

Need for Flexibility: Bulk Power System Reliability Perspective

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Panel: Power Sector Vulnerabilities

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RELIABILITY | ACCOUNTABILITY



What is Bulk Power System Reliability?

Large-scale storage is a GAME CHANGER for reliability

- **Adequacy** —

High storage production capability would greatly minimize long-term generation project uncertainty, lead times, and commitments

- **Operating Reliability** —

Fast-acting storage devices can quickly remedy BPS disturbances and provide essential reliability services

Is there enough supply of electricity?

Is there enough supply of operational reliability and control?

Can the system operate under a variety of conditions?

- Retirement/displacement of conventional generation
 - Variable energy resources
 - Rapid penetration of inverter-based and asynchronous resources
- Essential Reliability Services
 - Inertia
 - Frequency Response
 - Voltage Support
 - Ramping and flexibility
- New load characteristics
- System controls and protection coordination
- Modeling and simulation constraints
- Increasing interface with distributed resources

What is Storage?

Load?



Capacity?

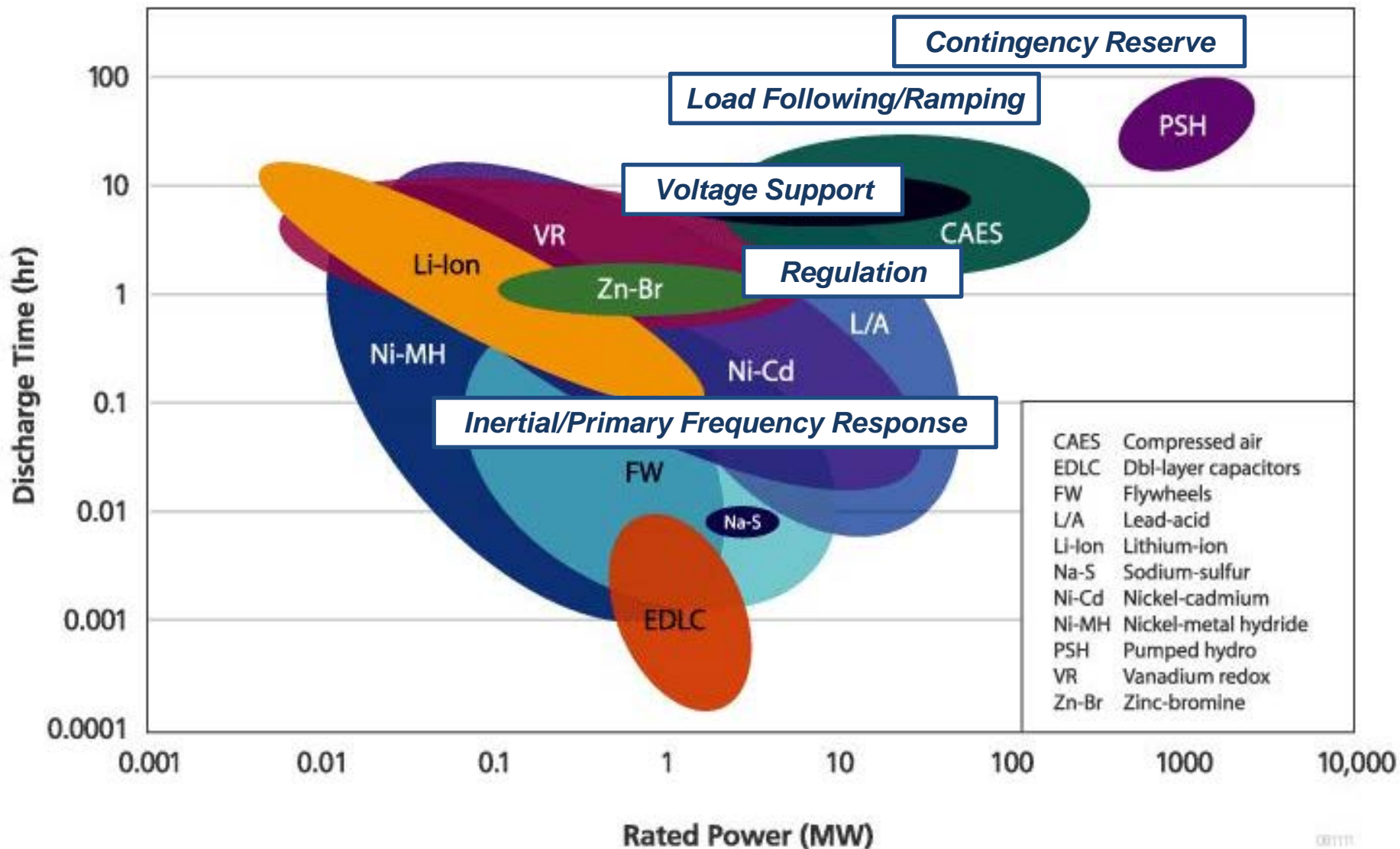


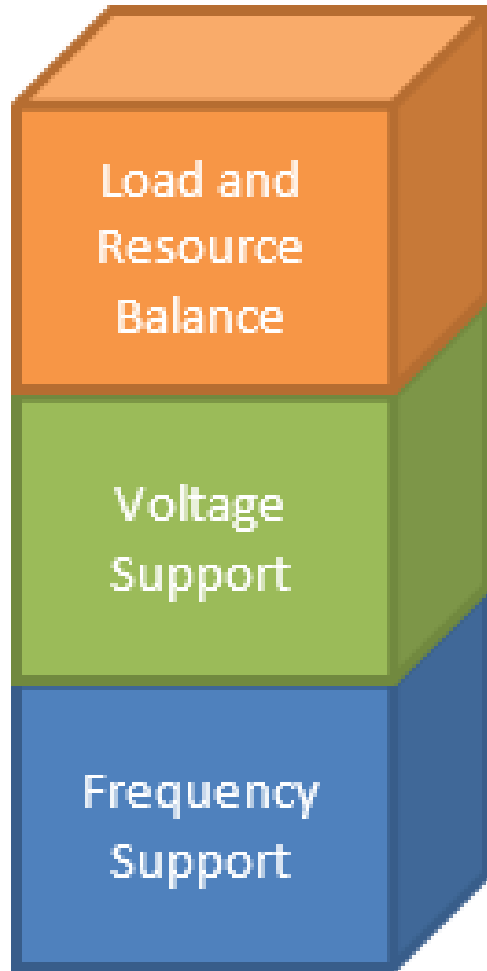
Transmission?



- *Storage is:*
 - *Dynamic*
 - *What you need it to be, when you need it to be there*
 - *Needed as a result of non-dispatchable variable resources*

Storage and Flexibility Functions

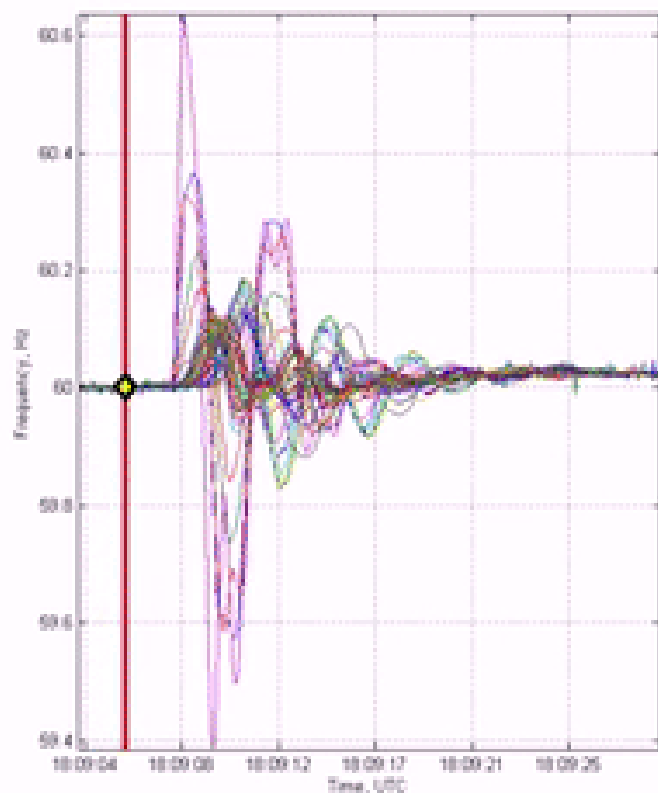




- “Building blocks” of physical capabilities
- Accentuated by resource changes
- Not all MWs are equal
- Retired services/characteristics need to be replaced
- Some partly covered through ancillary services
- Accommodate local/regional needs

