Hybrid Resources Phase 2B Training

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Lead Client Trainer

August 18, 2022

Rev 08/17/22

INTRODUCTION

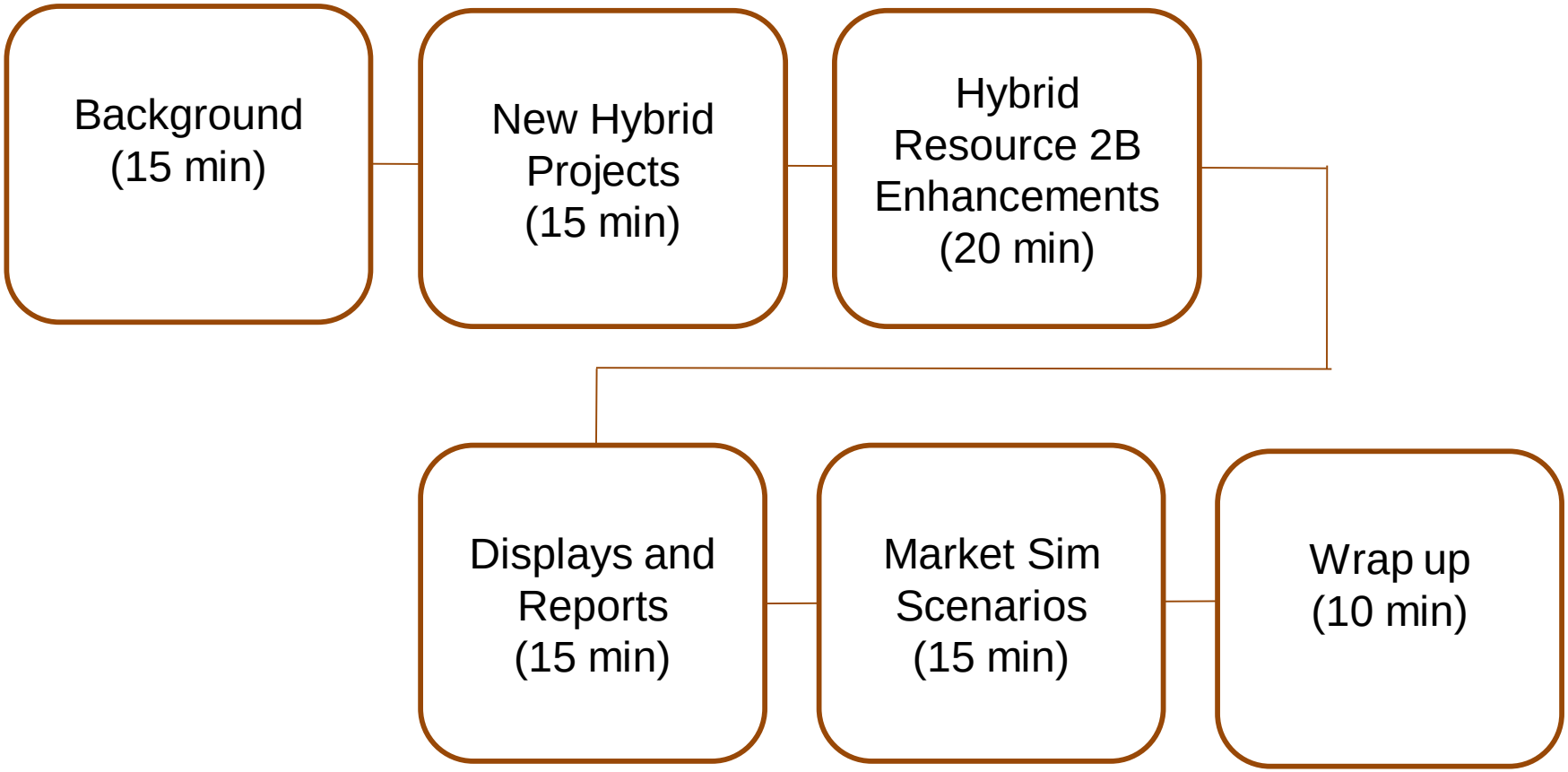
Housekeeping

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

In today's session we'll cover:



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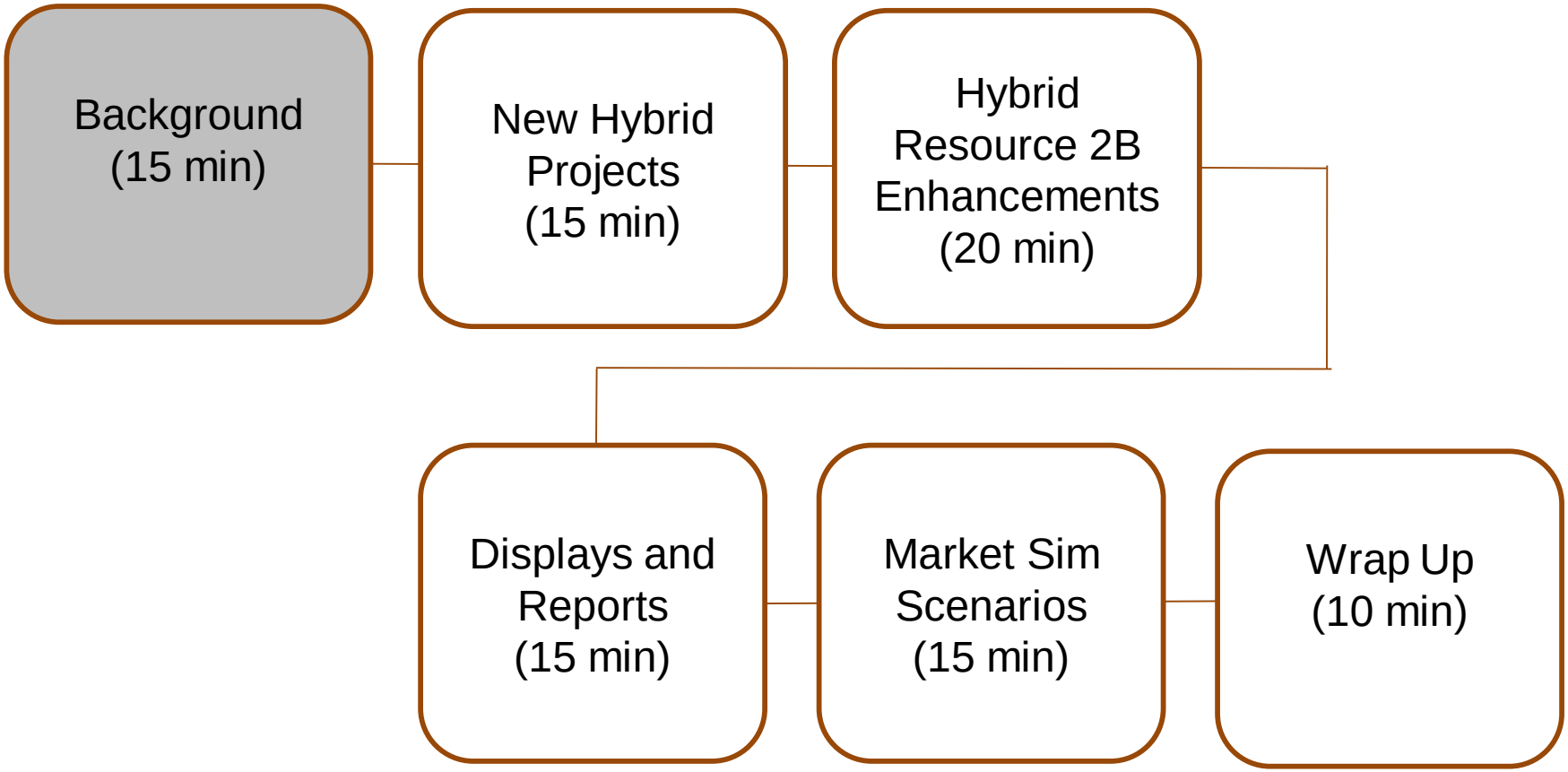
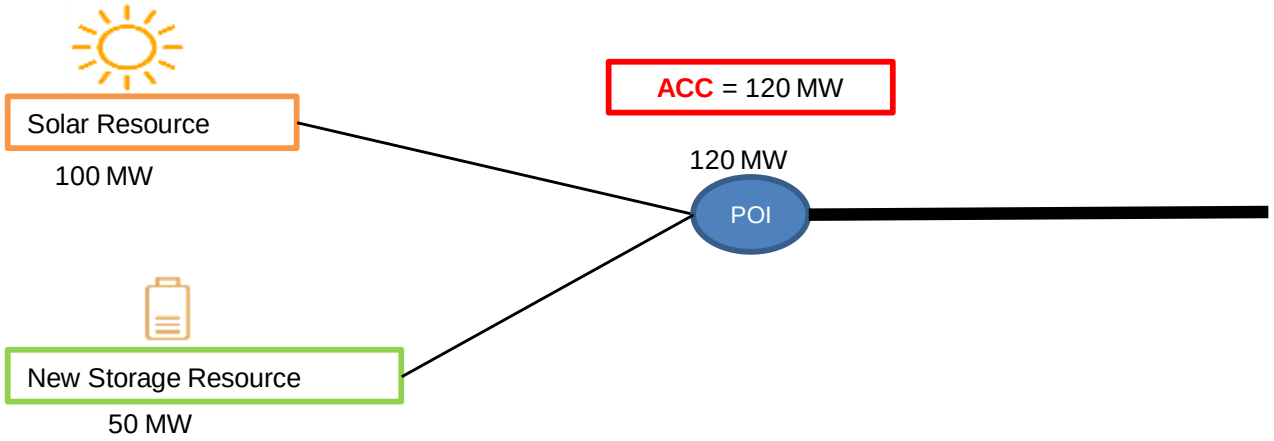


Hybrid Resource Project - Phase 1

Co-located Resources - Multiple resources of different technologies that share a common point of interconnection but are modeled as individual resources

Production date – December 2020



Hybrid Resource - Phase 2

Multiple resources of different technologies that share a common point of interconnection; these resources are modeled as one resource

Phase 2-A

Implement High Sustainable Limit (HSL), Ancillary Services (AS),

Production Date – November, 2021

Phase 2-B

Implement Master/subordinate Aggregated Capability Constraint (ACC)

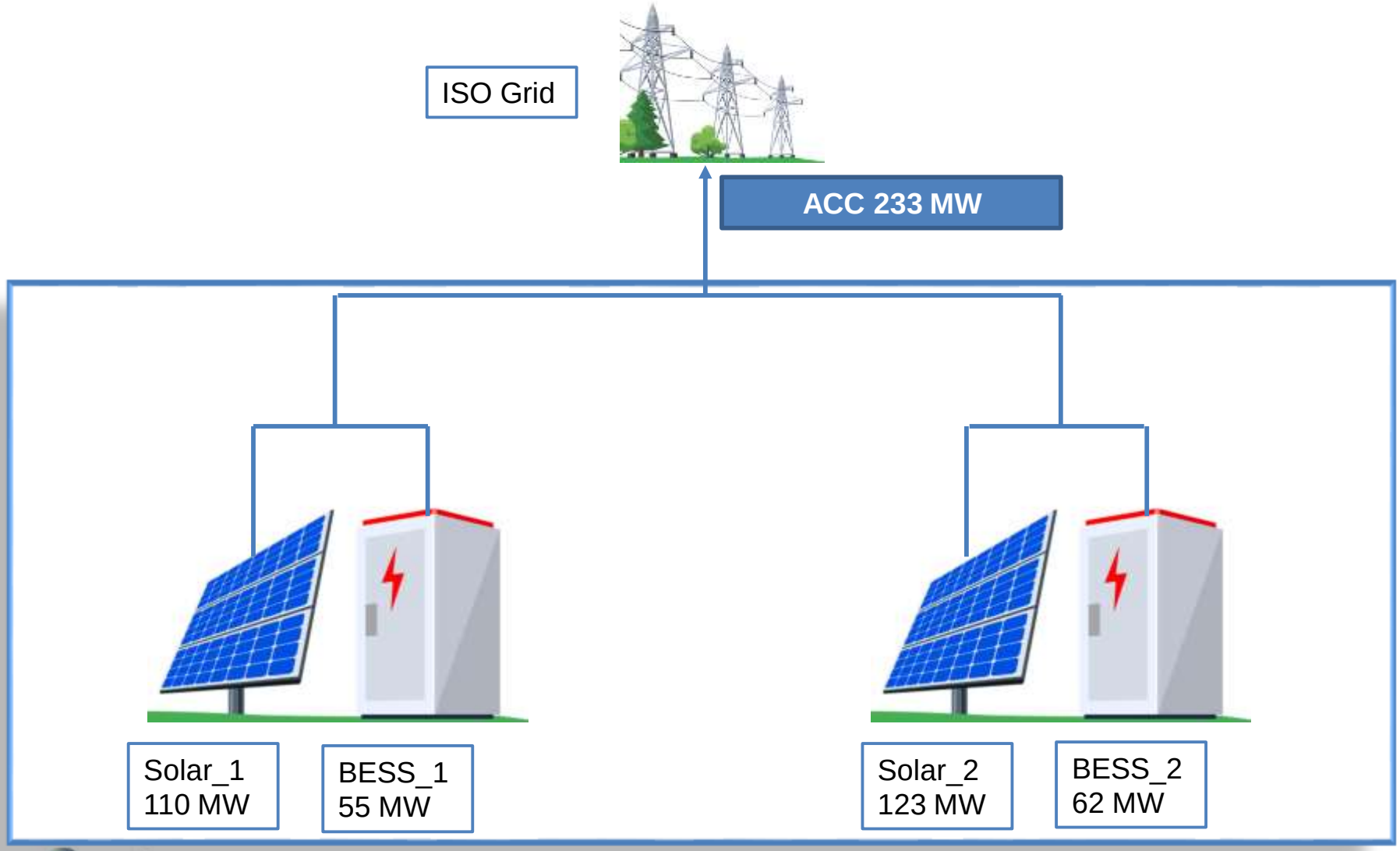
Implement Hybrid Dynamic Limit functionality

