



Forecasting Evolution with Hybrid Resources from the ISO Point of View

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June 15th, 2021



<https://www.vox.com/energy-and-environment/2019/8/9/20767886/renewable-energy-storage-cost-electricity>

Agenda

- CAISO Background
- What is a “Hybrid” Resource?
 - Hybrid
 - Co-Located
- Importance of new data variable for renewable forecasting:
 - High Sustainable Limit (HSL)
 - Forecasting using the HSL



California ISO's market footprints

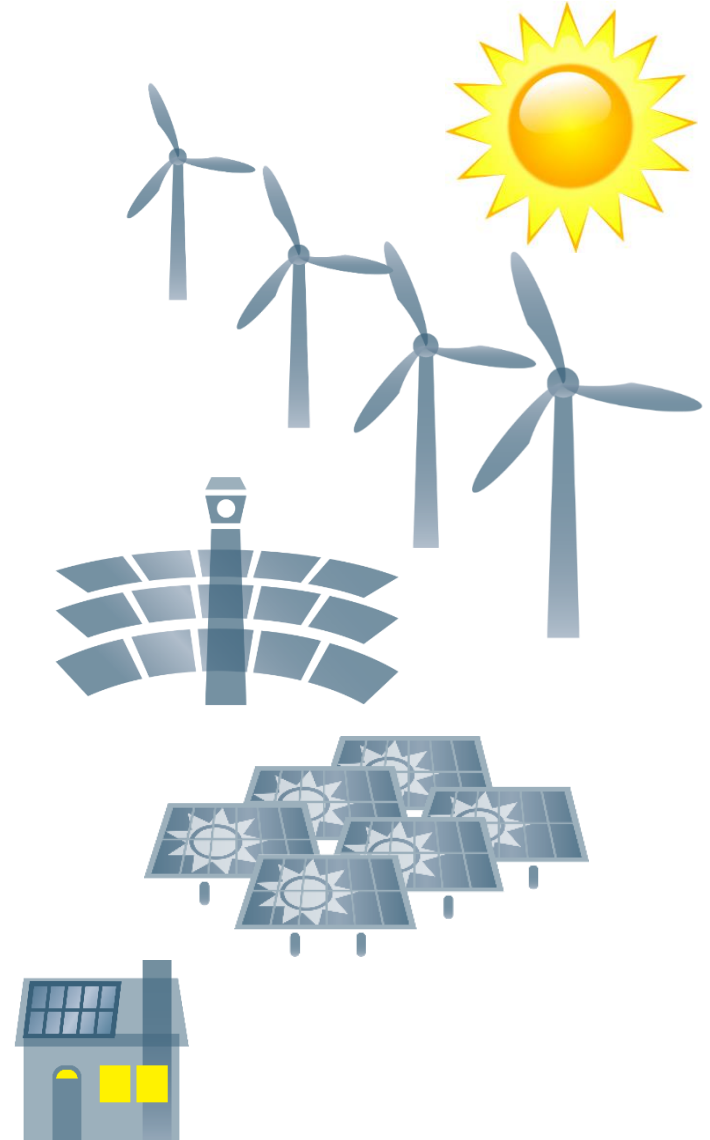
<https://www.westerneim.com/pages/default.aspx>

Active and pending participants **Energy Imbalance Market Real-time Market Only**



