Western Conference 2017

DER 2.0:

The Evolution of Distributed Resource Technologies and Regulators

DER 2.0: Evolution of Distributed Energy Resource Technologies and Regulations

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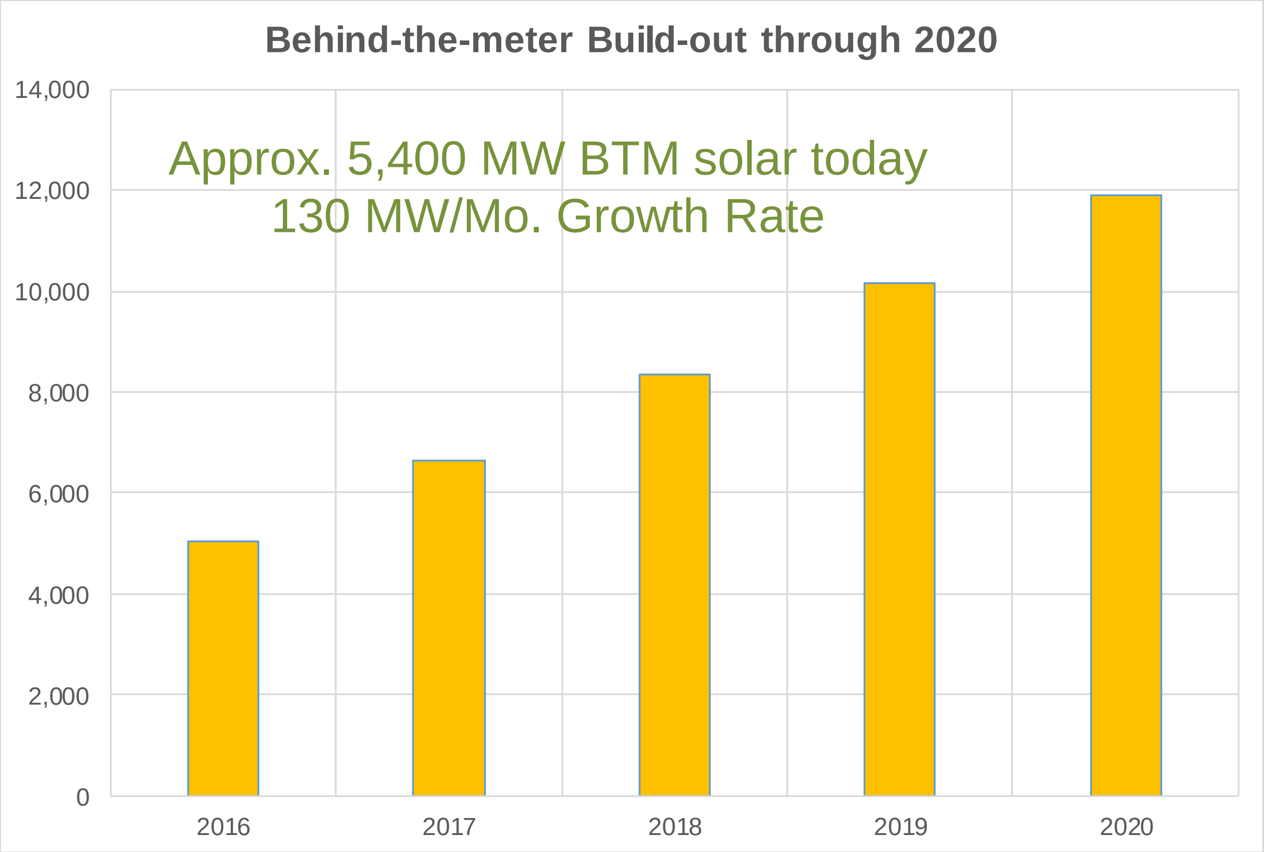
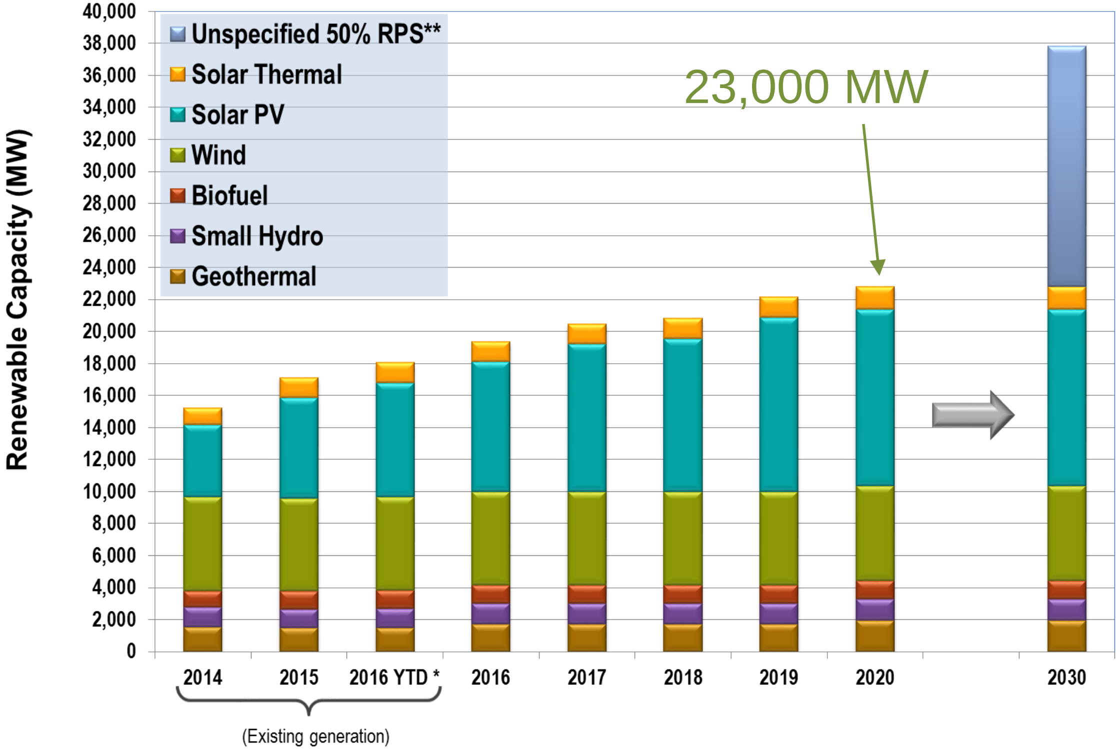
The growth in renewables and distributed energy resources is transforming California's energy supply portfolio and how our grid functions.





