

NERC

NORTH AMERICAN ELECTRIC
RELIABILITY CORPORATION

Distributed Energy Resources Affects on Resource Requirements

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RELIABILITY | ACCOUNTABILITY



- Concern about changing generation fleet
 - Large coal fired power plants are being retired
 - Renewables and variable generation are increasing
 - Large generators inherently provide Essential Reliability Services
- Essential Reliability Services
 - Generation Ramping – ability to adjust to meet changing loads
 - Frequency Control
 - Inertia – object in motion tends to stay in motion
 - Primary frequency response – automatic counter response compensating for the loss of a large generator
 - Voltage control – maintain within equipment limits
- Reliability Effects
 - How does reliability change with newer resources?

- DER penetration is growing in the west - California
- DER generation is approaching 7000 MW each day
 - This is equivalent to seven nuclear or large coal plants
- How does this affect operation of the high voltage transmission system?
 - This is connected directly to distribution load – houses, businesses, etc
 - Offsets load – utility generates less due to less system load
 - Changes load patterns
 - Much less load during mid-day
 - Large changes at sunrise and sunset – ramping issue startup and shutdown
- Is there a reliability issue to the high voltage system?
 - Some potential issues have been identified
 - Data collection and situational awareness needs grow with more DER

Distributed Energy Resource (DER) is any resource on the distribution system that produces electricity and is not otherwise included in the formal NERC definition of the Bulk Electric System (BES).

Types of DER :

- Distributed Generation
- Behind the Meter Generation
- Energy Storage Facility
- DER Aggregation
- Micro-Grid
- Cogeneration
- Emergency, Stand-By or Back-Up Generation

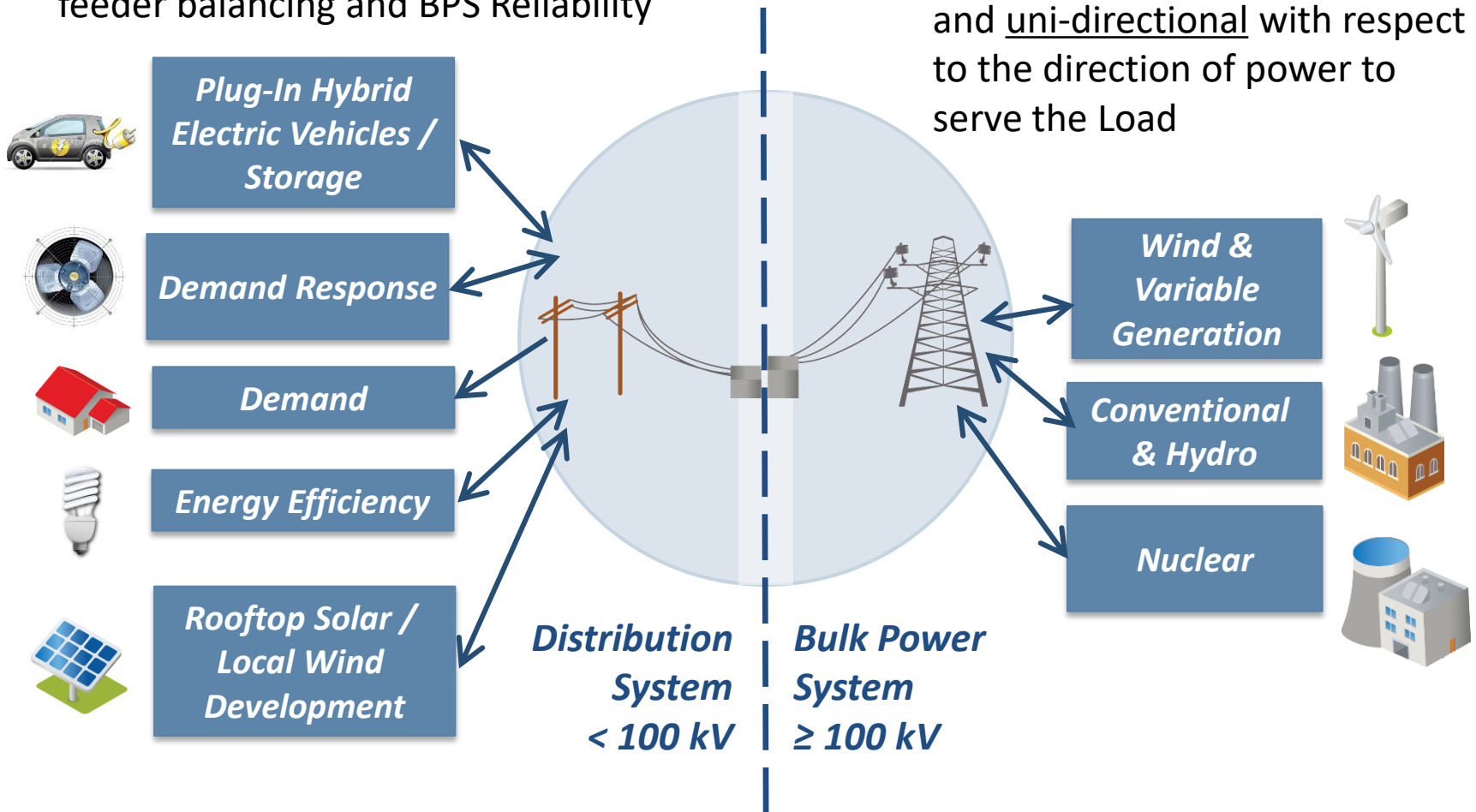
Some Problem Complexities:

- Various technologies, unit sizes, ages, customer types
- Physical and Virtual Aggregation
- Variable output of units which can be dependent on weather (uncontrollable factor)

DER and BPS Power Flow Changes

- DER enable bi-directional power flows from the Distribution System which effects feeder balancing and BPS Reliability

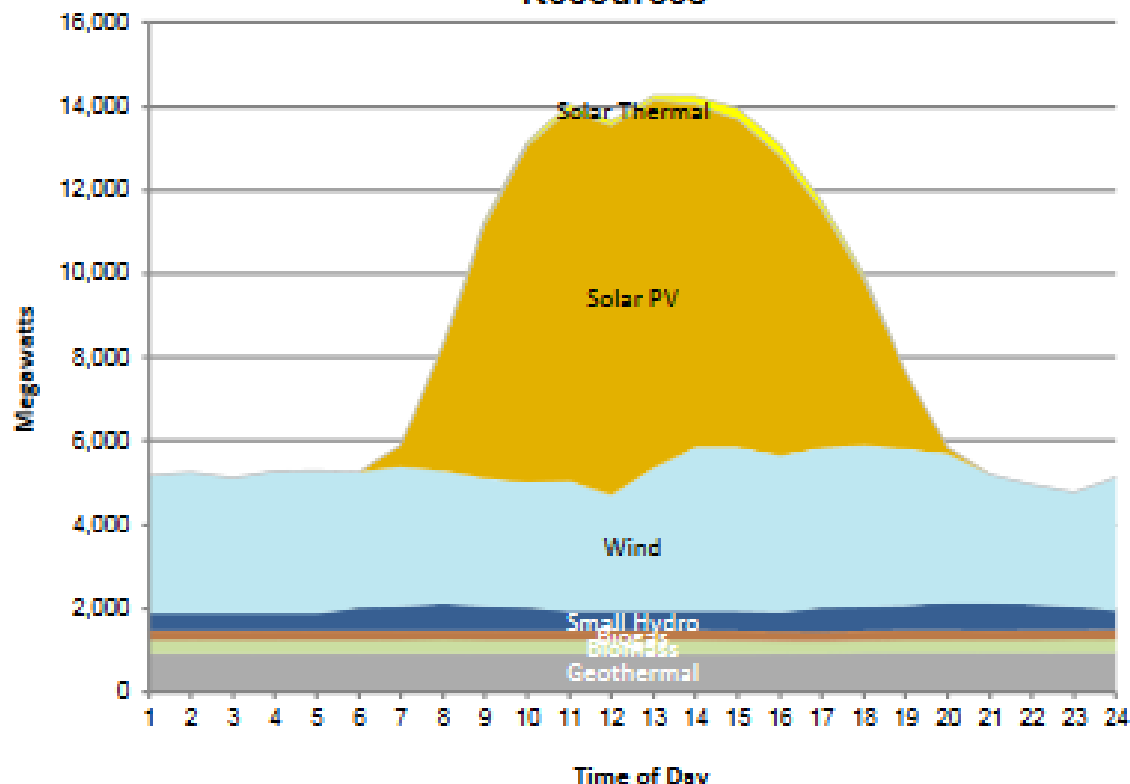
- BPS previously considered the Distribution System as balanced and uni-directional with respect to the direction of power to serve the Load



- **Distribution System Perspective**
 - Abnormal frequency and voltage – isolate from system
 - IEEE 1547, UL1741
 - Local safety
- **Transmission System Perspective**
 - Abnormal frequency and voltage – stay connected
 - NERC PRC-024-2
 - System reliability
- **Unplanned resource losses (DER tripping)**
 - Could make a frequency decline to a generator loss more severe
 - Unplanned loss of generation (increase in load) due to local faults
 - Coordination needed between BPS and DER resources