Changes to various applications, reports and displays

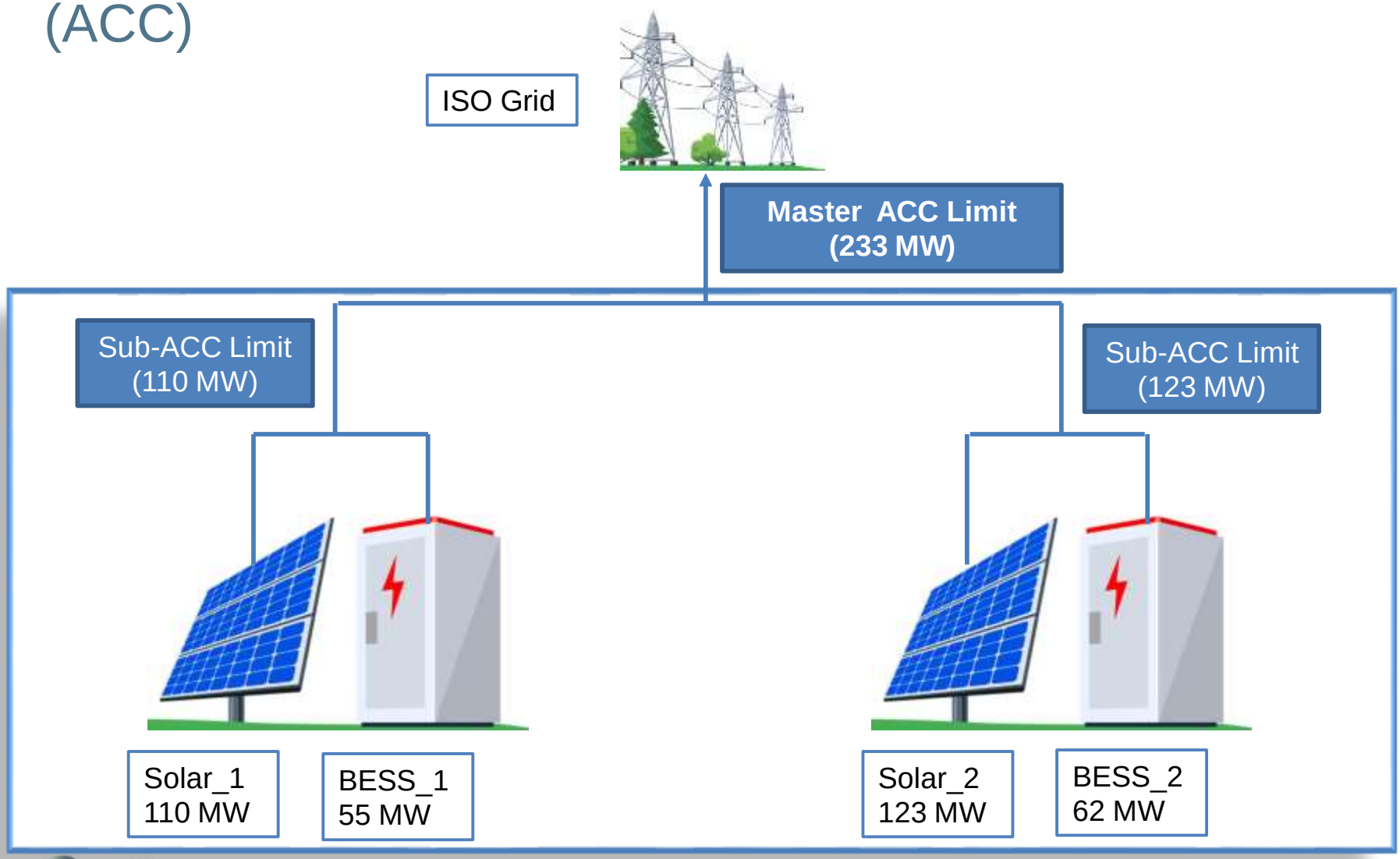
Scheduled Production Date – November 1, 2022

For more information about the Hybrid Resource Initiative visit：
https://stakeholdercenter.caiso.com/StakeholderInitiatives/Hybrid-resources

Standalone Aggregate Capability Constraint (ACC)



Master and Sub-Aggregate Capability Constraint (ACC)



Q&A

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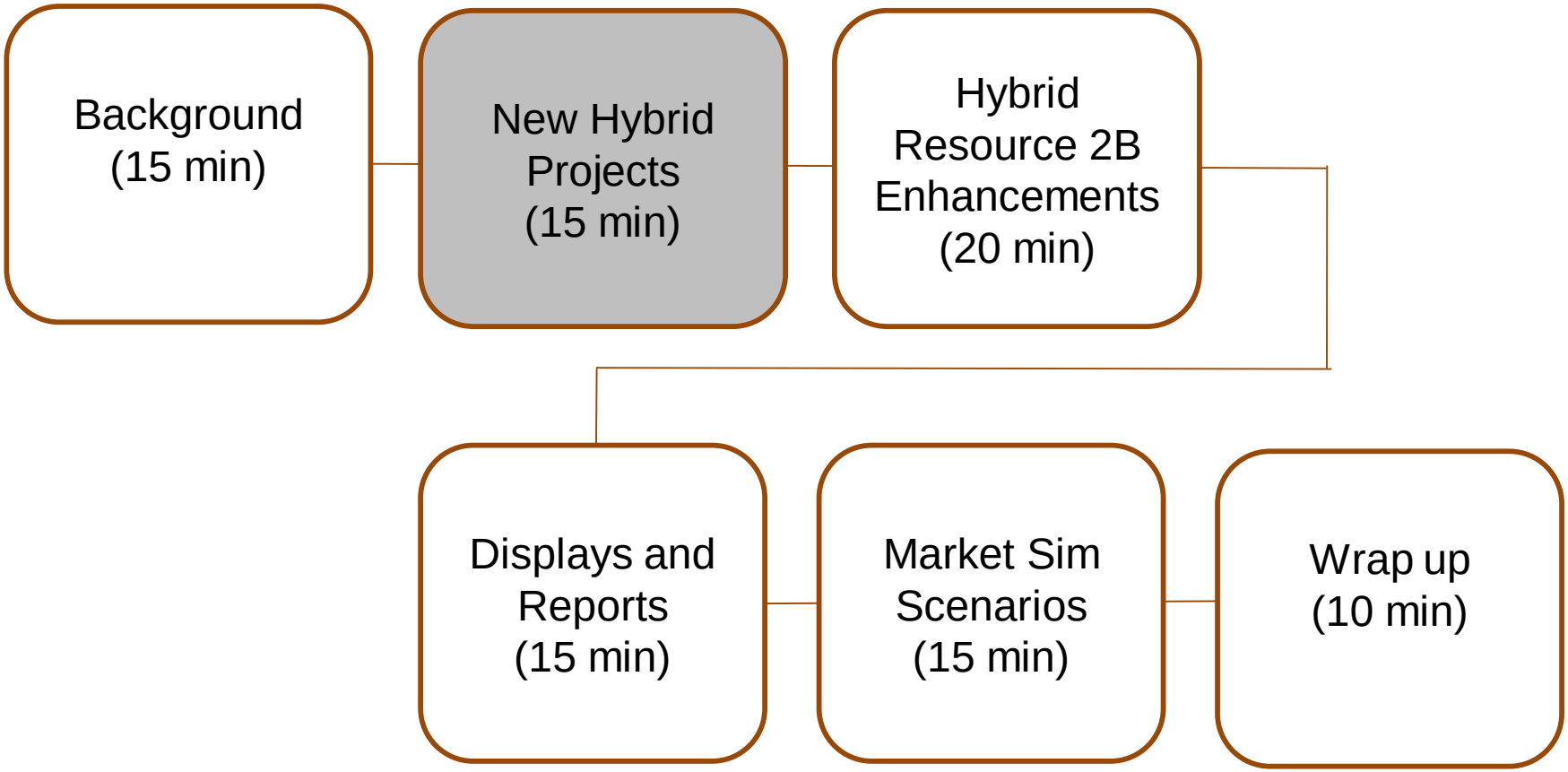


Interconnecting to the Grid

What is changing?

- Updated Interconnection Request form
- Updated Project Details form
- New “Hybrid Components" tab in the generator resource data template (GRDT)

Where can I learn more about the interconnection process? Look at the ISO website and attend the next Resource Interconnection Fair.

For more information resource interconnection procedures
http://www.caiso.com/participate/Pages/ResourceInterconnectionGuide/default.aspx

Interconnection Request – Appendix 1 Sec. 4.c.

c. Type of project (i.e., gas turbine, hydro, wind, etc.) and general description of the equipment configuration (if more than one type is chosen include **gross** installed **MW** for **each**).

- **If project is an increase to an existing project, provide values based on the MW increase only**.

Technology

Select Gen Type	Select Fuel Type	(MW)	Co-Located	Hybrid
Select Gen Type	Select Fuel Type	(MW)	Co-Located	Hybrid
Select Gen Type	Select Fuel Type	(MW)	Co-Located	Hybrid

Other (please describe): (MW) Co-Located Hybrid

Generator Type: Fuel Type:

Comments:

General description of the equipment configuration (e.g. number, size, type, etc):

California ISO

Project Details Form

Submit a new request through the Resource Interconnection Management System (RIMS) public site. 1) Fill out the "New Request" section 2) Choose the "NRI Project Details Form" drop down 3) Click "Register". A registration code will be emailed to the email contact in the New Request. 4) Place this code within the "Registration Code" section of the public site. 5) Click "submit" to access the upload screen for the project details form. You will receive an ISO Project code after the form validation is complete. The ISO project code will be used for all filenames.

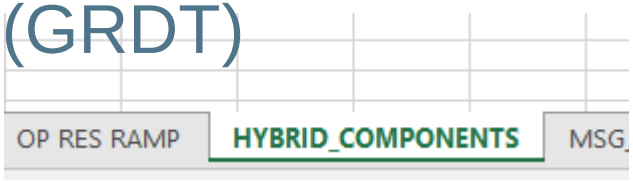
All fields must be filled in, additional fields for Natural Gas Combustion Turbines complete section 8 A-E.
RIG Reconfiguration, Meter Replacement and Meter Maintenance Project Types please only fill out rows 1, 2A- 2G, 3A-C, 6A, 7A-C only.
The following characters are not allowed in any filename: ~ ' # % & @ * { } : ; < > ? / \ | ( ) [ ] - _

1	**Project Type:**	**Select One**
2		***Authorized Contact(s) for the Resource***
A	**Project**	source owner. A consultant or third party is not an acceptable contact. Consults contacts can added using the email field below.
B	**Project Contact F**	
C	**Authorized Contact(s) En**	ultiple email addresses with a **semi colon** ";" between them. These email only receive project updates.
D	**Full Legal Name of C**	retary of State Business License.
E	**Legal Address of C**	ity: State: Zip Code:
F	**Resource Name (facility; unit;** (Resource ID will not be accepted a **Energy Information Administra**	he resource name that will be used in the CAISO Master File and in Regulatory s subject to CAISO approval. See resource naming guidelines found in the NRI ct RegulatoryContracts@caiso.com for approval. EIA Generator ID The EIA Plant Code as generated and provided by the EIA.): The generator ID supplied to the EIA. This ID must be uniquely defined within a plant.
G	**Proje**	Provide an explanation of the project. Meter Replacement include CAISO meter device ID's

Select One
Solar
Wind/Wind Repower
Existing QF
Wind QF
Conventional
Dynamic
Dynamic New Construction
Pseudo
Pseudo New Construction
Non-Generation
Storage
Load
Custom LAP
Meter Replacement
Meter Maintenance
RIG Reconfiguration

