Hybrid Resources Phase 2B Training

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Lead Client Trainer

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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:

- **Background** (15 min)
- **New Hybrid Projects** (15 min)
- **Hybrid Resource 2B Enhancements** (20 min)
- **Displays and Reports** (15 min)
- **Market Sim Scenarios** (15 min)
- **Wrap up** (10 min)
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- **Wrap Up** (10 min)
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

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**Phase 2-A**

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

Production Date – November, 2021

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**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

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For more information about the Hybrid Resource Initiative visit:

https://stakeholdercenter.caiso.com/StakeholderInitiatives/Hybrid-resources
Standalone Aggregate Capability Constraint (ACC)

ISO Grid

ACC 233 MW

Solar_1
110 MW

BESS_1
55 MW

Solar_2
123 MW

BESS_2
62 MW
Master and Sub-Aggregate Capability Constraint (ACC)

ISO Grid

Master ACC Limit (233 MW)

Sub-ACC Limit (110 MW)

Solar_1 110 MW  BESS_1 55 MW

Sub-ACC Limit (123 MW)

Solar_2 123 MW  BESS_2 62 MW
Q&A
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- Wrap up (10 min)
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
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.

<table>
<thead>
<tr>
<th>Technology</th>
<th>Select Gen Type</th>
<th>Select Fuel Type</th>
<th>(MW)</th>
<th>Co-Located</th>
<th>Hybrid</th>
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<td>Select Fuel Type</td>
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<td></td>
<td>Select Gen Type</td>
<td>Select Fuel Type</td>
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<td></td>
</tr>
</tbody>
</table>

Other (please describe):

Generator Type:  
Fuel Type:  
Comments:  

General description of the equipment configuration (e.g. number, size, type, etc):  
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: ~' # % & @ * () : ; < > ? / | \ [ ] {} - _

<table>
<thead>
<tr>
<th>Project Type:</th>
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<tr>
<td>Select One</td>
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<tr>
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<td>Wind/Wind Repower</td>
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<tr>
<td></td>
<td>Existing QF</td>
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<td>Wind QF</td>
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<tr>
<td></td>
<td>Conventional</td>
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<td>Dynamic</td>
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<tr>
<td></td>
<td>Dynamic New Construction</td>
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<td>Pseudo</td>
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<td>Pseudo New Construction</td>
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<tr>
<td></td>
<td>Non-Generation</td>
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</table>

**Authorized Contact(s) for the Resource**

Provide an explanation of the project. Meter Replacement include CAISO meter device ID's.
<table>
<thead>
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<th>Column</th>
<th>Description</th>
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<tbody>
<tr>
<td>A</td>
<td>PTO/UDC (transmission/utility owner): Select One (If not listed please pick closest)</td>
</tr>
<tr>
<td>B</td>
<td>Net Output Generation MW for this Resource: Note: May not exceed the Interconnection Agreement studied MW value.</td>
</tr>
<tr>
<td>C</td>
<td>Configuration, Fuel Type(s) and MW(s): Configuration: Select One Additional Fuel Type 2: Select One Additional Fuel Type 3: Select One Additional Fuel Type 4: Select One Forecast Election: Select One Forecast Election: Select One Forecast Election: Select One</td>
</tr>
<tr>
<td>D</td>
<td>Point of Interconnection: If Known The more detailed information provided here will expedite the modeling.</td>
</tr>
<tr>
<td>E</td>
<td>Connection Voltage: SELECT kV Connection at the utility substation or tap (Select closest value. If less than 12kV, Select 12kV)</td>
</tr>
<tr>
<td>F</td>
<td>Nearest 60kV or Up Substation Name: (Can be pole/tower number, bank/bay number, and location name of a tap)</td>
</tr>
<tr>
<td>G</td>
<td>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 <a href="#">here</a> 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 4 of <a href="#">NRI Guide</a>.  • If Dynamic or Pseudo Generator choose the same Agreement and Project Type</td>
</tr>
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## Generator Resource Data Template (GRDT)

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
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<tbody>
<tr>
<td>1</td>
<td>Resource ID</td>
<td>Component ID</td>
<td>FUEL_TYPE</td>
<td>GEN_TECH_TYPE</td>
<td>MAX_GEN</td>
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<tr>
<td>2</td>
<td>EXAMPLE_2_HYB1</td>
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<td>SOLR</td>
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<tr>
<td>4</td>
<td>EXAMPLE_2_HYB1</td>
<td>EXAMPLE_2_HYB1_LESR1</td>
<td>LESR</td>
<td>OTHER</td>
<td>36</td>
</tr>
</tbody>
</table>

- **Name of the Hybrid Resource**
- **Name of individual component**
- **Completed by Master File Team**
- **Modifiable by customer**

- **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**

<table>
<thead>
<tr>
<th>Resource ID</th>
<th>Component ID</th>
<th>VER_NGR</th>
<th>FORECAST_SELECTION</th>
<th>DISP</th>
<th>MIN_CONT_ENERGY_LIMIT</th>
<th>MAX_CONT_ENERGY_LIMIT</th>
<th>ENERGY_EFFIC</th>
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<td>ISO</td>
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<td>SC</td>
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<td>0.9</td>
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<td>EXAMPLE_2_HYB1_LESR1</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>1</td>
<td>144</td>
<td>0.9</td>
</tr>
</tbody>
</table>

- **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**

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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
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- **Wrap Up** (10 min)
**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
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.

