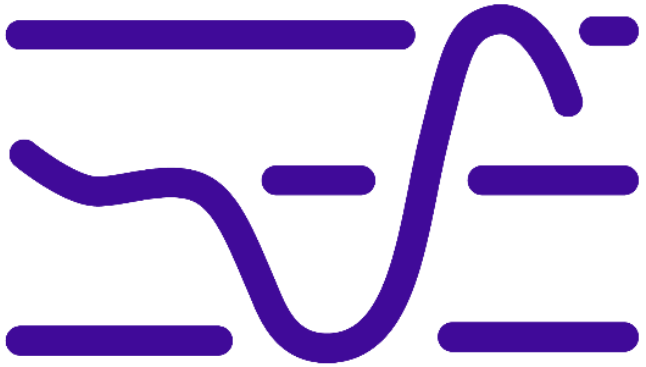
- ISO expects about 1800 MW of storage capacity available to provide RA by August 2021
  - Currently there are about 550 MW of storage available for RA capacity
- MSOC requirement will ensure state of charge availability for evening peak periods
  - This requirement will not be permanent
- A new energy storage enhancements initiative will begin in Q2 2021 to develop a market-based tool to procure state of charge from storage resources and provide compensation for that product

What is the purpose of the MSOC requirement?

- Day-Ahead Market (DAM) commitments are not immutable and can be adjusted and undone by the Real-Time Market (RTM) optimization
  - The RTM sends dispatch instructions to resources based on prevailing market prices and resource bids and does not consider day-ahead schedules
- The ISO's current 5-minute RTM looks ahead 65 minutes, but most storage resources take several hours to fully charge
  - In contrast, the DAM optimizes the use of resources across the full 24-hour planning horizon

What is the purpose of the MSOC requirement?

- MSOC requirement ensures storage resources providing RA capacity are sufficiently charged in the RTM to meet DAM discharge schedules when storage resources are needed to meet evening net-load peak



MSOC requirement will only be applied on days where needs are critical

- ISO will use the results from the DA RUC process to determine days when minimum state of charge will be required
- Minimums will only be imposed on days when RUC is under-gen infeasible
  - This happens very infrequently, but indicates tight system conditions
- Operators will have further opportunity to drop requirements in real-time if conditions are different in the RTM

Requirements are designed to reduce impact to storage

- MSOC requirement will be implemented in the RTM to set a minimum threshold state of charge for each RA storage resource with a DA discharge award
  - A series of “critical hours” will be determined by operations, which will be the only hours that the requirement is imposed
  - Minimums will be imposed on hours directly prior to discharge schedules, and not in hours earlier in the day
  - The RTM will optimally schedule storage resources to charge or hold state of charge to meet these requirements

Public reporting via OASIS

- The ISO will report the following for the next trade day, **only** for trade days that have non-zero RUC under-gen infeasibility for at least one trade hour:
  - Critical hours used to calculate the minimum end-of-hour (EOH) SOC requirements
  - RUC under-gen infeasibility hours and MW amounts

Sample OASIS report mockup: RUC under supply infeasibility and enforced constraints

Trade Date	Trade Hour	Under-Gen Infeasibility MW	Critical Hour Flag	Time Stamp of Min SOC Deactivation in RTM
7/30/2021	1	0.00	N	
7/30/2021	2	0.00	N	
7/30/2021	3	0.00	N	
7/30/2021	4	0.00	N	
7/30/2021	5	0.00	N	
7/30/2021	6	0.00	N	
7/30/2021	7	0.00	N	
7/30/2021	8	0.00	N	
7/30/2021	9	0.00	N	
7/30/2021	10	0.00	N	
7/30/2021	11	0.00	N	
7/30/2021	12	0.00	N	
7/30/2021	13	0.00	N	
7/30/2021	14	0.00	N	
7/30/2021	15	0.00	N	
7/30/2021	16	0.00	N	
7/30/2021	17	0.00	N	
7/30/2021	18	10.00	N	
7/30/2021	19	0.00	Y	
7/30/2021	20	9.00	Y	
7/30/2021	21	8.00	Y	
7/30/2021	22	7.00	Y	
7/30/2021	23	0.00	Y	
7/30/2021	24	0.00	N	

Note that critical hours may be different from RUC under-gen infeasibility hours

OASIS

(This is a preliminary report mockup. The final report may vary.)