*All online resources that are not in test mode are included in the 2016 YTD amounts, including those yet to achieve full commercial operation.
**Approximate

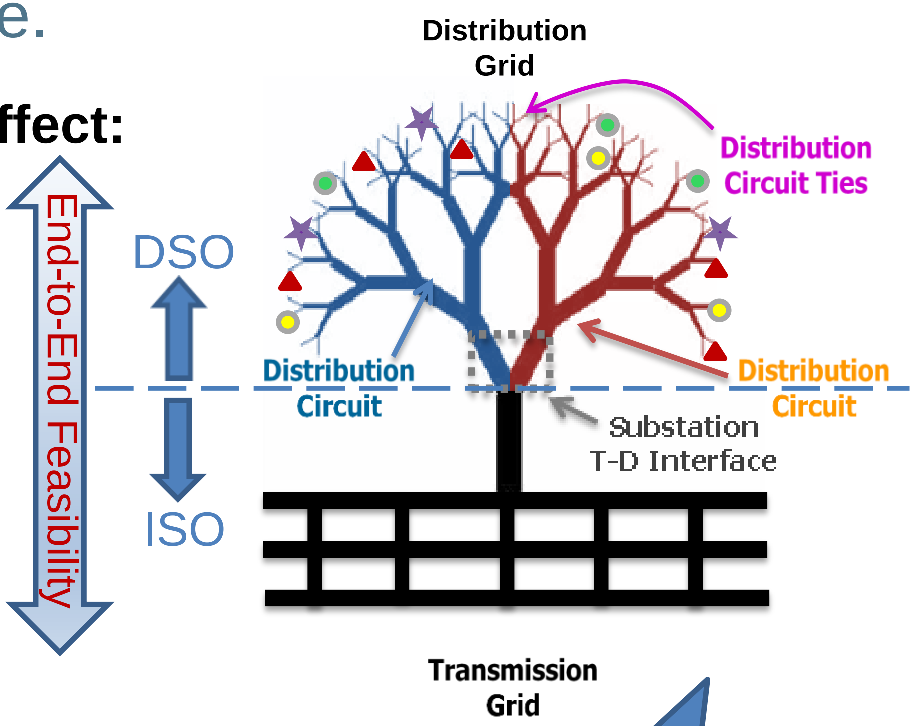
System Peak Demand was 46,232 MW on July 27, 2016