Major progress on meeting CA's renewable goals

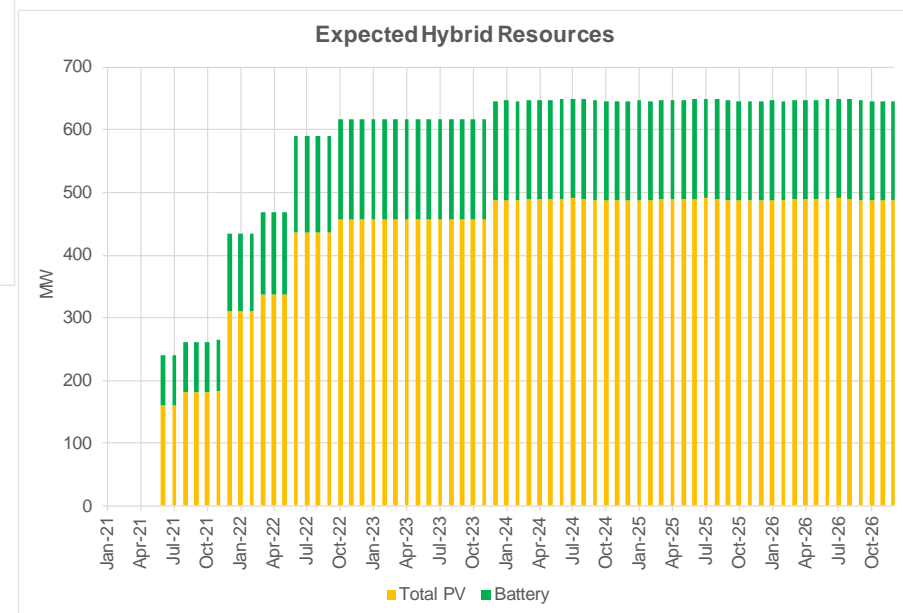
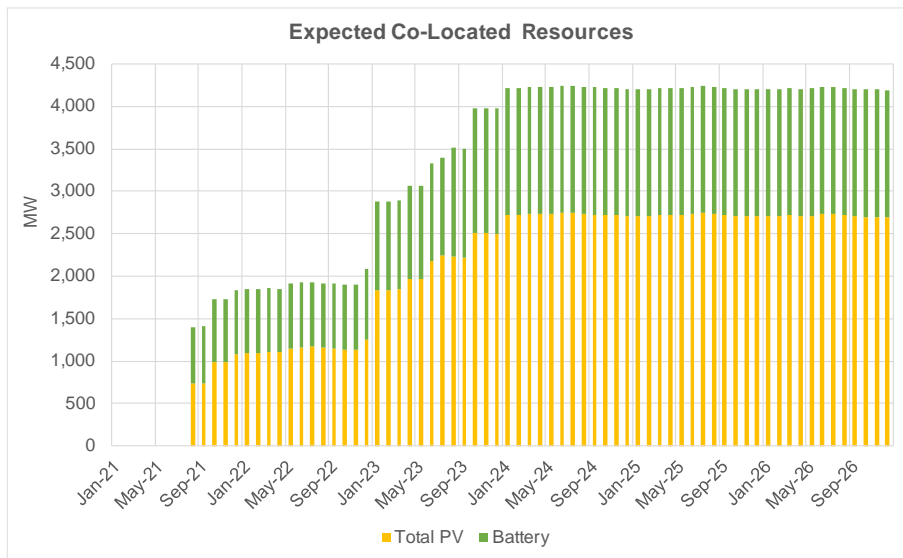
- Currently Installed:
 - 21,000 MW of utility-scale renewables
 - ~11,000 MW of consumer rooftop solar
- Additional renewables:
 - 4,000+ MW additional utility-scale renewables by 2026
 - ~16,750 MW of consumer rooftop solar by 2026



What is a “Hybrid” Resource?

- **Hybrid Resource:** A Generating Unit, with a unique Resource ID at a single Point of Interconnection, with components that use different fuel sources or technologies
 - Solar and a battery with one resource ID in the market
 - CAISO will receive separate telemetries for the battery and solar components
- **Co-Located Resource:** A Generating Unit with a unique Resource ID that is part of a Generating Facility with other Generating Units. Solar and a battery each with their own resource ID in the market

Expected co-located and hybrid renewable buildout through December 2026



Data based on Annual Flex Resource Adequacy Survey from Load Serving Entities

Rapid growth in storage technologies will require new forecasting techniques to support market participation

- [Hybrid Resource Initiative](#)

Phase 2 go-live Fall 2021/Spring 2022

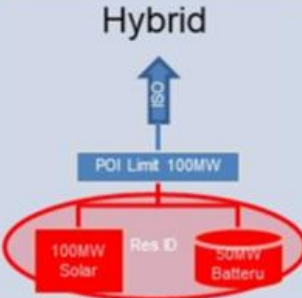
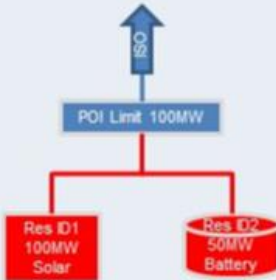
- Phase 1 go-live was Dec 2020