New – Hybrid Dynamic Limit

Real-Time Energy Bid
25 MW for the hour

Forecast of resource availability forecast for the hour

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<td>1 MW</td>
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<td>1 MW</td>
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</table>
Dynamic Limits

https://developer.caiso.com
Select the new Dynamic Limit Tab

Enter the date and the Scheduling Coordinator ID
Select Apply to reveal the grid
Click the “Create Dynamic limit” icon

A new window will open.

Select a resource from the drop down. Also add the Minimum and Maximum limit values.

Click Create.
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
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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

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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

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<tr>
<th>Date From</th>
<th>Date To</th>
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</table>
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
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 AND DOWNLOAD ACCORDINGLY.

To the best of CAISO’s knowledge, the information contained herein is true and accurate as of the date published and is provided for informational purposes only. CAISO does not assume any liability whatsoever for the accuracy and completeness of the published information.

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 reported 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.
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
**Interval Variable Energy Resource Forecast**

The California ISO Customer Market Results Interface displays 5 minute forecast for VER components.

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### 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

- Renewables: 30.0% (7,500 MW)
- Natural gas: 20.2% (9,886 MW)
- Large hydro: 3.1% (1,755 MW)
- Imports: 21.0% (5,173 MW)
- Batteries: 0.1% (10 MW)
- Nuclear: 4.6% (1,140 MW)
- Coal: 0.1% (17 MW)
- Other: 0.3% (0 MW)

Current renewables includes hybrids

- Renewables serving load: 31%

- Solar: 63.7% (4,837 MW)
- Wind: 14.0% (1,066 MW)
- Geothermal: 13.3% (1,012 MW)
- Biomass: 4.0% (303 MW)
- Biogas: 2.8% (211 MW)
- Small hydro: 2.1% (161 MW)

Current hybrids

- Hybrids serving load: 5%

- Solar: 75.3% (2000 MW)
- Wind: 12.5% (500 MW)
- Natural gas: 8% (200 MW)
- Battery: 2% (50 MW)

Update existing graph

New graph
Existing trend charts will also incorporate hybrid data:
- Supply Trend
- Renewables Trend
- Import Trend
- Batteries Trend
In today’s session we’ll cover:

- Background (15 min)
- New Hybrid Projects (15 min)
- Hybrid Resource 2B Enhancements (20 min)
- Displays and Reports (15 min)
- Market Sim Scenarios (15 min)
- Wrap Up (10 min)
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.
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<thead>
<tr>
<th>Scenario Number</th>
<th>Unstructured guided Scenario</th>
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<tbody>
<tr>
<td>Description</td>
<td>Verify submitted hybrid resource data and component level data</td>
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<tr>
<td>ISO Actions</td>
<td>ISO to dispatch Hybrid resources</td>
</tr>
<tr>
<td>EIM Market Participant Actions</td>
<td>EIM SCs to submit dynamic limits and real-time (RT) forecasts for hybrid resources</td>
</tr>
<tr>
<td>ISO Market Participant Actions</td>
<td>SCs to submit dynamic limits and real-time (RT) forecasts for hybrid resources</td>
</tr>
<tr>
<td>Expected Outcome</td>
<td>Verify Hybrid Resource data in Master File</td>
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<tr>
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<td>Verify submission of upper and lower resource limit in Market (Dynamic Limit Tool)</td>
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<td>Verify the following in CMRI:</td>
</tr>
<tr>
<td></td>
<td>• Hybrid resource award is within the dynamic limit as submitted by Market Participant</td>
</tr>
<tr>
<td></td>
<td>o 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.</td>
</tr>
<tr>
<td></td>
<td>o 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.</td>
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<tr>
<td>Anticipated Settlement Outcome</td>
<td>701</td>
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<tr>
<td>-------------------------------</td>
<td>-----</td>
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</table>

**Original lower bid limit MW value.**

- Hybrid resource forecast data is published at the VER component level

**Velocity utilization of ISO forecast of Hybrid Resources in MRI-S Settlements Statement**

| Expected Settlement Outcome | EIM Participants: Verify Hybrid Resources are assessed a forecast fee.  
ISO Market Participants Only: Verify Hybrid Resources are fully exempted from RAAM 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
<table>
<thead>
<tr>
<th>Scenario Number</th>
<th>Unstructured guided Scenario</th>
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</thead>
<tbody>
<tr>
<td><strong>Description</strong></td>
<td>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.</td>
</tr>
<tr>
<td>ISO Actions</td>
<td>ISO to normally enforce ACCs and dispatch their resources as per the regular EIM clearing process.</td>
</tr>
<tr>
<td>EIM Market Participant Actions</td>
<td>EIM SCs to submit AS base schedules for non-VER resources behind Sub-ACCs with VERs.</td>
</tr>
<tr>
<td>ISO Market Participant Actions</td>
<td>SCs to submit economical AS bids in the DAM and RTM for non-VER resources behind Sub-ACCs with VERs.</td>
</tr>
</tbody>
</table>
| **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-ACC1 has an AS award/base schedule, then VERs in Sub-ACC2 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).
In today’s session we’ll cover:

1. **Background** (15 min)
2. **New Hybrid Projects** (15 min)
3. **Hybrid Resource 2B Enhancements** (20 min)
4. **Displays and Reports** (15 min)
5. **Market Sim Scenarios** (15 min)
6. **Wrap Up** (10 min)
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