	Generator Information	
A	**PTO/UDC (transmission/utility owner):**	**Select One** **(If not listed please pick closest)**
B	**Net Output Generation MW for this Resource:**	Note: May not exceed the Interconnection Agreement studied MW value.
C	**Configuration, Fuel Type(s) and MW(s):**	**Configuration: Select One** Select One Single Hybrid Co-located Hyrbid Co-Located **Fu** **MW** **Fo** *If p… …ype of Load* **Additional Fuel Type 2: Select One** **MW:** **Forecast Election: Select One** *Choose Additional fuel type(s) for a mixed fuel resource* **Additional Fuel Type 3: Select One** **MW:** **Forecast Election: Select One** **Additional Fuel Type 4: Select One** **MW:** **Forecast Election: Select One** *Choose Additional fuel type(s) for a mixed fuel resource*
D	**Point of Interconnection:**	If Known The more detailed information provided here will expedite the modeling.
E	**Connection Voltage:**	SELECT kV Connection at the utility substation or tap (Select closest value. If less than 12kV Select 12kV)
F	**Nearest 60kV or Up Substation Name:**	(Can be pole/tower number, bank/bay number, and location name of a tap)
G	**Generator Interconnection Agreement?** **Agreement Type: Select One** **Enter number here:**	• **If 2-party,** enter Agreement number below (i.e. WDAT Number, Rule 21 Number, etc.) • **If 3-party**, look-up CAISO Queue Position number here and enter Queue # below, if multiple Queue numbers apply to this project separate with a comma. • **If 3-party QF**, please enter Queue Position number in the number field, see Section 4a of NRI Guide. • **If Dynamic or Pseudo Generator** choose the same Agreement and Project Type

Generator Resource Data Template (GRDT)



Name of the Hybrid Resource

Name of individual component

Completed by Master File Team

Modifiable by customer

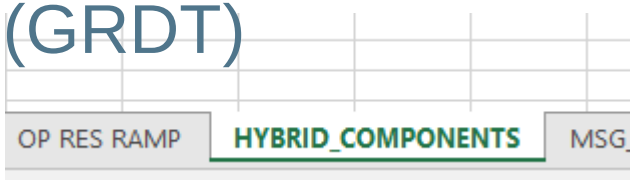
	A	B	C	D	E	F
1	Resource ID	Component_ID	FUEL_TYPE	GEN_TECH_TYPE	MAX_GEN	MIN_GEN
2	EXAMPLE_2_HYB1	EXAMPLE_2_HYB1_SOLR1	SOLR	PHOT	130	0
3	EXAMPLE_2_HYB1	EXAMPLE_2_HYB1_SOLR2	SOLR	PHOT	130	0
4	EXAMPLE_2_HYB1	EXAMPLE_2_HYB1_LESR1	LESR	OTHR	36	-36

Fuel type of the component

Specific technology used for the fuel type

Pmax and Pmin

Generator Resource Data Template (GRDT)



Identifies VER component of NGR

ISO or SC Forecast

Completed by Master File Team

Modifiable by customer

	A	B	G	H	I	J	K	L
1	Resource ID	Component_ID	VER_NGR	FORECAST_SELECTION	DISP	MIN_CONT_ENERGY_LIMIT	MAX_CONT_ENERGY_LIMIT	ENERGY_EFFIC
2	EXAMPLE_2_HYB1	EXAMPLE_2_HYB1_SOLR1	Y	ISO	N			
3	EXAMPLE_2_HYB1	EXAMPLE_2_HYB1_SOLR2	Y	SC	N			
4	EXAMPLE_2_HYB1	EXAMPLE_2_HYB1_LESR1			Y	1	144	0.9

N – Wind and Solar
Y – Storage

(Used for Effective Flexible Capacity (EFC) calculations)

Minimum/Maximum State of Charge

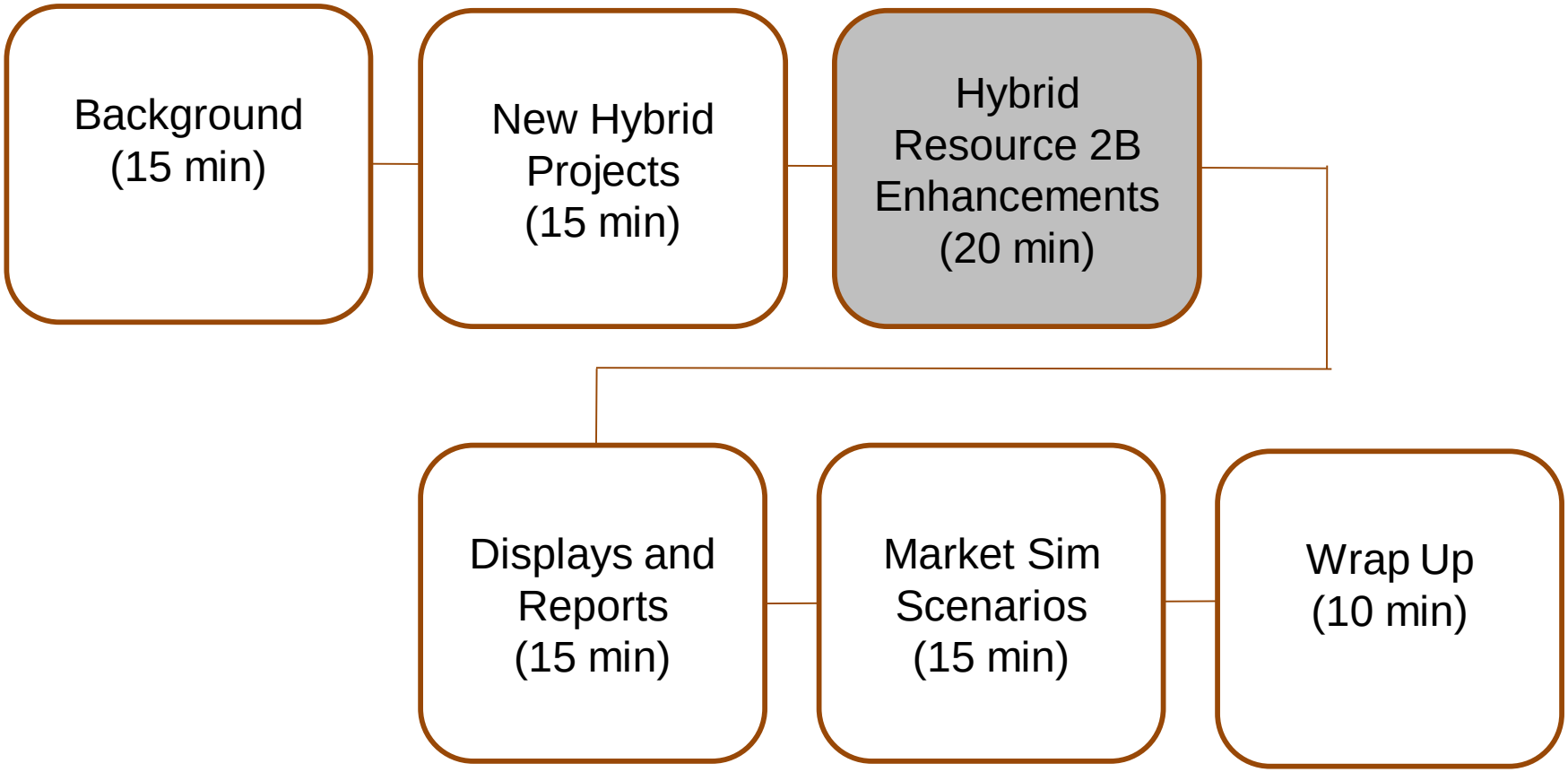
% of charging energy a battery can store and later discharge

New Hybrid Resource – Action Items

- ❑ Use the updated Interconnection Request form and submit via RIMS
- ❑ Use the updated Project Details Form and submit via RIMS
- ❑ GRDT – Submit via RIMS (new) or Master File UI (updates)
  - ❑ Update modifiable fields, as necessary
  - ❑ Check non-modifiable fields for accuracy
    - ❑ Submit concerns to RDT@caiso.com

Q&A

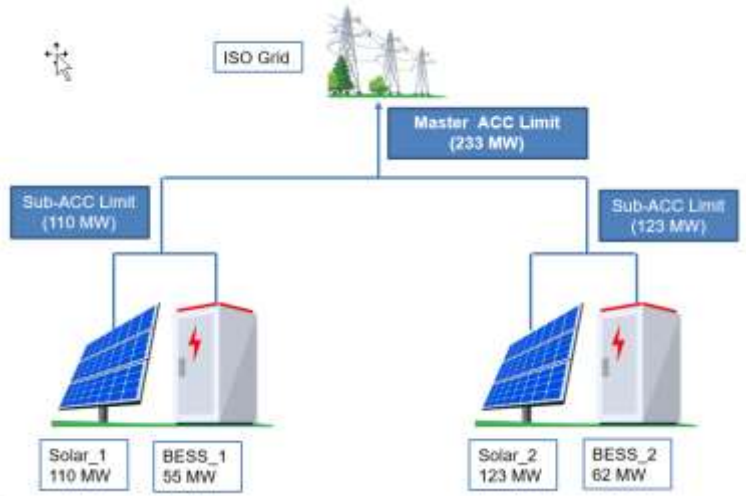
In today's session we'll cover:



Requesting Master and Sub-ACC

Why would I do this? Used in situations where there are contractual limitations on components that are subordinate to the aggregate capacity constraint of the interconnection.

Why is this important? So that co-located resources are dispatched appropriately.



New Master and Sub-ACC– Action Items

- ISO BAA participants
  - Work with ISO contracts department to set up/update the Participating Generator Agreement (PGA)
- WEIM participants
  - New resources – include request in SC Letter
  - Existing resources – submit a CIDI ticket with this request

SC Forecast Selection

What is this? Hybrid customers can choose to submit their own VER forecast data to the ISO, rather than using the ISO's forecast.

Is this available for other VER resources? Yes, for dispatch and settlement purposes only. An ISO forecast will still be needed for forecasting and internal DOT formation.

How do SCs submit them? Via the Automated Load Forecast System (ALFS) using the API

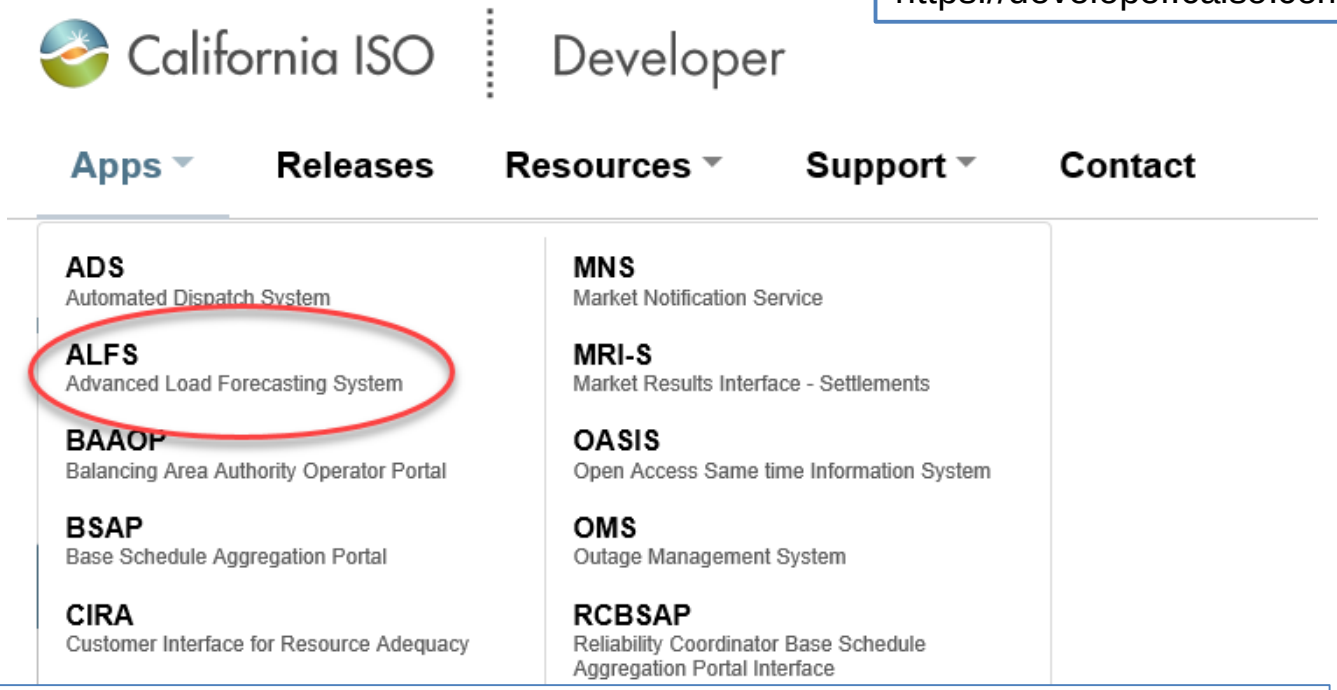
The technical specifications are located on the Developer's site (registration required):
https://developer.caiso.com/

Signing up to provide SC Forecast

- New customers
  - WEIM participants – request during the onboarding process
  - CAISO BAA participants – request during the NRI process

- Existing customers that want to switch forecast options should submit a CIDI ticket request

https://developer.caiso.com



Tech Specs

About status

NAME	STATUS	RELEASE	LAST UPDATED
ALFS Interface Specification v1.0.0.pdf	PROD_LATEST	Fall 2017	12/6/2019
ALFS Interface Specification v1.2.pdf	PROD_LATEST	2020	3/13/2020
ALFS SC VER Interface Specification v1.0.pdf	UPCOMING	Fall 2022	5/25/2022
RC ALFS Interface Specification v1.0.0.pdf	PROD_LATEST	2019	12/6/2019

SC Forecast – Action Items

- ❑ New customers – indicate your forecast choice in the onboarding process
- ❑ Existing customers – submit a CIDI ticket if you want to change your forecast option
- ❑ Submit forecast via ALFS (not SIBR)

Dynamic Limits

What are they? Minimum and maximum MW limits for Hybrid Resources that can be submitted for every 5 minute interval.