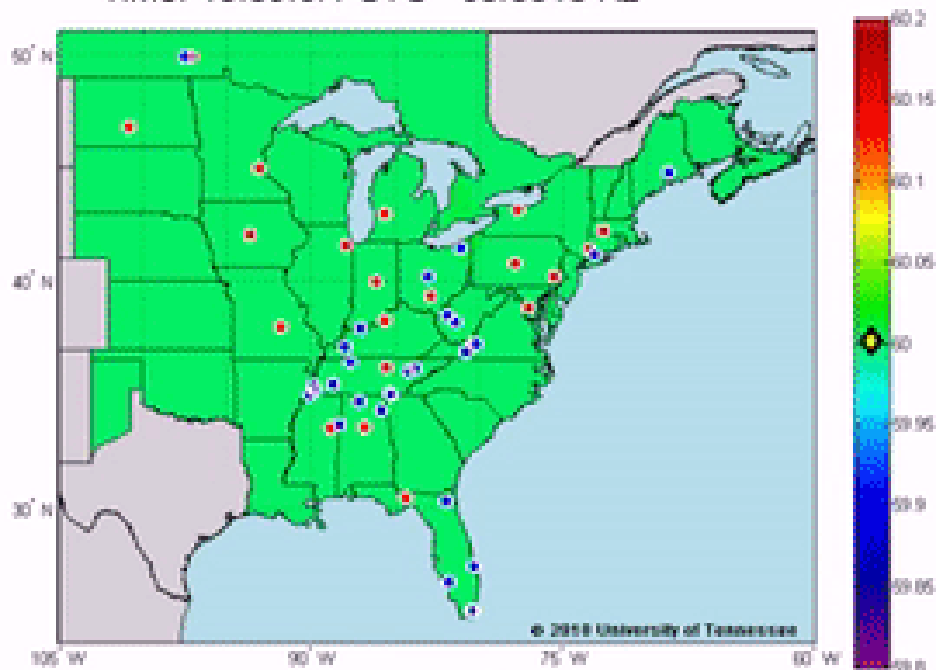


Frequency Excursion – Interconnection-wide Phenomena



Florida Event Replay with FNET Data [2/26/2008]