- Expected to have 5,000 MW of renewable + storage by 2024

- Based on LSE survey

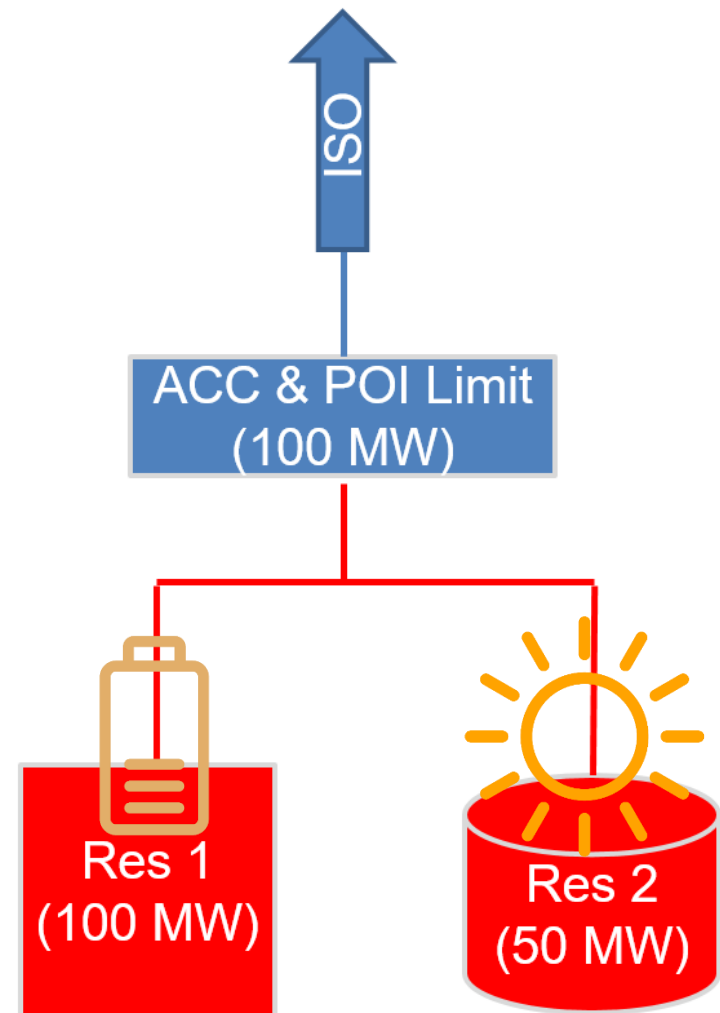
- CAISO will provide wind and solar forecasting services:

- Optional for hybrid renewables
- Required for co-located

Hybrid vs. Co-located	Definition	Forecasting / Dispatch
 <p>Hybrid</p>	<p>A Generating Unit, with a unique Resource ID at a single Point of Interconnection, with components that use different fuel sources or technologies.</p>	<ul style="list-style-type: none"> • No aggregate forecast for hybrid • Hybrid expected to follow dispatch
 <p>Co-located</p>	<p>A Generating Unit with a unique Resource ID that is part of a Generating Facility with other Generating</p>	<ul style="list-style-type: none"> • VER component will be forecast • VER dispatched rules • Battery will be dispatched and state of charge managed

Co-Located Resources and the Aggregated Capability Constraint (ACC)

- The ACC prevents dispatch of co-located resources from exceeding the Point-of-interconnect (POI) limits
 - Example: Solar + Storage Resources
- ISO is evaluating the capability to apply multiple ACCs at a single point of interconnection