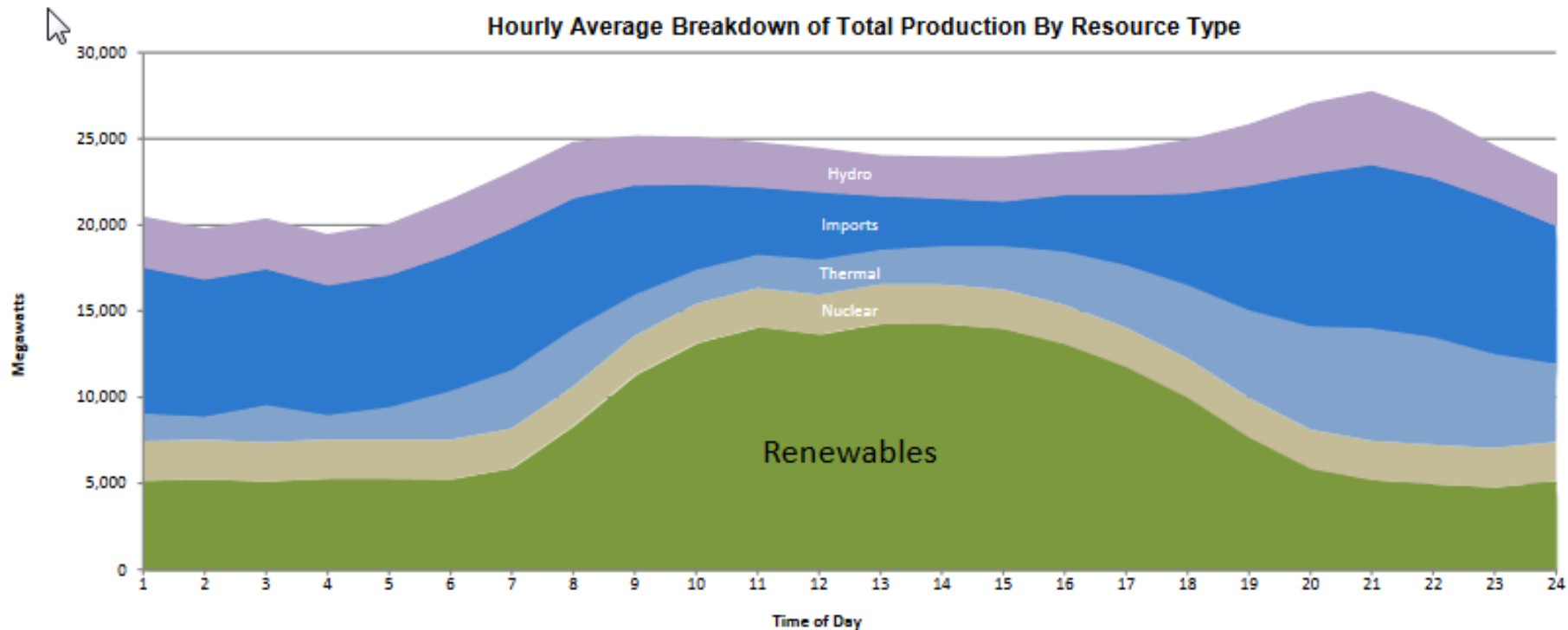
- Balancing Authority Load = Generation – Interchange
 - Loads are not directly metered when calculating BA Load
 - BA Load captures system losses as well as customer load
- DER offsets customer load
- Bulk System load is less when DER generates
- DER (particularly solar) changes System load characteristics
- Resource needs move from steady over many hours to variable movement
- Capacity and energy needs differ