Public reporting via OASIS

- The ISO will report the following for the current trade day **only** if deactivation of MSOC enforcement event occurred in a trade day:
  - Date/time of global deactivation of enforcement of binding MSOC in RTM

Sample OASIS report mockup: RUC under supply infeasibility and enforced constraints

Trade Date	Trade Hour	Under-Gen Infeasibility MW	Critical Hour Flag	Time Stamp of Min SOC Deactivation in RTM
7/31/2021	1	0.00	N	
7/31/2021	2	0.00	N	
7/31/2021	3	0.00	N	
7/31/2021	4	0.00	N	
7/31/2021	5	0.00	N	
7/31/2021	6	0.00	N	
7/31/2021	7	0.00	N	
7/31/2021	8	0.00	N	
7/31/2021	9	0.00	N	
7/31/2021	10	0.00	N	
7/31/2021	11	0.00	N	
7/31/2021	12	0.00	N	
7/31/2021	13	0.00	N	
7/31/2021	14	0.00	N	7/31/2021 13:57
7/31/2021	15	0.00	N	7/31/2021 13:57
7/31/2021	16	0.00	N	7/31/2021 13:57
7/31/2021	17	0.00	N	7/31/2021 13:57
7/31/2021	18	10.00	N	7/31/2021 13:57
7/31/2021	19	0.00	Y	7/31/2021 13:57
7/31/2021	20	9.00	Y	7/31/2021 13:57
7/31/2021	21	8.00	Y	7/31/2021 13:57
7/31/2021	22	7.00	Y	7/31/2021 13:57
7/31/2021	23	0.00	Y	7/31/2021 13:57
7/31/2021	24	0.00	N	7/31/2021 13:57

- The MSOC requirement was cancelled for HE 14
- The report is updated with the date/time of deactivation
- The RUC infeasibility and critical hours remain the same to preserve historical data

OASIS

(This is a preliminary report mockup. The final report may vary.)

Summary: Public reporting via OASIS

- Market participants can use the OASIS report to identify which days the ISO enforced the MSOC constraint
- The ISO reports the RUC “Under-Supply Infeasibility” and the “Critical Hour” for each trade date
  - Only on those days when the under-gen infeasibility is greater than zero will the ISO enforce the MSOC
- The MSOC constraint is enforced in the critical hour, which may include additional hours than the RUC under-supply infeasibility
- Report navigation path: OASIS > Energy > System > RUC Under Supply Infeasibility and Enforced Constraints

Resource-specific reporting via CMRI

- The ISO will publish the following for the next trade day:
  - Binding minimum EOH SOC requirements that are generated by DAM and are more restrictive than lower SOC limits listed in Master File + any existing outages
- This report will publish on a similar timeline as the DAM results
- This report is **not** updated if the MSOC requirement is deactivated in real-time

CMRI

CMRI report mockup: Binding minimum EOH SOC requirements

Trade Date	Trade Hour	Resource ID	Market Type	Min EOH SOC (MWh)
7/30/2021	16	ABC	DAM	30.00
7/30/2021	17	ABC	DAM	80.00
7/30/2021	18	ABC	DAM	180.00
7/30/2021	19	ABC	DAM	160.00
7/30/2021	20	ABC	DAM	130.00
7/30/2021	21	ABC	DAM	80.00
7/30/2021	22	ABC	DAM	30.00
7/30/2021	23	ABC	DAM	30.00
7/31/2021	16	ABC	DAM	30.00
7/31/2021	17	ABC	DAM	80.00
7/31/2021	18	ABC	DAM	180.00
7/31/2021	19	ABC	DAM	160.00
7/31/2021	20	ABC	DAM	130.00
7/31/2021	21	ABC	DAM	80.00
7/31/2021	22	ABC	DAM	30.00
7/31/2021	23	ABC	DAM	30.00

- If 30 MWh is your existing lower SOC limit, this trade hour would not be shown.
- The report only shows when the SOC is more restrictive than current parameters.

CMRI

(This is a preliminary report mockup. The final report may vary.)

Questions

MARKET SIMULATION

Market participant pre-market simulation actions

- Market simulation structured scenarios provide customers with the ability to preview and test new functionality from bid to bill
- Attend the market simulation calls to stay informed on the timing of activities for this and other releases
- Send registration request to the MarketSim@caiso.com mailbox
  - Register for **Resource Adequacy Enhancements: Track 1** project by **April 26, 2021**
  - Register for **Summer 2021 Readiness** project by **May 6, 2021**

Summer 2021 readiness: Market sim scenarios

Scenario Number	Scenario Execution Trade Date: TBD	
3	Description	Ensure Storage Resources have Sufficient SOC to Support Regulation Up and Regulation Down Awards for at Least 30 Minutes in RTM
	ISO Actions	
	EIM Market Participant Actions	
	ISO Market Participant Actions	Storage resources submit competitive regulation up and regulation down bids in RTM.
	Expected Outcome	Verify storage resources RT regulation up and down awards
	Anticipated Settlement Outcome	*N/A*
	Expected Settlement Outcome	• CAISO will execute settlements calculations. • SCs will validate their statements.