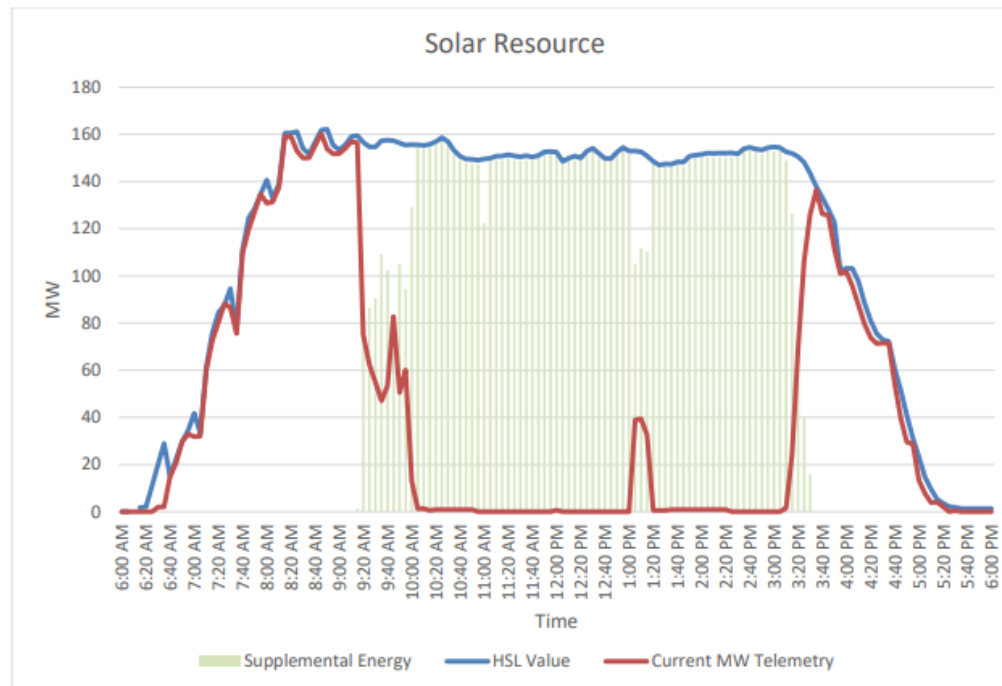


New Forecasting Information Needed: High Sustainable Limit (HSL)

- **High Sustainable Limit (HSL):** The instantaneous generating capability of a variable or intermittent Generating Unit or component thereof, updated through telemetry at the Generating Unit.
 - This is a real-time telemetered value showing the full-fuel capability of the renewable resource
 - It is based on the available fuel, i.e. sunlight or wind, as well as the resources physical properties, i.e. number of solar panels or wind turbines and available inverters
 - Will be required for all hybrid and co-located resources beginning Fall 2021
 - CAISO is working on an initiative to make this a required point for all VERs in the future

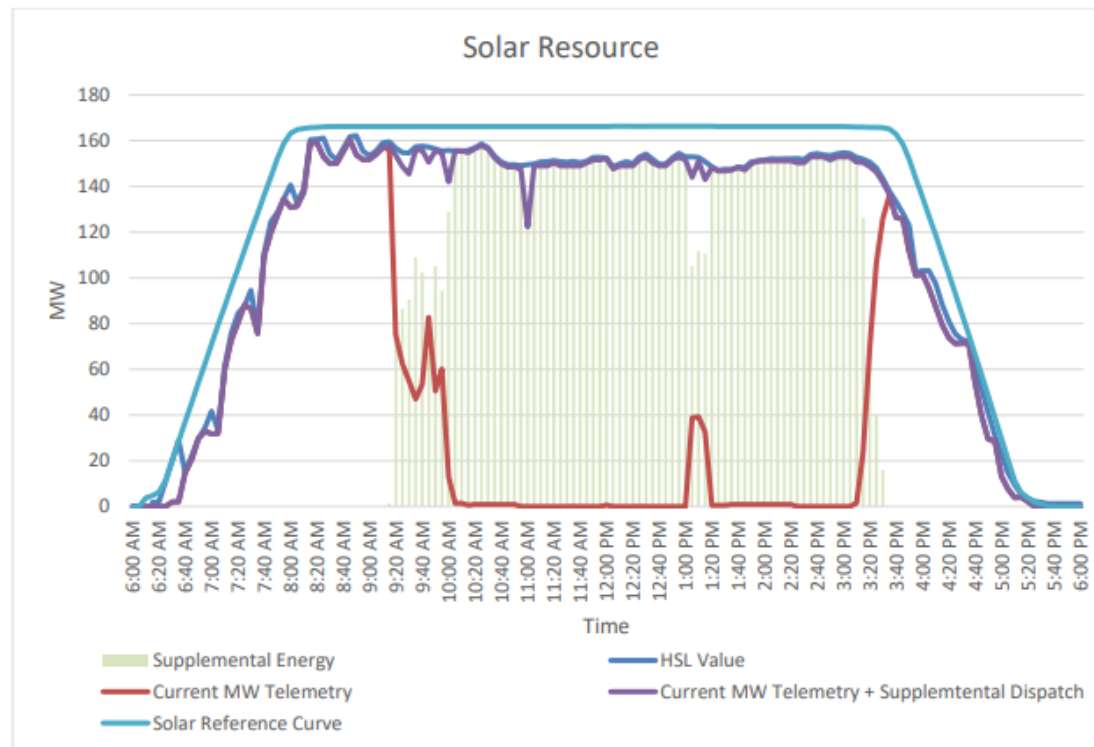
Benefits

- HSL will have no market impacts in its telemetry – solely based off weather
 - No supplemental, ancillary services, operating instructions, etc.
- This will allow for a significant increase in the number of good telemetry periods for a resource to use in model training and forecasting