Why are they important? Enables SC to limit the dispatch instruction from the ISO for positions of the bid curve that are unavailable for dispatch based on actual production limitations for the hybrid resource.

How do SCs submit them? Via SIBR using the API or the UI.

The SIBR User Guide is located at:
http://www.caiso.com/participate/Pages/ApplicationAccess/Default.aspx

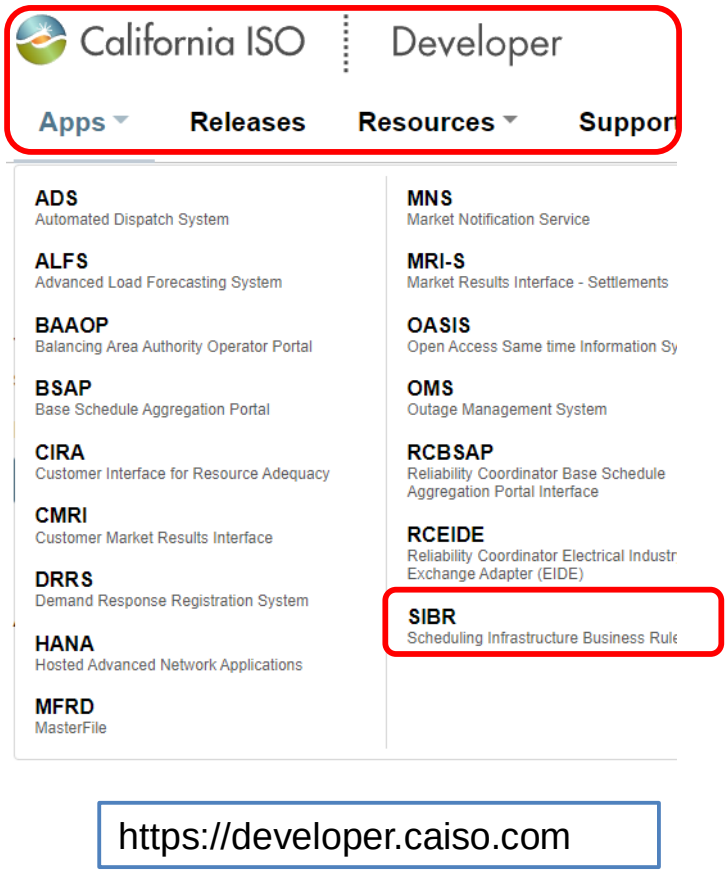
New – Hybrid Dynamic Limit

Real-Time Energy Bid
25 MW for the hour

Forecast of resource availability forecast for the hour

Interval	:05	:10	:15	:20	:25	:30	:35	…	:00
Upper Limit	25 MW	23 MW	25 MW	22 MW	20 MW	22 MW	20 MW	…	19 MW
Lower Limit	1 MW	1 MW	1 MW	1 MW	1 MW	1 MW	1 MW	…	1 MW

Dynamic Limits



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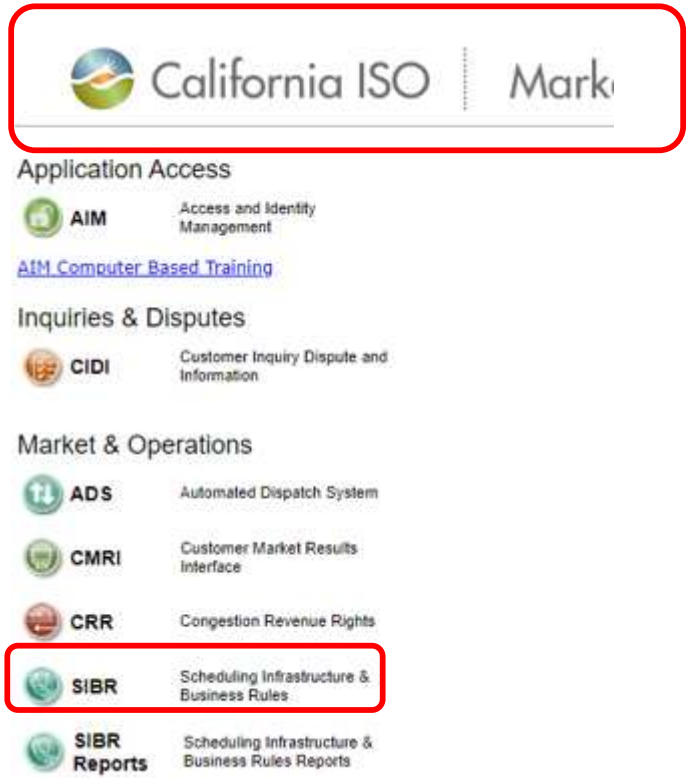
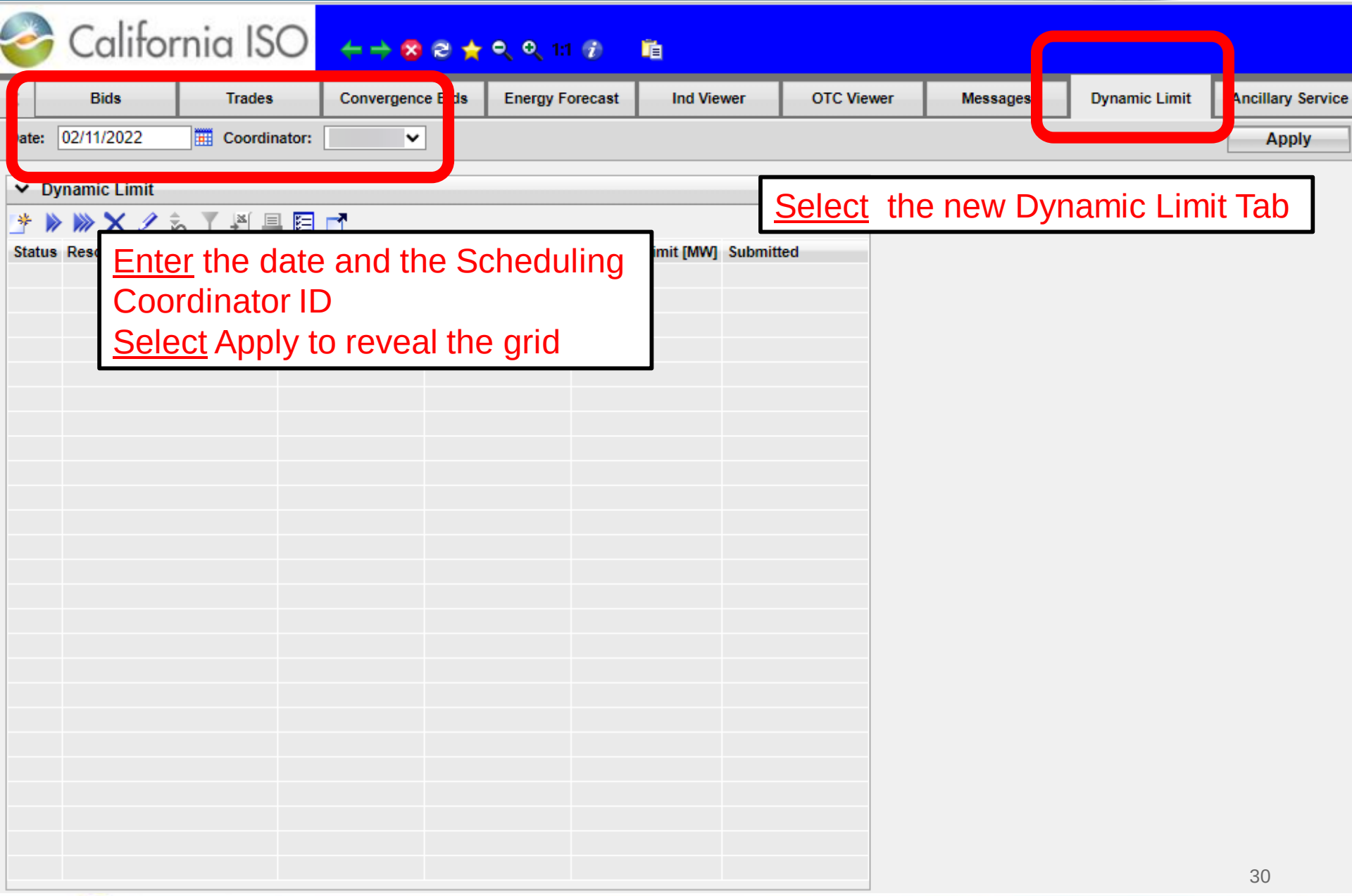
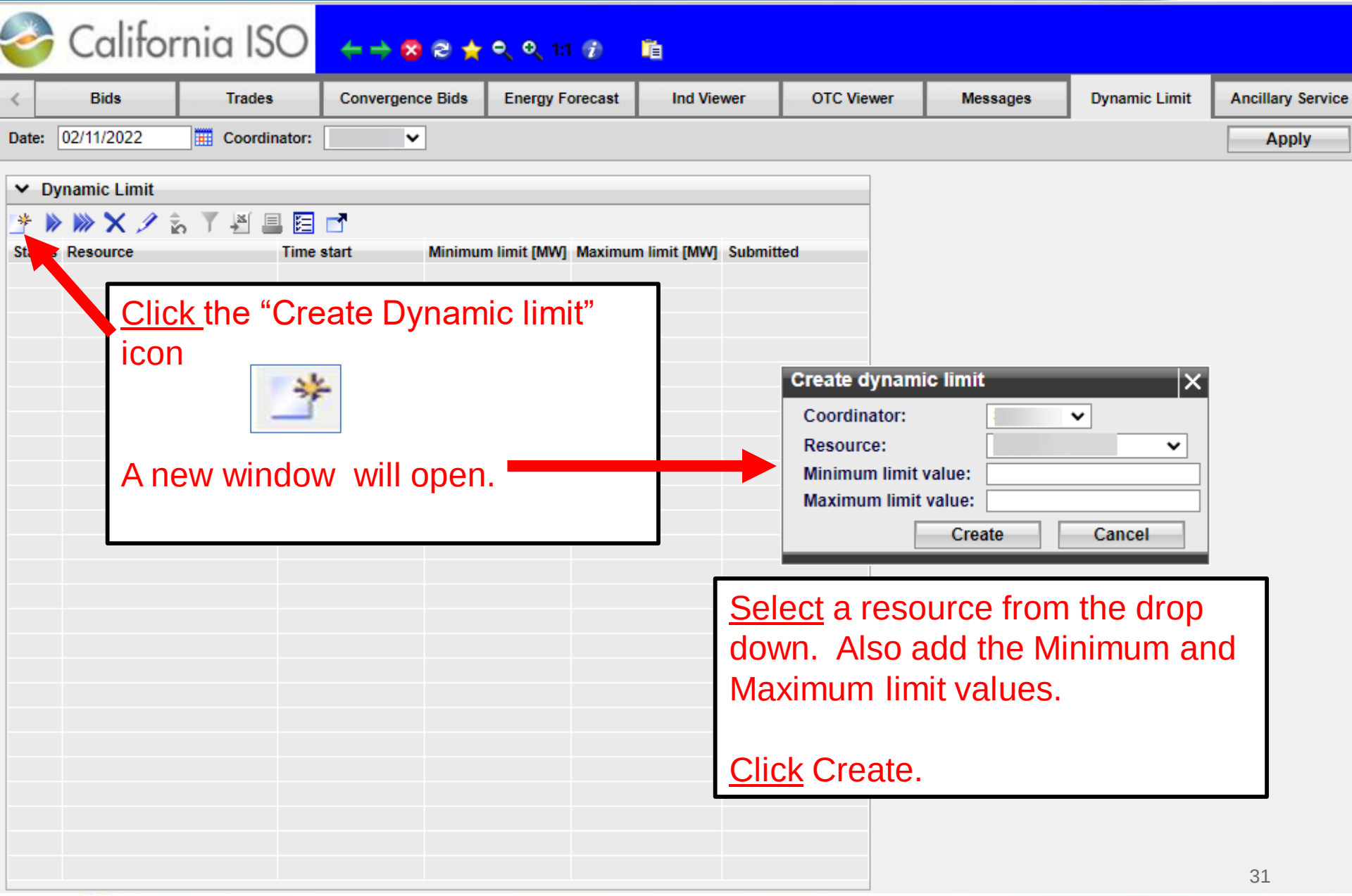
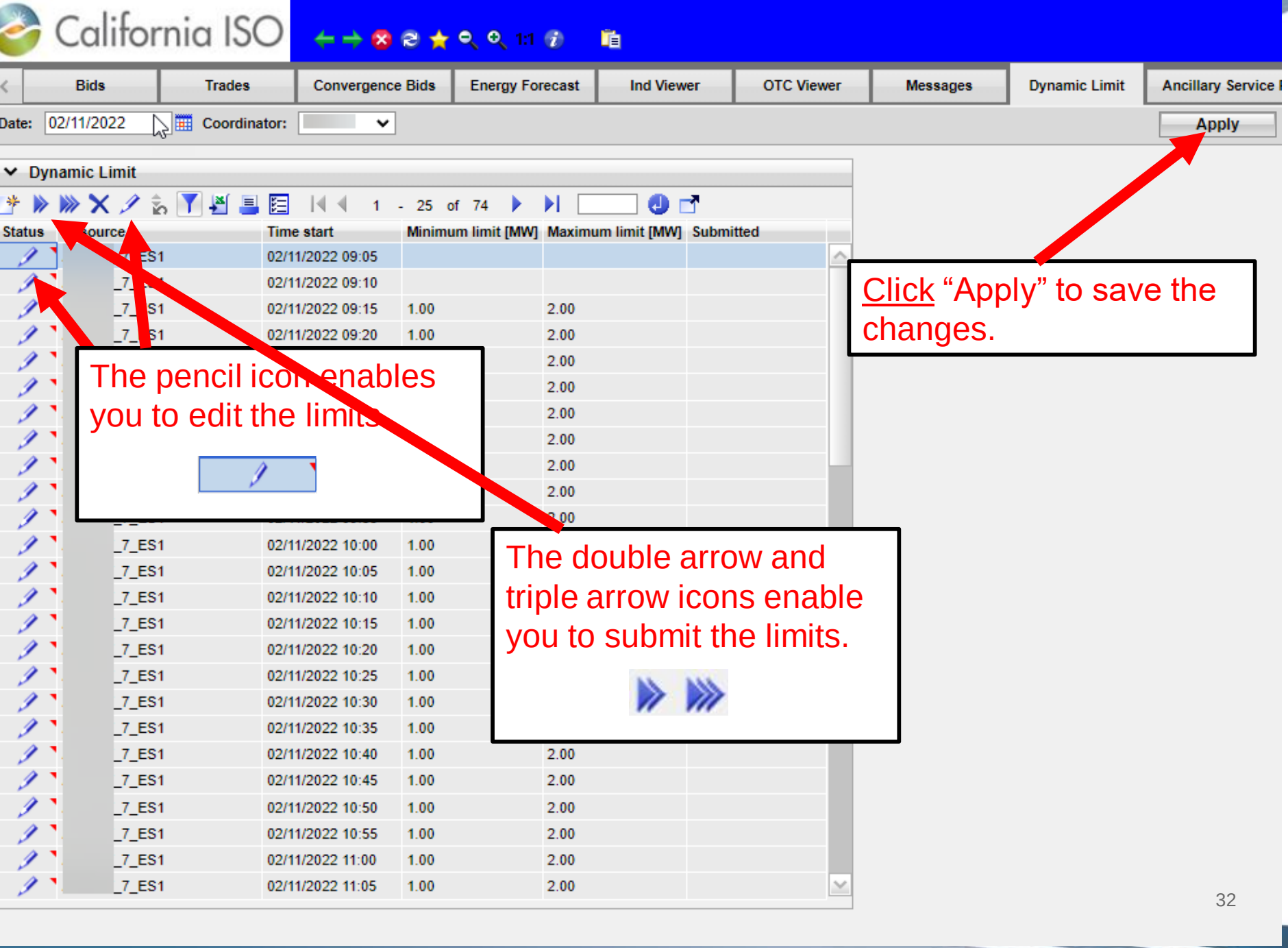