Summer 2021 readiness: Market sim scenarios

Scenario Number	Scenario Execution Trade Date: TBD	
4	Description	Operator Utilization of Traditional ED for Storage Resources
	ISO Actions	o RUC under generation infeasibility occurs for some hours of same RTM trade day. o CAISO issues traditional max GOTO EDs for storage resources with a GOTO below zero, instructing them to charge as necessary.
	EIM Market Participant Actions	
	ISO Market Participant Actions	
	Expected Outcome	Verify storage resources dispatch follow issued EDs (existing functionality). (ADS, CMRI and BAAOP) Verify storage resources settlements per existing EDs rules (existing functionality). (MRI-S)
	Anticipated Settlement Outcome	*N/A*
	Expected Settlement Outcome	• CAISO will execute settlements calculations. • SCs will validate their statements.

Summer 2021 readiness: Market sim scenarios

Scenario Number	Scenario Execution Trade Date: TBD	
5	Description	RDRR Enable dispatch in RTM
	ISO Actions	Tight system conditions exist. (CAISO to create conditions in RTM conducive to buying energy near the bid cap.) At various times during the tight systems conditions, CAISO enables RDRR system-wide, within a region or within a sub-region
	EIM Market Participant Actions	
	ISO Market Participant Actions	Submit RDRR bids in RTM, between 95% -100% of soft bid cap. Register and submit bids for 60-minute and 15-minute dispatchable RDRRs.
	Expected Outcome	RDRRs are dispatched as necessary to meet system needs. • 60-minute dispatchable RDRRs are dispatched at a uniform value over a trade hour. 5 minute dispatch=FMM dispatch = HASP dispatch. • 15-minute dispatchable RDRRs are dispatched at a uniform value over an FMM interval. 5 minute dispatch = FMM dispatch. • 5-minute dispatchable RDRRs are dispatched similar to generating resources. At times, RDRRs may set the LMP.
	Anticipated Settlement Outcome	*N/A*
	Expected Settlement Outcome	• CAISO will execute settlements calculations. • SCs will validate their statements.

RA enhancements – track 1: Market sim scenarios

Scenario Number	Scenario Execution Trade Date: TBD	
4	Description	Binding Min EOH SOC Requirements
	ISO Actions	CAISO will setup a scenario where RUC under-gen infeasibility is triggered for at least 1 hour in trade day T+1
	EIM Market Participant Actions	N/A
	ISO Market Participant Actions	*N/A*
	Expected Outcome	Verify that DAM binding Min SOC requirements is published for trade date T+1 (CMRI) Verify that RUC undergen infeasibility is published for trade date T+1. (OASIS) Verify that Critical Hours are published for trade date T+1. (OASIS) Verify enforcement of binding min end-of-hour SOC requirements for RA storage resources in RTM during trade date T+1.
	Anticipated Settlement Outcome	• CAISO will execute settlements calculations. • SCs will validate their statements.

RA enhancements – track 1: Market sim scenarios

Scenario Number	Scenario Execution Trade Date: TBD	
5	Description	Deactivation of Enforcement of Binding Min EOH SOC Requirements in RTM
	ISO Actions	CAISO will setup a scenario where RUC under-gen infeasibility is triggered for at least 1 hour of trade day T+1. CAISO operator deactivates enforcement of binding Min EOH SOC requirements in RTM before noon of Trade day T+1.
	EIM Market Participant Actions	N/A
	ISO Market Participant Actions	*N/A*
	Expected Outcome	Verify that DAM binding Min SOC requirements is published for trade date T+1 (CMRI). Verify that RUC undergen infeasibility is published for trade date T+1. (OASIS). Verify that Critical Hours are published for trade date T+1. (OASIS). Verify that time stamp when CAISO operator deactivated enforcement of binding Min EOH SOC requirements in RTM is published for trade date T+1. (OASIS). Verify enforcement of binding min end-of-hour SOC requirements for RA storage resources STOPS in RTM during trade date T+1 from time of deactivation onwards.
	Anticipated Settlement Outcome	• CAISO will execute settlements calculations. • SCs will validate their statements.

Final Questions

Upcoming training

Date	Topic
April 28, 2021 (11 am – 12:30 pm)	FERC Order 831 – Import Bidding and Market Parameters
April 29, 2021 (9 am – 11 am)	Market Enhancements for Summer 2021 Readiness – Part 2 • Import market incentives during tight system conditions • Real-time scarcity pricing enhancements • OASIS report showing gross exports and imports by intertie • Today's Outlook/ISO Today enhancements

Thank you for your participation!

For more detailed information on anything presented, please visit our website at:
www.caiso.com

Or send an email to:
CustomerReadiness@caiso.com