Time: 18:09:6.1 UTC 60.0013 Hz

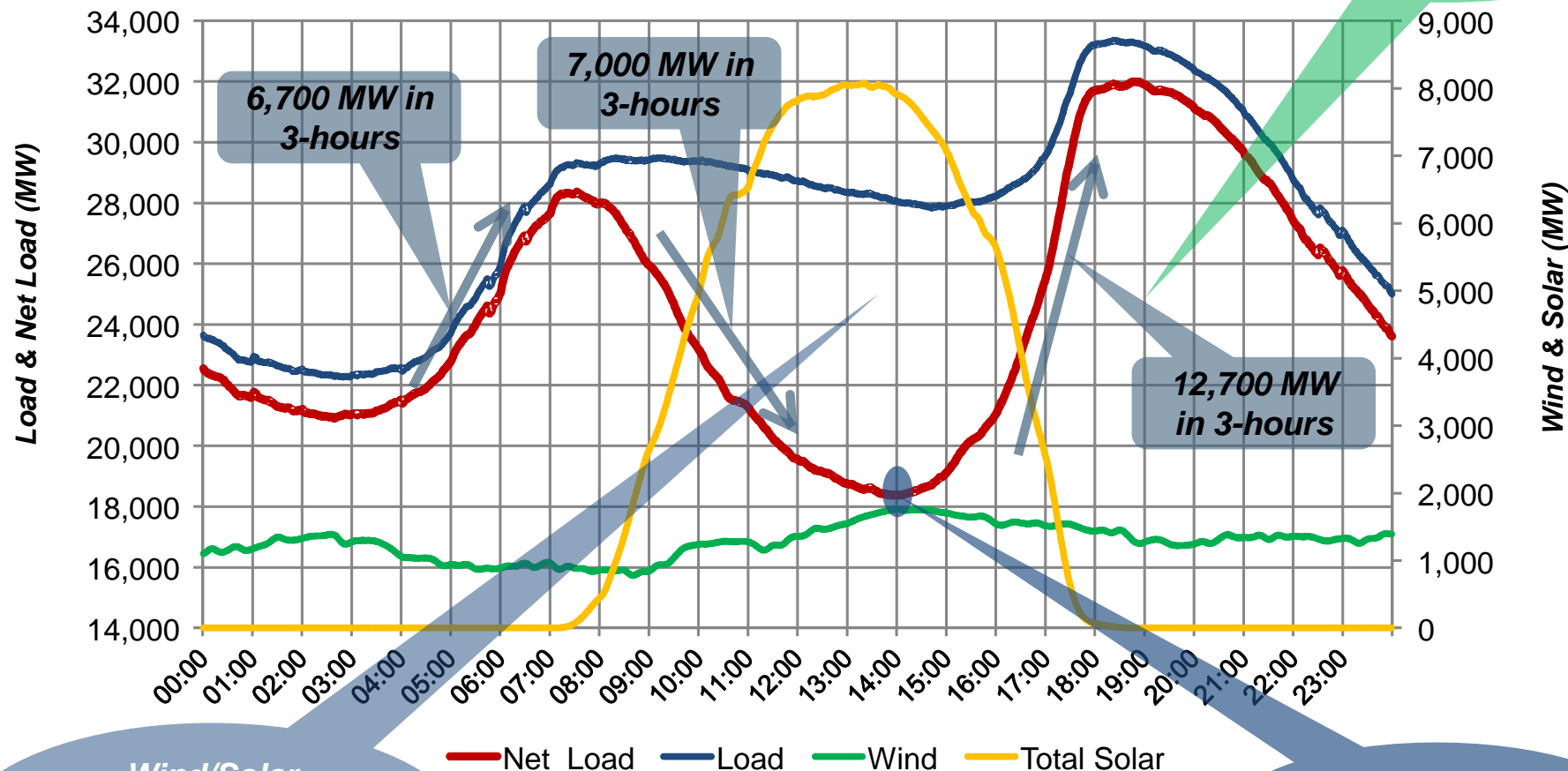


THE UNIVERSITY OF
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CURRENT

**Load, Wind & Solar Profiles --- Base Scenario
January 2020**



— Net_Load — Load — Wind — Total Solar

$$\text{Net Load} = \text{Load} - \text{Wind} - \text{Solar}$$

Aliso Canyon Outage in Southern California

SCE Aliso Canyon Awarded Procurements

1. Western Grid Santa Paula, 5 MW/20 MWh
On-line target Q1 2017
2. AltaGas-Greensmith Pomona, 20 MW/80 MWh
On-line target Q4 2016
3. Tesla Ontario, 20 MW/80 MWh
On-line target Q4 2016
4. Powin Energy Irvine, 2 MW/8 MWh
On-line target Q1 2017
5. GE Center, 10 MW/4.3 MWh
On-line target Q4 2016
6. GE Grapeland, 10 MW/4.3 MWh
On-line target Q4 2016

SDG&E Aliso Canyon Awarded Procurements

1. AES Escondido 30 MW/120 MWh
On-line target Q1 2017
2. AES El Cajon 7.5 MW/30 MWh
On-line target Q1 2017

SCE Procurement	SDG&E Procurement
47 MW/4-hr. duration, 20 MW/25-min duration	37.5 MW/4-hr. duration
Multiple RFP winners	Single awardee
On-line 2016/2017	On-line 2017
New procurements ordered from CPUC	Procurements expedited from ongoing LCR program