California ISO
Bids
Trades
Convergence Bids
Energy Forecast
Ind Viewer
OTC Viewer
Messages
Dynamic Limit
Ancillary Service
ate: 02/11/2022
Coordinator:
Apply
Dynamic Limit
Status
Submitted
Select the new Dynamic Limit Tab
Enter the date and the Scheduling Coordinator ID
Select Apply to reveal the grid


California ISO
Bids
Trades
Convergence Bids
Energy Forecast
Ind Viewer
OTC Viewer
Messages
Dynamic Limit
Ancillary Service
Date: 02/11/2022
Coordinator:
Apply
Dynamic Limit
Resource
Time start
Minimum limit [MW]
Maximum limit [MW]
Submitted
Click the “Create Dynamic limit” icon
A new window will open.
Create dynamic limit
Coordinator:
Resource:
Minimum limit value:
Maximum limit value:
Create
Cancel
Select a resource from the drop down. Also add the Minimum and Maximum limit values.
Click Create.


California ISO
Bids
Trades
Convergence Bids
Energy Forecast
Ind Viewer
OTC Viewer
Messages
Dynamic Limit
Ancillary Service
Date: 02/11/2022
Coordinator:
Apply
Dynamic Limit
1 - 25 of 74
Status
Source
Time start
Minimum limit [MW]
Maximum limit [MW]
Submitted
02/11/2022 09:05
02/11/2022 09:10
02/11/2022 09:15 1.00 2.00
02/11/2022 09:20 1.00 2.00
2.00
2.00
2.00
2.00
2.00
2.00
_7_ES1 02/11/2022 10:00 1.00
_7_ES1 02/11/2022 10:05 1.00
_7_ES1 02/11/2022 10:10 1.00
_7_ES1 02/11/2022 10:15 1.00
_7_ES1 02/11/2022 10:20 1.00
_7_ES1 02/11/2022 10:25 1.00
_7_ES1 02/11/2022 10:30 1.00
_7_ES1 02/11/2022 10:35 1.00
_7_ES1 02/11/2022 10:40 1.00 2.00
_7_ES1 02/11/2022 10:45 1.00 2.00
_7_ES1 02/11/2022 10:50 1.00 2.00
_7_ES1 02/11/2022 10:55 1.00 2.00
_7_ES1 02/11/2022 11:00 1.00 2.00
_7_ES1 02/11/2022 11:05 1.00 2.00
The pencil icon enables you to edit the limits
The double arrow and triple arrow icons enable you to submit the limits.
Click “Apply” to save the changes.

Dynamic Limits – Action Items

- Using SIBR UI or API, submit dynamic limit information (minimum and maximum MW) for hybrid resources, every 5 minutes

Other features of Hybrid Resources

Meters must be installed at the component level

Hybrid resources are excluded from Generic RAAIM

Forecast fee is waived for those that choose SC forecast

Bids are not subject to market power mitigation

Q&A

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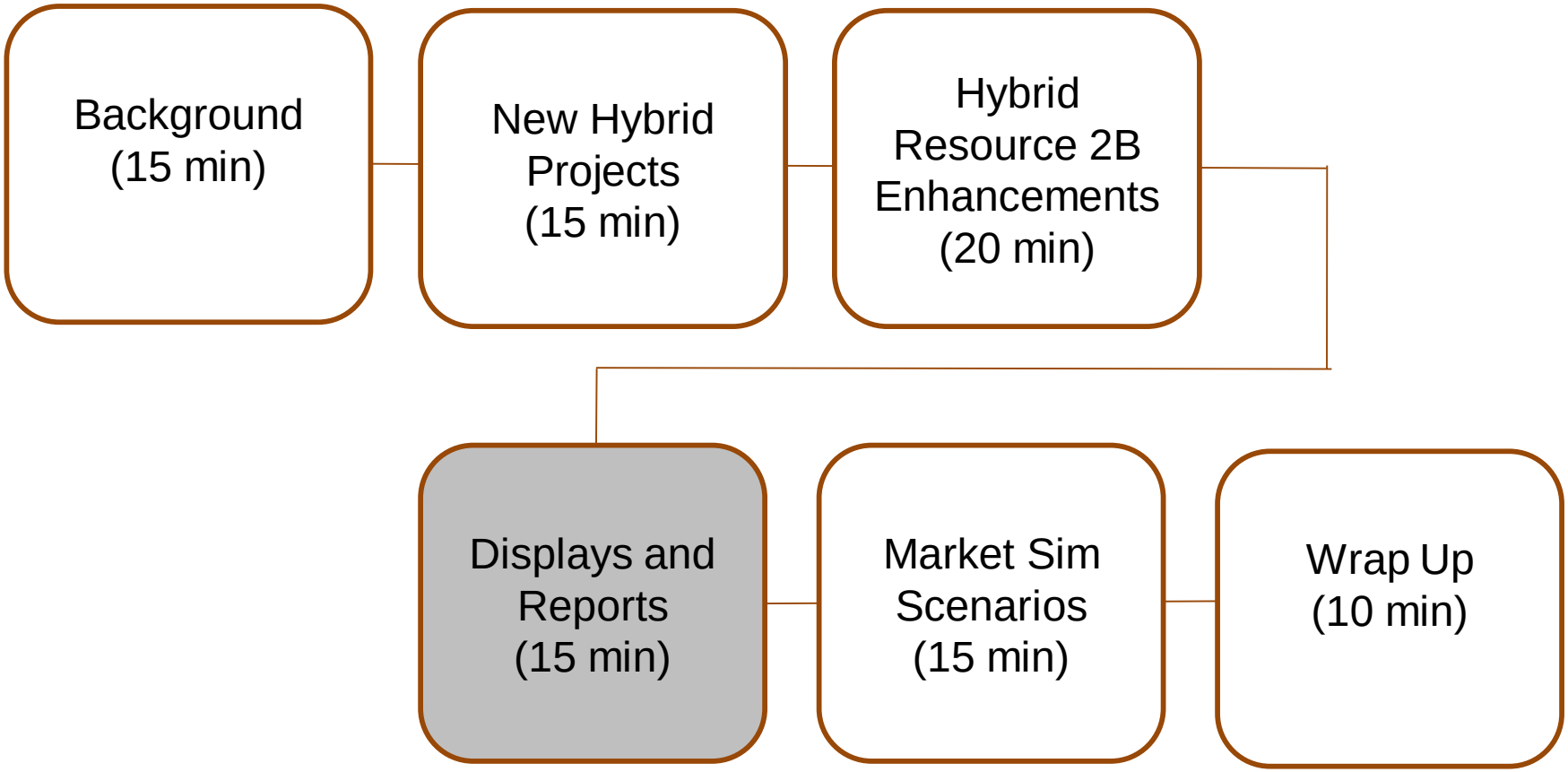


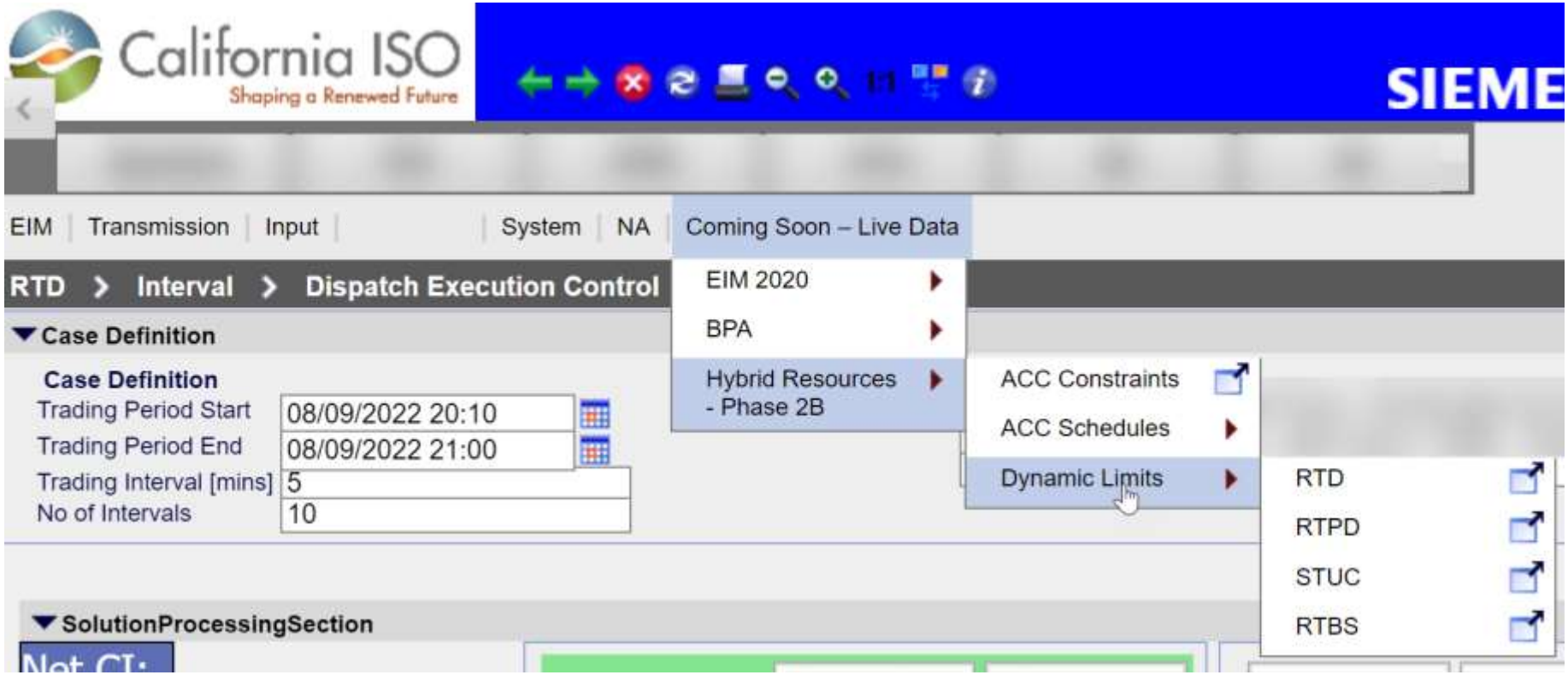
Balancing Authority Area Operations Portal (BAAOP) - WEIM Application

What is it? Used by the WEIM operators to monitor market operations.