Hourly Average Breakdown of Renewable Resources

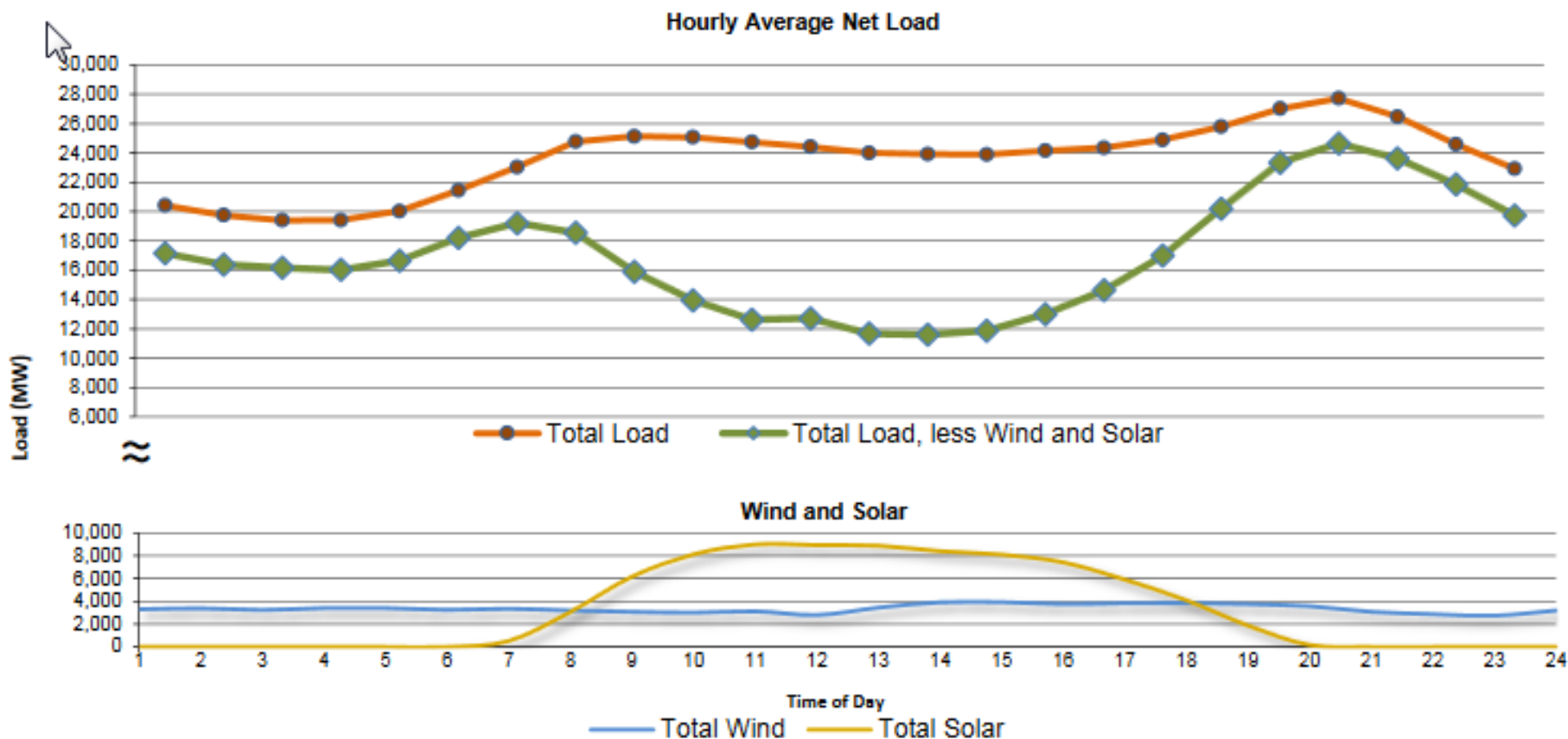


This graph shows the production of various types of renewable generation across the day.

- DER is behind the meter – unmetered
- Transmission connected Solar PV is about 9500 MW
- DER solar is an additional 6000-7000 MW
- CISO Load 24-26 GW
- CISO Load is 30-33 GW negating DER offset
- DER is passive – no control of the resource



This graph depicts the production of various generating resources across the day.



Dispatchable Capacity Needs

Ramp down in the morning ~7000 MW over four hours
 Ramp up in the evening ~ 11,000 MW over five hours

- DER can be reliably integrated with BPS
- DER (usually solar) is a variable resource
- DER offsets energy consumption
 - Decreases customer usage of utility supplied energy
- DER increases capacity requirements
 - Fast ramping (up and down) resources operating a few hours per day
- DER aggregation and dispatch control could be useful
 - Behind-the-meter DER is a passive resource at this time
 - No control
 - No metering
- DER can become a significant component of the resource mix
 - Geography will drive some of this – need the sun (nice weather)

- How will DER affect distribution planning?
- How will DER affect peak load capacity requirements?
- How will DER affect load profile? Seasonal variation?
- How will DER affect capacity requirements?
- What are the possibilities for aggregation and dispatch?

- Essential Reliability Services Work Group
 - [http://www.nerc.com/comm/Other/Pages/Essential-Reliability-Services-Task-Force-\(ERSTF\).aspx](http://www.nerc.com/comm/Other/Pages/Essential-Reliability-Services-Task-Force-(ERSTF).aspx)
- Distributed Energy Resources Report
 - http://www.nerc.com/comm/Other/essntlrbltysrvcstskfrcl/Distributed_Energy_Resources_Report.pdf
- ERS Concept Paper
 - <http://www.nerc.com/comm/Other/essntlrbltysrvcstskfrcl/ERSTF%20Concept%20Paper.pdf>
- ERS Videos
 - <https://vimeopro.com/nerclearning/erstf-1>



Questions and Answers

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