Rapid DER deployment is spurring a democratized and decentralized system calling for enhanced coordination at the T&D interface.

- **Diverse end-use devices and diverse owners/operators affect:**
  - Load shapes, peak demand, total energy consumption
  - Energy flows, voltage variability, phase balance
  - Variability and unpredictability of net loads and grid conditions

- **CAISO "sees" DER as if located at T&D substations**
  - No ISO visibility to distribution grid conditions/impacts
  - Distribution utility is unaware of DER bids and dispatches

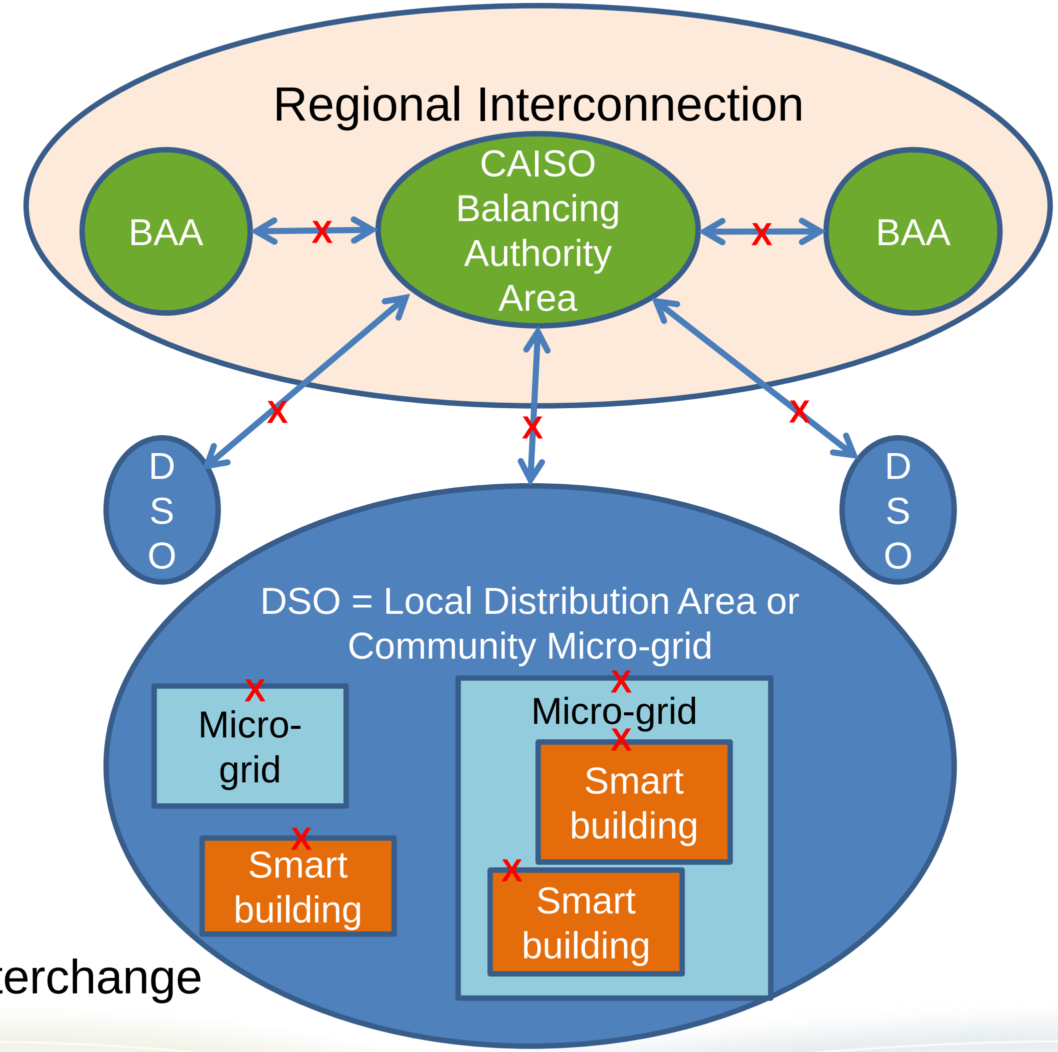
- **DER providing services to customers and the distribution system affects the T&D interfaces**
  - Need accurate operational forecasting and local management of DER variability to ensure end-to-end feasibility