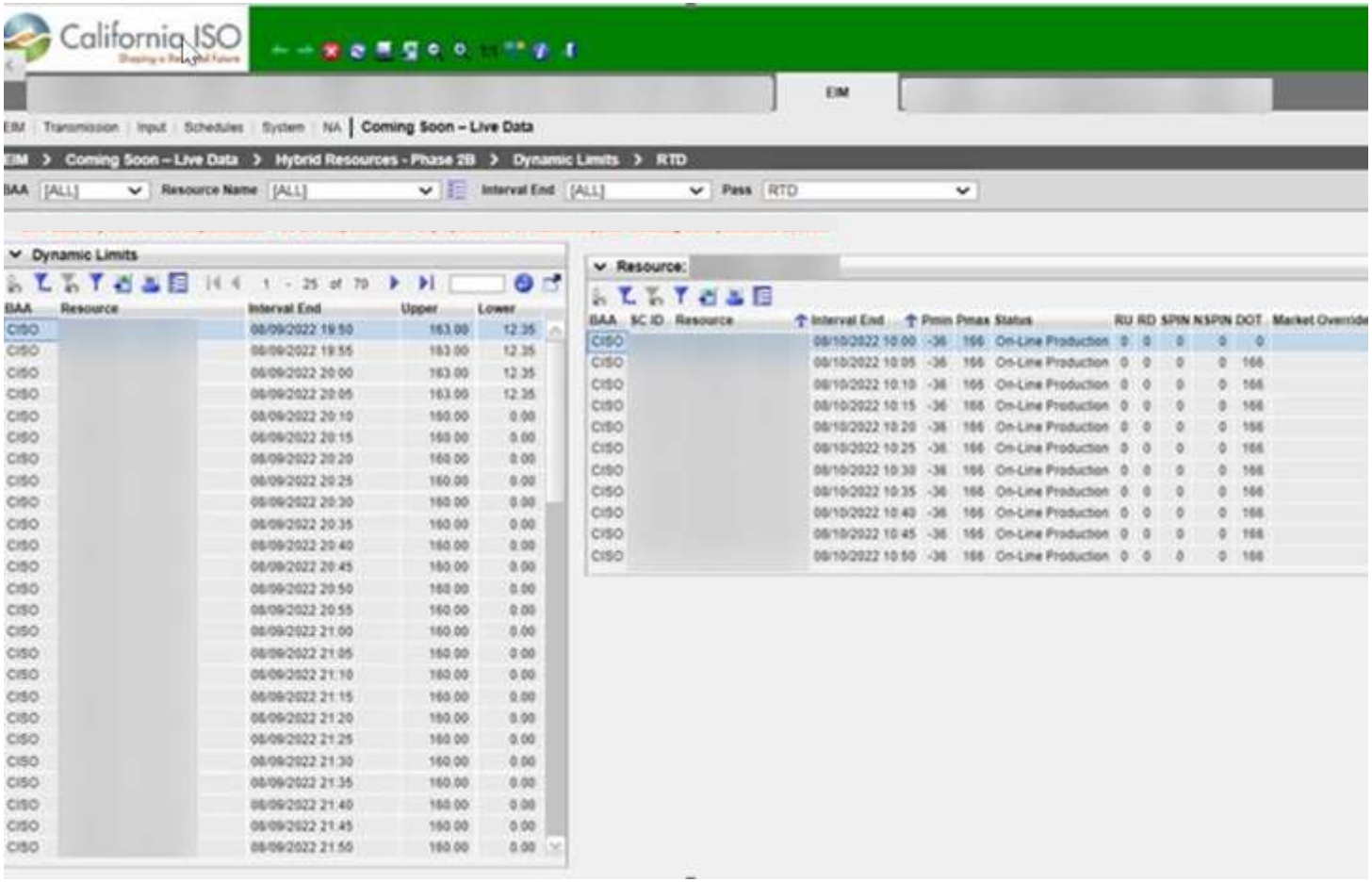
Is there a new display? Yes, Dynamic Limits.

Is anything else changing? Yes, We are adding a new "Type" column to the ACC Schedules and ACC Constraints displays.

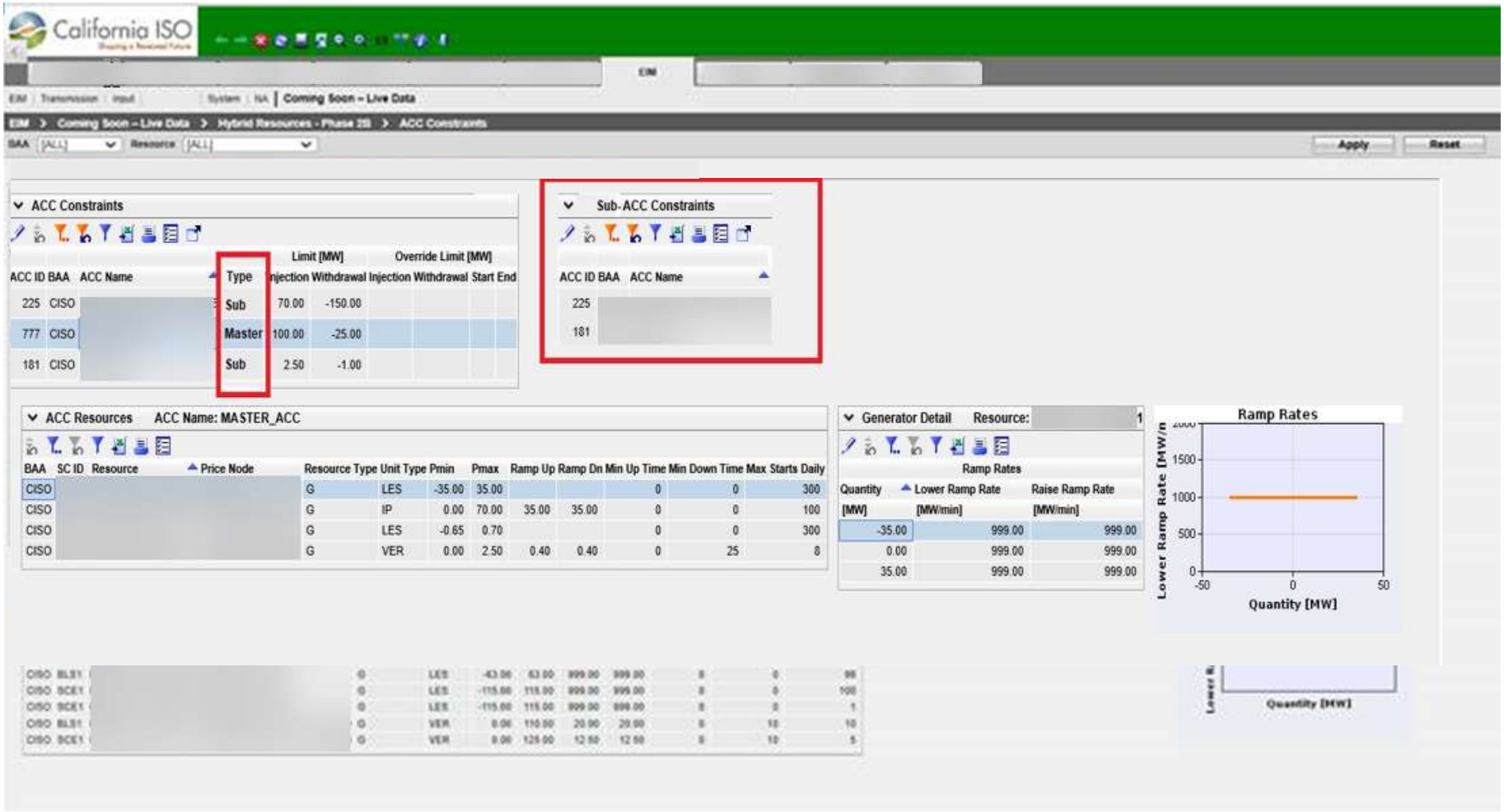
BAAOP – Coming Soon – Hybrid Resources Phase 2B



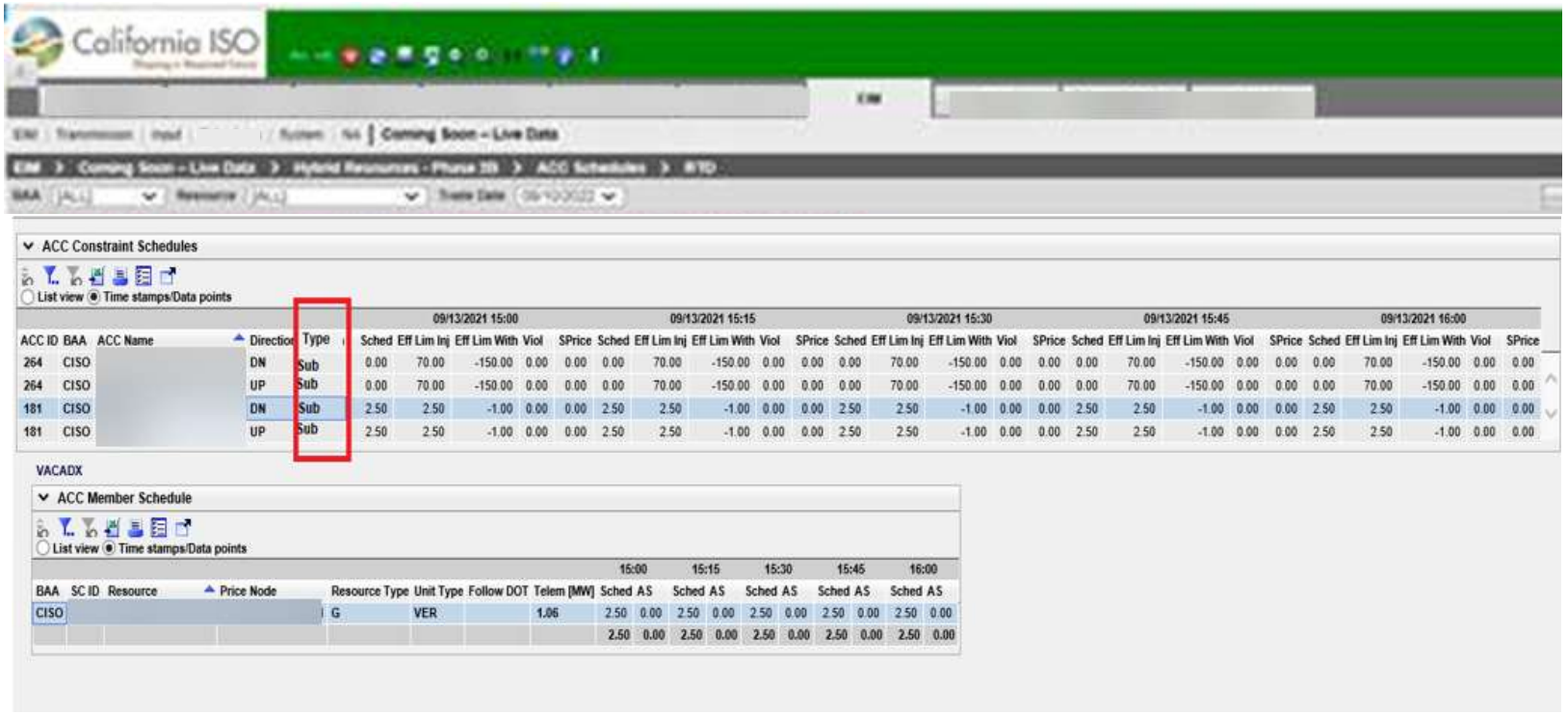
BAAOP – Dynamic Limits Display



BAAOP – ACC Constraints



BAAOP – ACC Schedules



Open Access Same-time Information System (OASIS) Reports

What does it contain? Market and operations data that is available to the public via caiso.com.

Which existing reports are impacted?

None

Are there new reports?

Aggregate Capability Constraint Shadow Prices

Aggregate Capability Constraint Shadow Prices

Date From	Date To	Market			
Aggregate Capability Constraint Shadow Prices					
Market	**Opr Date**	**Opr Interval**	**Constraint Name**	**Direction**	**HE1…HE25**
DAM				DN	N.NN
RTD				UP	
RTPD					

Market Participant Portal (MPP) Reports

What does it contain? It provides links to reports and applications used by market participants.

Which existing reports are impacted?