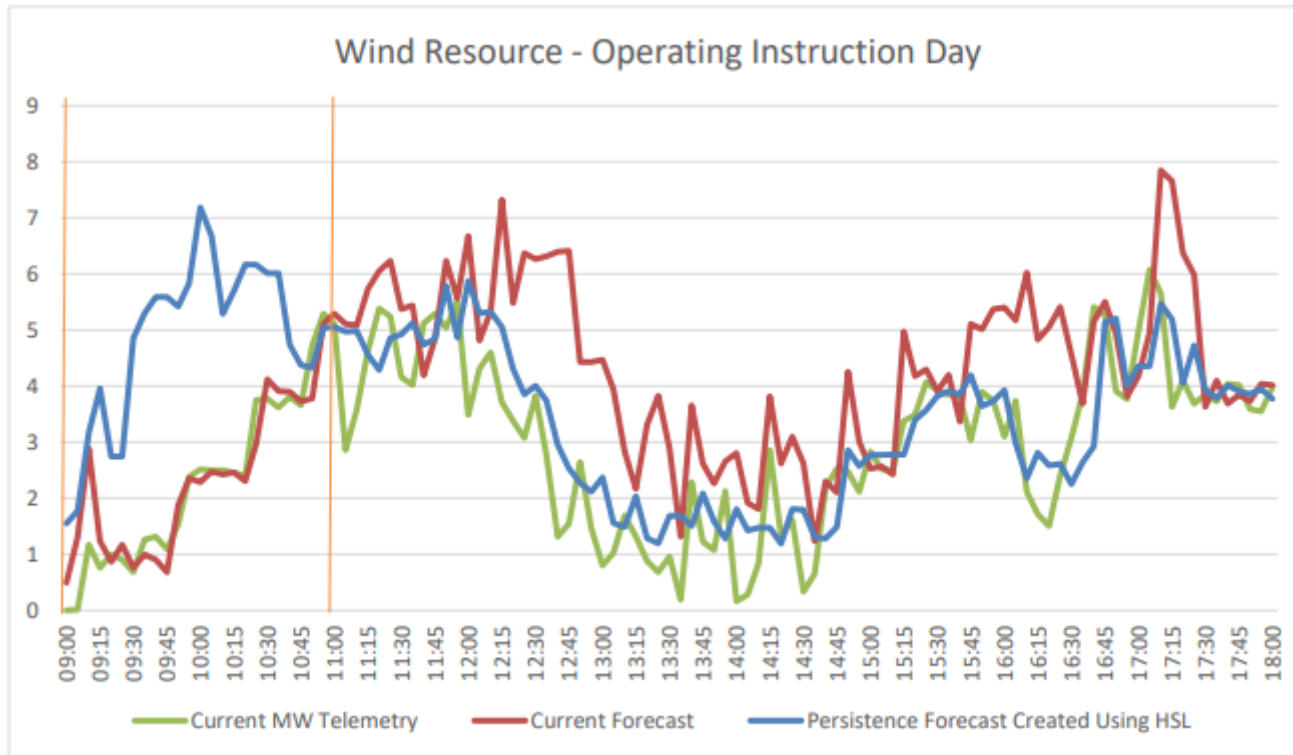


HSL vs. Reference Curve

- A solar reference curve is the maximum generation capability for that resource on a given day. It does not take into account current weather conditions the resource is experiencing



Use of HSL in Wind Resource Forecast



Additional Information

- Link to detailed paper on HSL and further uses in forecasting, such as renewable resources with Ancillary Services:
 - <http://www.caiso.com/InitiativeDocuments/FinalWhitePaper-HighSustainableLimit-HybridResourcesPhase2.pdf>