New control and coordination needed at the T-D Interface

Daily coordination, cooperation, and engagement is needed to ensure feasible energy transactions.

The future grid may be a layered hierarchy of nested optimizing sub-systems.



X Point of Interchange

- Each tier only needs to see interchange with the next tier above & below, not the details inside other tiers
- ISO focuses on regional bulk system optimization while DSO coordinates DERs
- Layered control structure reduces complexity, allows scalability, and increases resilience & security

Thank you.

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Food for thought as we move into a high-DER future...

- **Enabling Multi-use Applications of DER**
  - What grid services can be valued and stacked?
  - Who has primacy over the resource in what situations?
  - How to prevent double counting of capacity or resource capabilities?
  - Net energy metering interactions and impacts on multiple-use applications
- **Assessing DER Performance and Evaluation Methods**
  - Retail/wholesale metering interactions and adjustments needed.
  - Sub-metering issues, rules, and manipulation concerns/
  - Accounting for and removing the “typical use” of devices to ensure no double payments when selling specific grid services.
- **Understanding DER Modeling and Optimization Techniques**
  - Setting and managing aggregate DER resource distribution factors in network models, i.e. how much expected output from each Pnode?
  - How to account for the dynamic nature of DER when resource configurations and capabilities can vary greatly over time?
  - How to model and manage storage device state of charge constraints?
  - How to manage resource use limitations beyond 24 hour optimization horizons
- **Agreeing on the Best System Architecture Design**
  - How to properly model and forecast interactions at the T&D interface?
  - How to properly model micro-grids/Nano-grids?
  - What is the most elegant system architecture to employ in a high-DER future? A Nested architecture or ?
- **Coordinating Actions and Information at the T&D Interface**
  - How to ensure feasible dispatches from ISO to end-use customer
  - What are the essential roles and responsibilities of key players at the T&D interface?
  - What information must be exchanged and in what timeframes?
- **Addressing Station Power Rules and Regulations**
  - How to treat station power when storage device is in charging mode?
  - How to avoid double charging for station power at retail and wholesale level in behind the meter applications?

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No smoking: Toward 100% renewable

- Routinely achieving 90% renewable during mid-day
- All but 1 generator shut down on clear days for up to 6 hours

Next up: periods of 100% renewable during mid-day

No ability to take solar without significant storage

- SolarCity / Tesla 13 MW / 52 MWh
- AES 20 MW / 100 MWh
- Additional projects in the works

KIUC's Storage Fleet

Smoothing

Frequency Control v1

4.5 MW / 3.0 MWh advanced lead acid (own)

Frequency Control v2

6 MW / 4.6 MWh lithium ion (own)

Shifting

Dispatchable Solar v1

13 MW / 52 MWh lithium ion (PPA)

Dispatchable Solar v2

20 MW / 100 MWh lithium ion (PPA-planned)

100% RPS

We're working on it…


Tesla Powerpacks + Solar Powering Kauai
KAUAI
· HAWAII ·