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California ISO

Distributed Energy Resources in the CAISO Market and Operational Awareness

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CAISO participation models are technology neutral and focus on resource capabilities to provide wholesale market services

- Three major categories for distributed energy resource (DER) participation:
 - Generates only
 - Examples include: aggregated or stand-alone distribution-connected generators
 - Reduces load only
 - Examples include: “traditional” load drop, various demand response programs, storage-backed demand response
 - Reduces load and generates
 - Examples include: storage resources, aggregation of distributed energy resources

The CAISO is an early mover to integrate DERs into wholesale markets

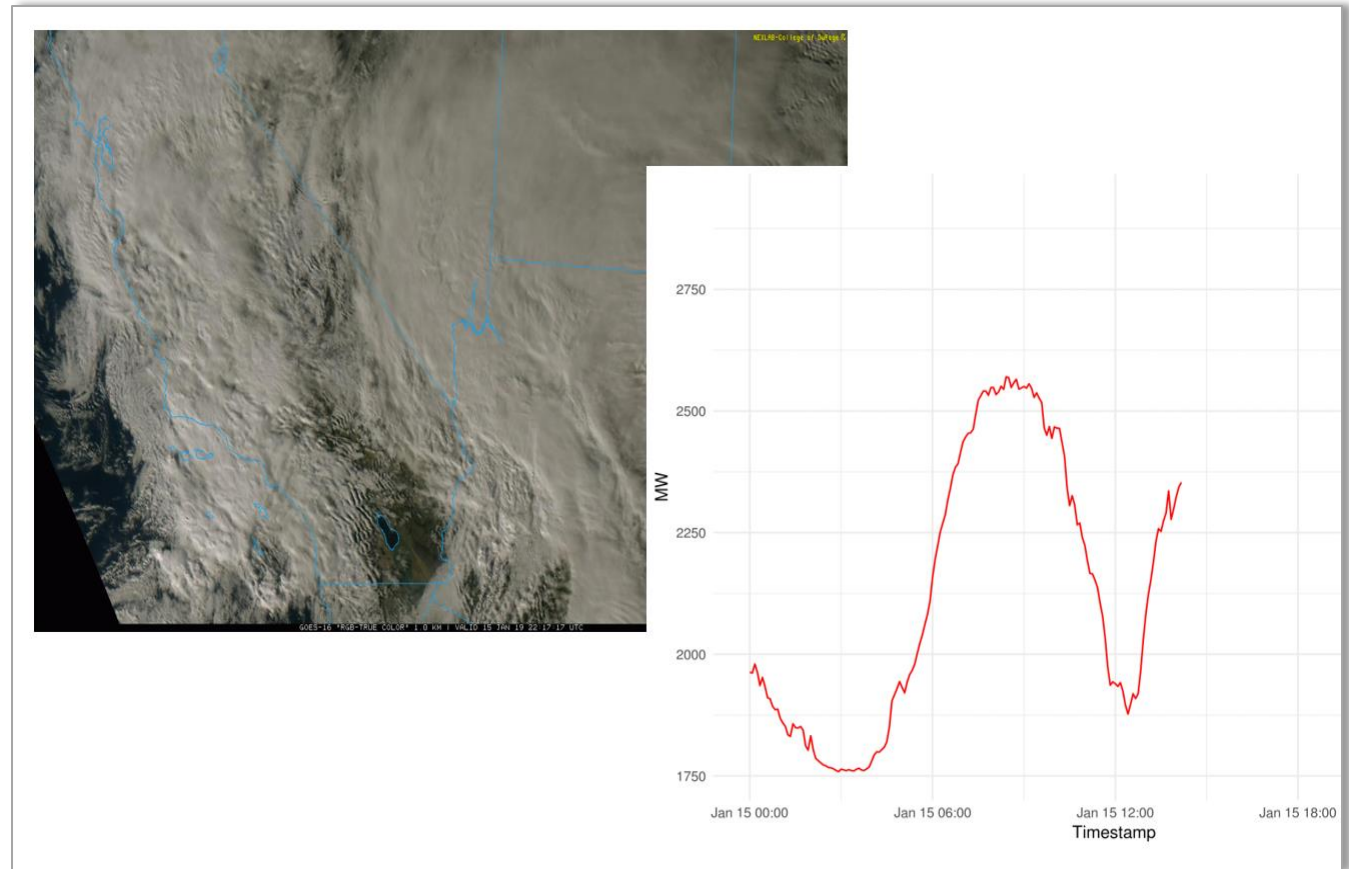
- The CAISO has participation models for a variety of services
 - 1) Stand-alone DERs
 - 500+ new DERs (2.2 GW) since 2005
 - Same requirements as transmission-connected resources
 - 2) Demand response (2010)
 - Distribution interconnection requirements, CAISO registration process
 - 2.0 GW in CAISO markets
 - Two major models (Proxy Demand Response and Reliability Demand Response Resource) with 7 settlement methodologies to accommodate electric vehicles, behind-the-meter solar/storage, etc.

The CAISO is an early mover to integrate DERs into wholesale markets (con't)

- 3) Distribution Energy Resource Aggregations (2016)
 - Allows small DERs to participate as a DERA
 - Created when CPUC had a 1 MW cap for net energy metering (NEM) resources, which was later removed
 - DERAs cannot participate in net energy metering program or demand response program
 - Distribution companies get 30 days to review DERA to ensure DERs are not also demand response participants, NEM, in other DERAs, conflict with their tariffs, or create risk
 - Federal Energy Regulatory Commission (FERC) Order 2222 (2020) largely based on CAISO's DERA

Telemetry enhances accuracy of load forecasting to account for behind-the-meter penetration

- Example shows impact of rapidly moving demand actuals due to movement of ~725 MW of DER generation due to cloud coverage throughout the middle of the day



Situational awareness is critical for CAISO operations

- Behind-the-meter solar has been the most impactful DER for CAISO operations thus far
- In future, DERs will be more heterogeneous, bi-directional, and driven by varying use patterns and customer needs
- Understanding the impact of DERs is critical to situation awareness and reliability
 - This will likely require access to aggregated telemetered response by technology type for both short-term (*i.e.*, within a few minutes or hours) and long-term modeling and forecasting