Transmission Limits

Are there new reports?

No

California ISO | Market Participant Portal

MPP Home | Market Modeling Data | System Integration Discussions | RC Working Groups | HANA

Market Modeling Data

This data is protected under ISO tariff and can only be viewed by or shared with persons that have fully executed the applicable Non-Disclosure Agreement.

PLEASE NOTE THAT THIS DATA IS AVAILABLE FOR A LIMITED TIME PERIOD (90-DAY ROLLING LOOK BACK), AFTER WHICH IT WILL NOT BE ACCESSIBLE. PLEASE ACCESS A DOWNLOAD ACCORDINGLY.

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Load Distribution Factors (LDF)

Displays the load distribution factors by node used in the Day-Ahead Market. To protect confidential data the load distribution factors for single customer nodes are aggregated and report by DLAP.

Shift Factors (SF)

Displays the complete list of shift factors for all binding constraints. In the IFM, HASP, and RTD markets.

Transmission Limits (TL)

Displays the transmission limits for all critical constraints in the IFM, HASP, FMM (RTUC), and RTD markets. The term "critical" refers to being close to or at the limit.

Current View ... Find a file

Name	Modified
Transmission Limits	December 12, 2012
Shift Factors	December 12, 2012
Load Distribution Factors	December 12, 2012

Customer Market Results Interface (CMRI) Reports

What does it contain? CMRI reports contain customer-specific market results and information.

Which existing reports are impacted?

Interval Variable Energy Resource Forecast Report

Variable Energy Resource Forecast Report

Are there new reports?

ACC Definition

California ISO | Customer Market Results Interface

Day-Ahead | Real-Time | Post-Market | Default Bids | Convergence Bidding | Forecast | Reference | LSE | Energy Imbalance Market | Phase Shifter | Gas Burn | Reliability Coordi

Trade Date: 07/29/2022 **Entity:** [Set] **Resource:** 1 item(s) **Forecast**

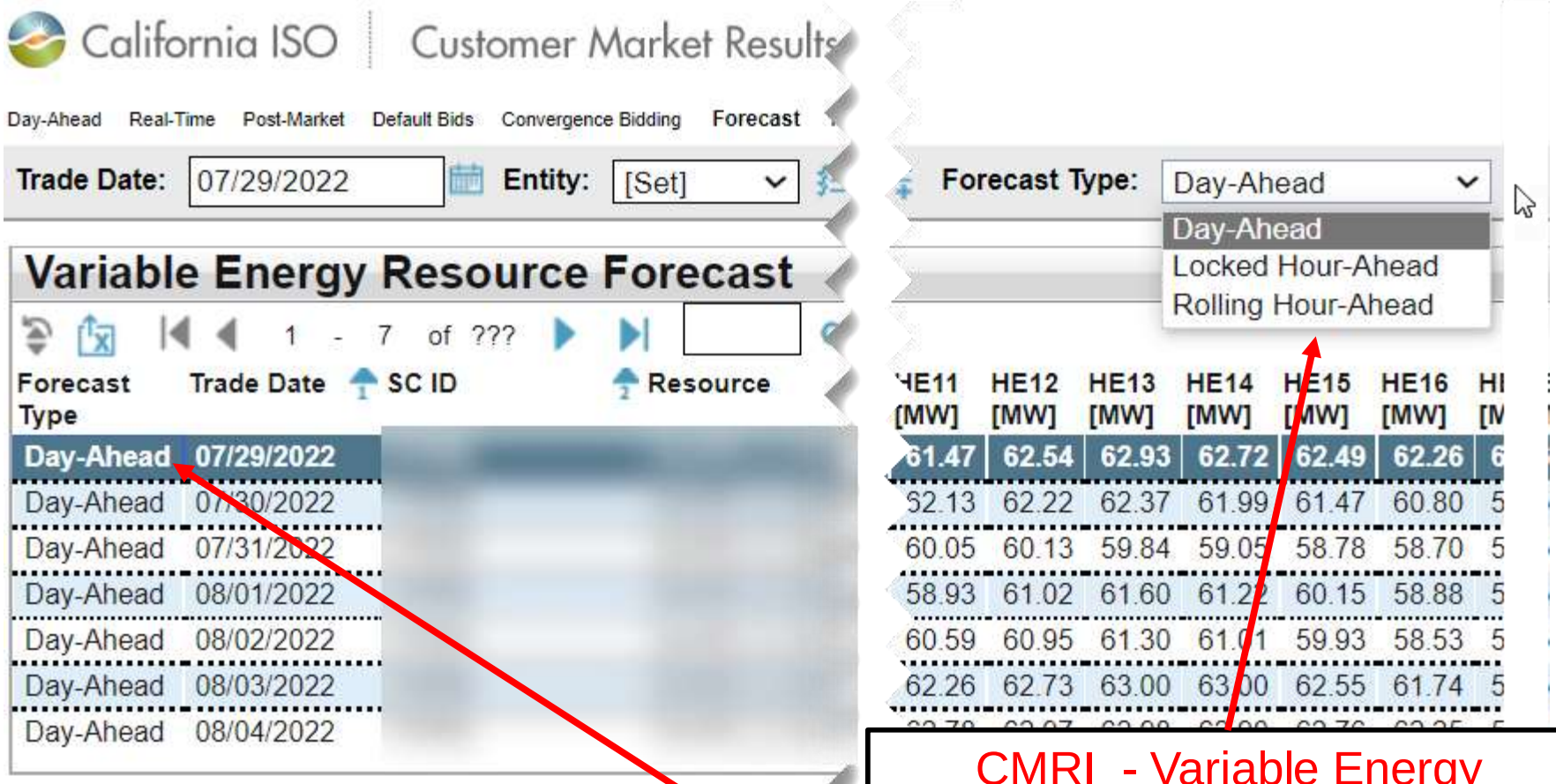
Interval Variable Energy Resource Forecast

1 - 12 of ??? GO

Forecast Type	Trade Date	SC ID	Resource	Interval	HE01 [MW]	HE02 [MW]	HE03 [MW]	HE04 [MW]	HE05 [MW]	HE06 [MW]	HE07 [MW]	HE08 [MW]
Rolling 5MIN	07/29/2022			1	0.00	0.00	0.00	0.00	0.00	0.00	0.31	15.26
Rolling 5MIN	07/29/2022			2	0.00	0.00	0.00	0.00	0.00	0.00	0.98	17.53
Rolling 5MIN	07/29/2022			3	0.00	0.00	0.00	0.00	0.00	0.00	1.74	20.09
Rolling 5MIN	07/29/2022			4	0.00	0.00	0.00	0.00	0.00	0.00	2.59	22.87
Rolling 5MIN	07/29/2022			5	0.00	0.00	0.00	0.00	0.00	0.00	3.27	28.58
Rolling 5MIN	07/29/2022			6	0.00	0.00	0.00	0.00	0.00	0.00	4.34	31.38
Rolling 5MIN	07/29/2022			7	0.00	0.00	0.00	0.00	0.00	0.00	5.53	34.03
Rolling 5MIN				8	0.00	0.00	0.00	0.00	0.00	0.00	6.84	36.55
Rolling 5MIN				9	0.00	0.00	0.00	0.00	0.00	0.00	8.27	38.92
Rolling 5MIN				10	0.00	0.00	0.00	0.00	0.00	0.00	9.83	41.15
Rolling 5MIN				11	0.00	0.00	0.00	0.00	0.00	0.00	11.50	43.24
Rolling 5MIN				12	0.00	0.00	0.00	0.00	0.00	0.00	13.30	45.19

CMRI - Interval Variable Energy Resource Forecast

Displays 5 minute forecast for VER components



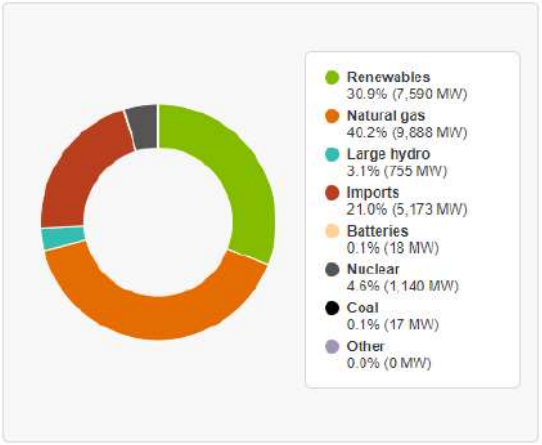
CMRI - Variable Energy Resource Forecast

Displays forecasts for VER components in various time frames

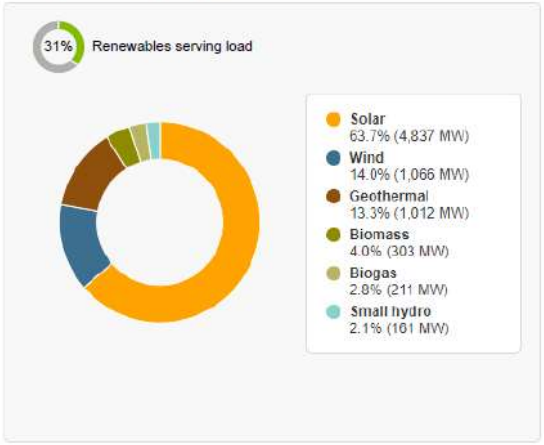
CMRI – ACC Definition

ISO Today/Today's Outlook – Pie Charts

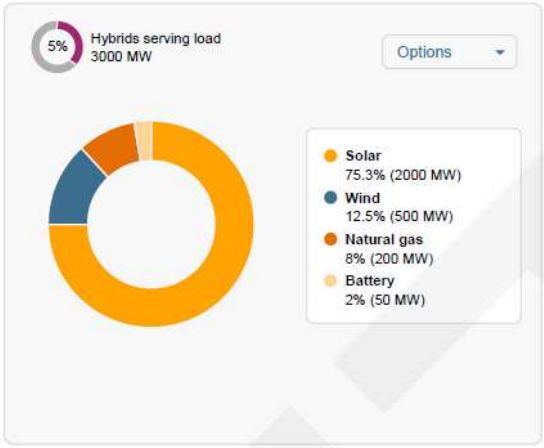
Current supply includes hybrids



Current renewables includes hybrids



Current hybrids

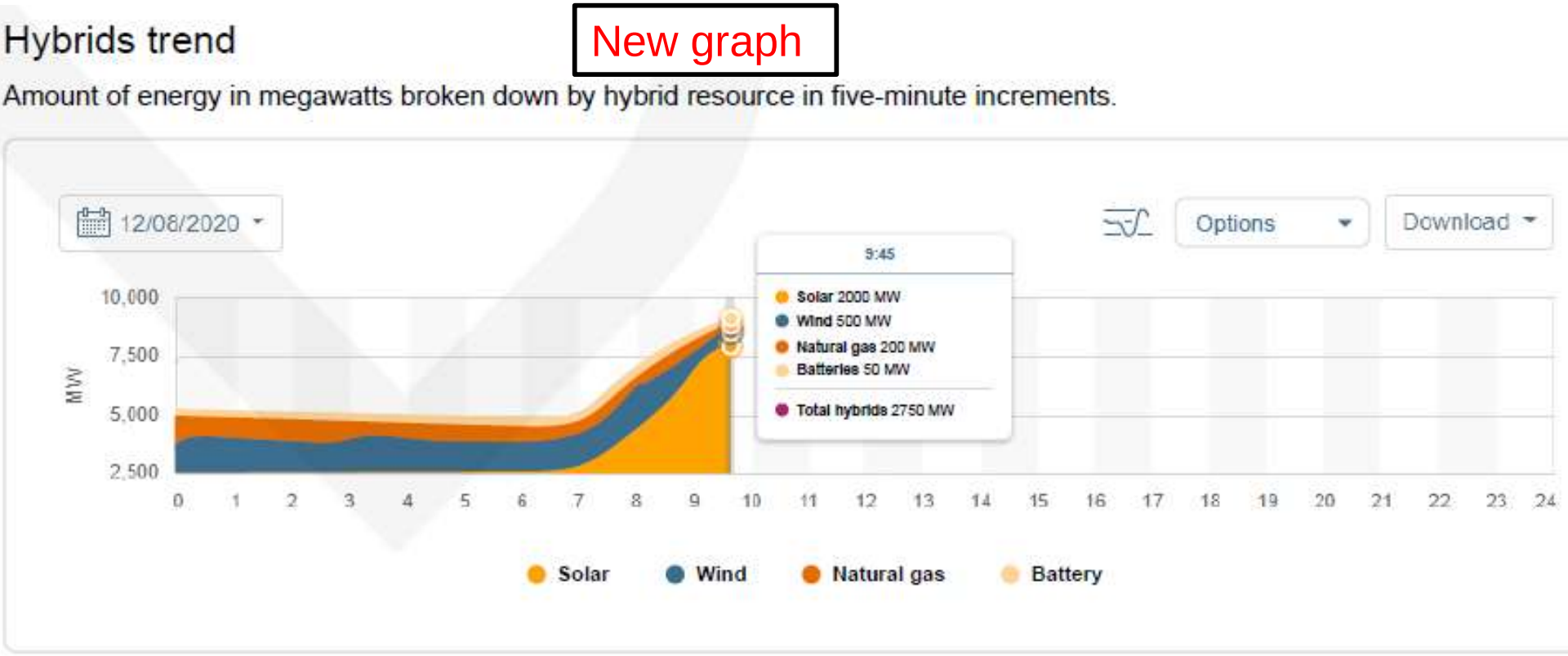


Update existing graph

New graph

ISO Today/Today's Outlook – Trend Charts

New graph



Existing trend charts will also incorporate hybrid data:

Supply Trend

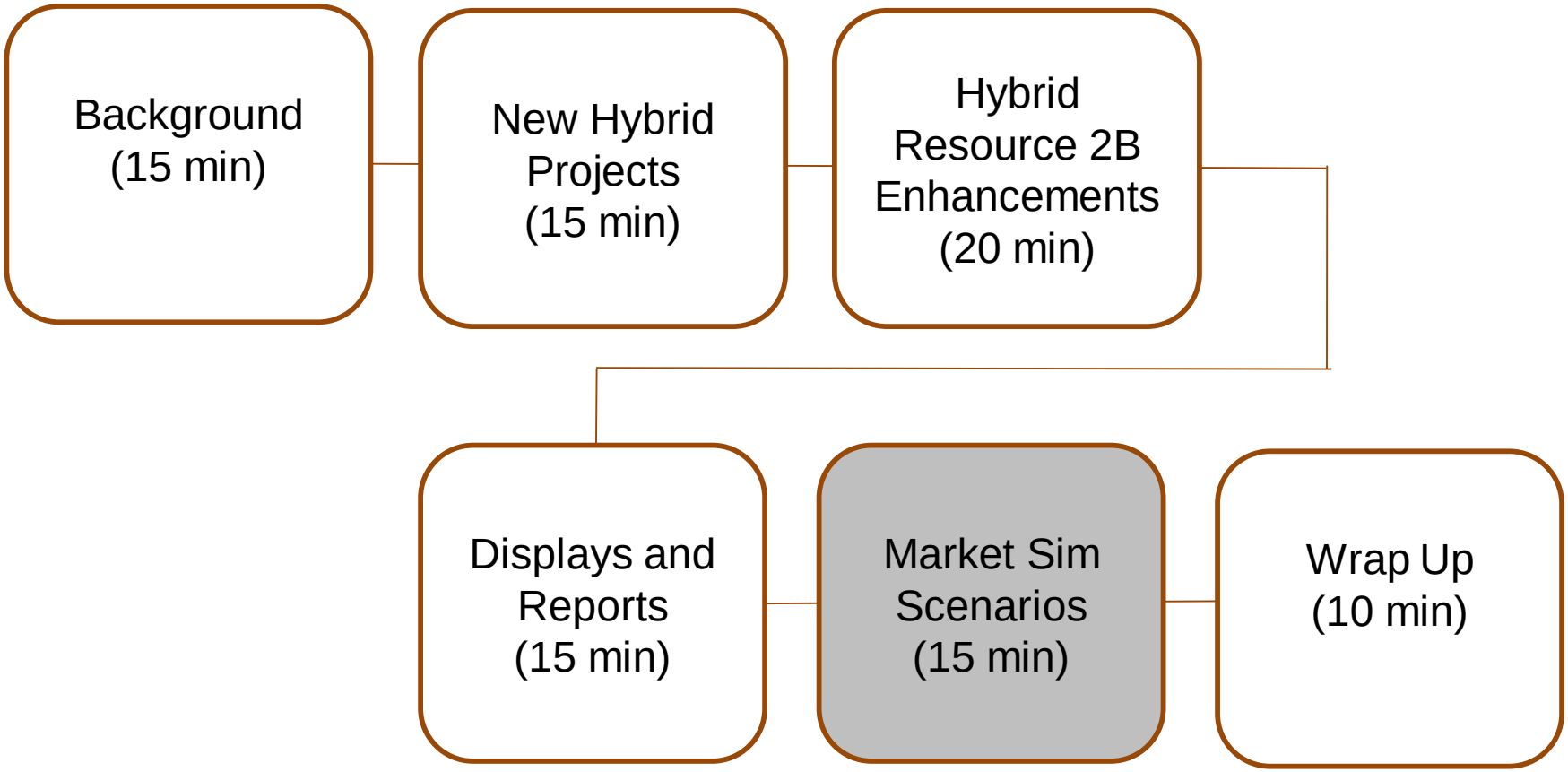
Renewables Trend

Import Trend

Batteries Trend

Q&A

In today's session we'll cover:



Market Simulation Logistics

- Market participants will need to register their request with the ISO to participate in the Hybrid Resources Phase 2 project simulation via the MarketSim@caiso.com mailbox.
- Please submit your request and any additional information identified above by August 12, 2022.

- http://www.caiso.com/Documents/MarketSimulationStructuredScenarios-HybridResourcesP2.pdf

Scenario Number	Unstructured guided Scenario	
1	Description	Verify submitted hybrid resource data and component level data
	ISO Actions	ISO to dispatch Hybrid resources
	EIM Market Participant Actions	EIM SCs to submit dynamic limits and real-time (RT) forecasts for hybrid resources
	ISO Market Participant Actions	SCs to submit dynamic limits and real-time (RT) forecasts for hybrid resources

	Expected Outcome	Verify Hybrid Resource data in Master File
		
		Verify submission of upper and lower resource limit in Market (Dynamic Limit Tool)
		
		Verify the following in CMRI:
		• Hybrid resource award is within the dynamic limit as submitted by Market Participant
		  ○ When the LMP is higher than the hybrid resource bid and the resource has ramping capability, hybrid resource award is at the upper dynamic limit MW value, including cases when the upper dynamic limit MW value is greater than the original upper bid limit MW value.
		  ○ When the LMP is lower than the hybrid resource bid and the resource has ramping capability, hybrid resource award is at the lower dynamic limit MW value, including cases when the lower dynamic limit MW value is lower than the original lower bid limit MW value.

		original lower bid limit MW value. • Hybrid resource forecast data is published at the VER component level Verify utilization of ISO forecast of Hybrid Resources in MRI-S Settlements Statement
	Anticipated Settlement Outcome	701

	Expected Settlement Outcome	EIM Participants: Verify Hybrid Resources are assessed a forecast fee. ISO Market Participants Only: Verify Hybrid Resources are fully exempted from RAAIM in Settlements and assessed a forecast fee.

Market Sim Recommendations – Scenario 1

- Master file – verify the data for your hybrid resources
- Market –
  - SIBR
    - Submit bids; submit dynamic limits that either limit or extend the upper and/or lower bid limits
    - Verify the dynamic limit information
  - CMRI
    - Verify market awards are within the dynamic limits
    - Verify forecast data is published at the VER component level
  - MRI-S
    - Review Forecast Fee (Charge Code 701) to ensure that it was applied appropriately
    - Verify that there was no RAAIM settlement

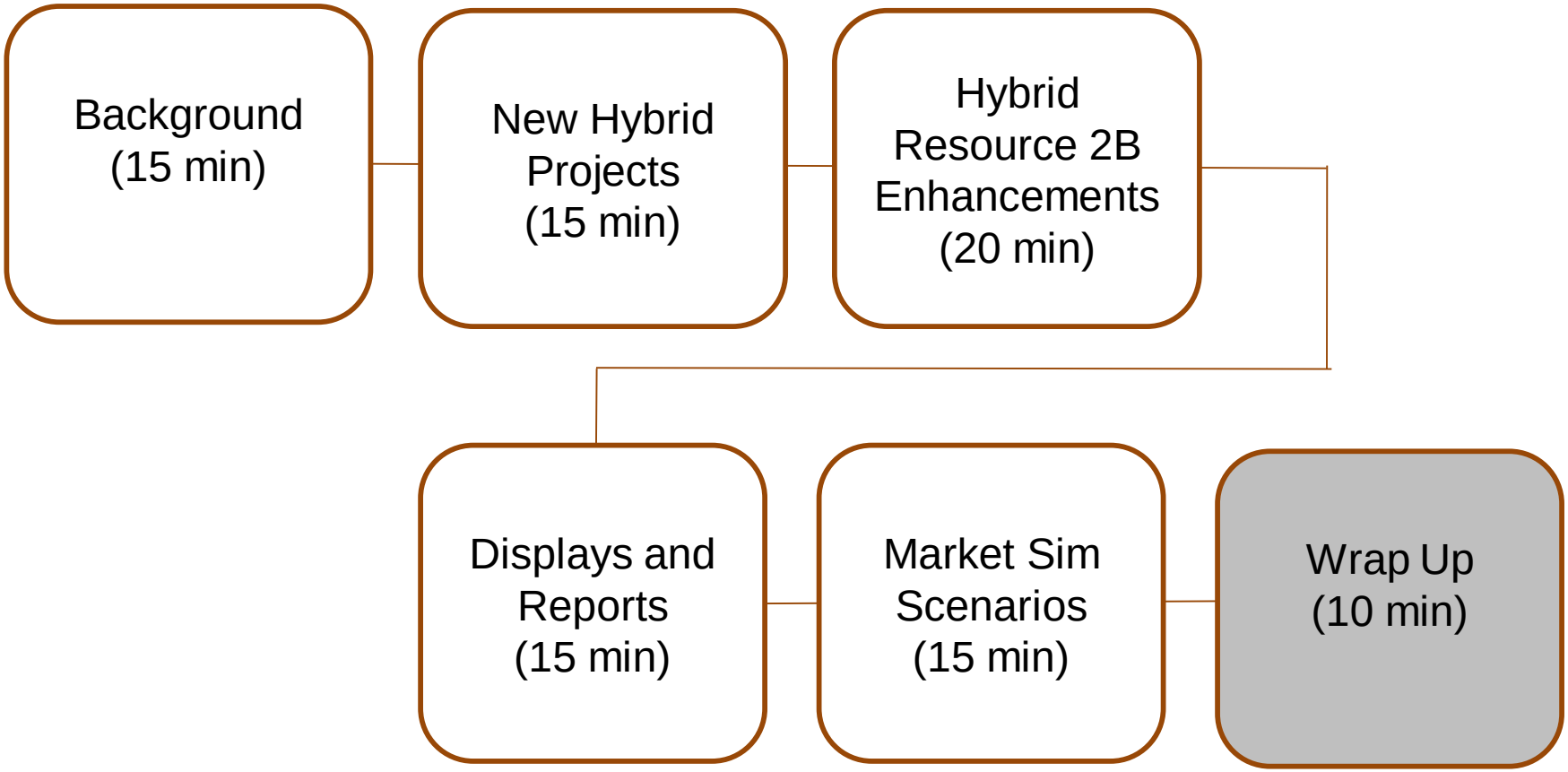
Scenario Number	Unstructured guided Scenario	
2	Description	Verify that VERs behind any given Sub-ACC have their "Follow DOT" flags set equal to 'Y' whenever one of their co-located resources has an AS award/AS base schedule.
	ISO Actions	ISO to normally enforce ACCs and dispatch their resources as per the regular EIM clearing process.
	EIM Market Participant Actions	EIM SCs to submit AS base schedules for non-VER resources behind Sub-ACCs with VERs.
	ISO Market Participant Actions	SCs to submit economical AS bids in the DAM and RTM for non-VER resources behind Sub-ACCs with VERs.
	Expected Outcome	• Verify non-VER resources behind Sub-ACCs with VERs have AS awards/AS base schedules going into RTD. • Verify in Market and ADS that VERs behind a Sub-ACC whose co-located resources have an AS award/AS base schedule have their "Follow DOT" flags set equal to 'Y'. • Verify that the aforementioned logic only applies on a per "Sub-ACC" basis, i.e., if a collocated resource in Sub-ACC**1** has an AS award/base schedule, then VERs in Sub-ACC**2** do not necessarily have their "Follow DOT" flags set equal to 'Y'.
	Anticipated Settlement Outcome	N/A
	Expected Settlement Outcome	N/A

Market Sim Recommendations – Scenario 2

- SIBR (ISO BAA only)
  - Submit ancillary service bids for co-located resources that are part of the sub-ACC.
- BSAP (WEIM only)
  - Submit base schedules with ancillary services for co-located resources that are part of the sub-ACC.
- CMRI
  - Verify that ancillary services were awarded appropriately
- ADS
  - Verify that VERs behind a sub-ACC, with a co-located resource that has an AS award, have their “Follow DOT” flag set equal to “Y”
  - VERs in *other* Sub-ACCs do not necessarily have their “Follow DOT” flag set equal to “Y” (unless their own co-located resources within the same Sub-ACC also has an AS-award).

Q&A

In today's session we'll cover:



Summary of Hybrid Resource 2B changes

- Interconnection
  - Interconnection Request
  - Project Details Form
  - Generator Resource Data Template
- New Master and Sub-ACC Configuration
- SC Forecast Option
- Submit Dynamic Limits
- BAAOP Displays
- New and Updated Reports
  - OASIS
  - CMRI
  - Transmission Limits
  - ISO Today/Today's Outlook

Coming soon-
External BRS V1.5

Final Q&A

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:
CustomerTraining@caiso.com