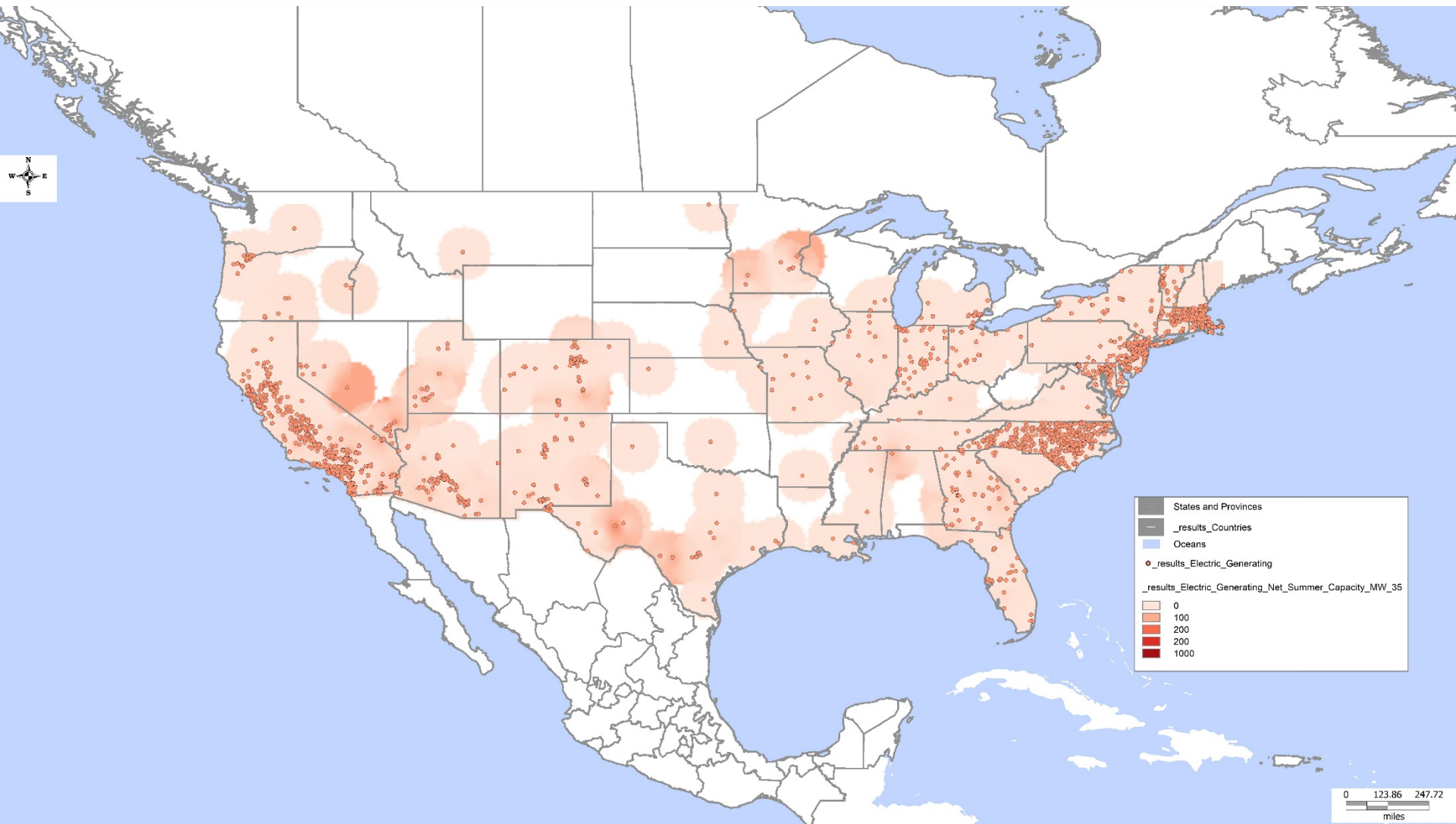


T:\Project\Special Requests 2016\Johnson\AlisoCanyon\AlisoCanyon_AffectedCities_SelectedPowerPlantsV2.mxd

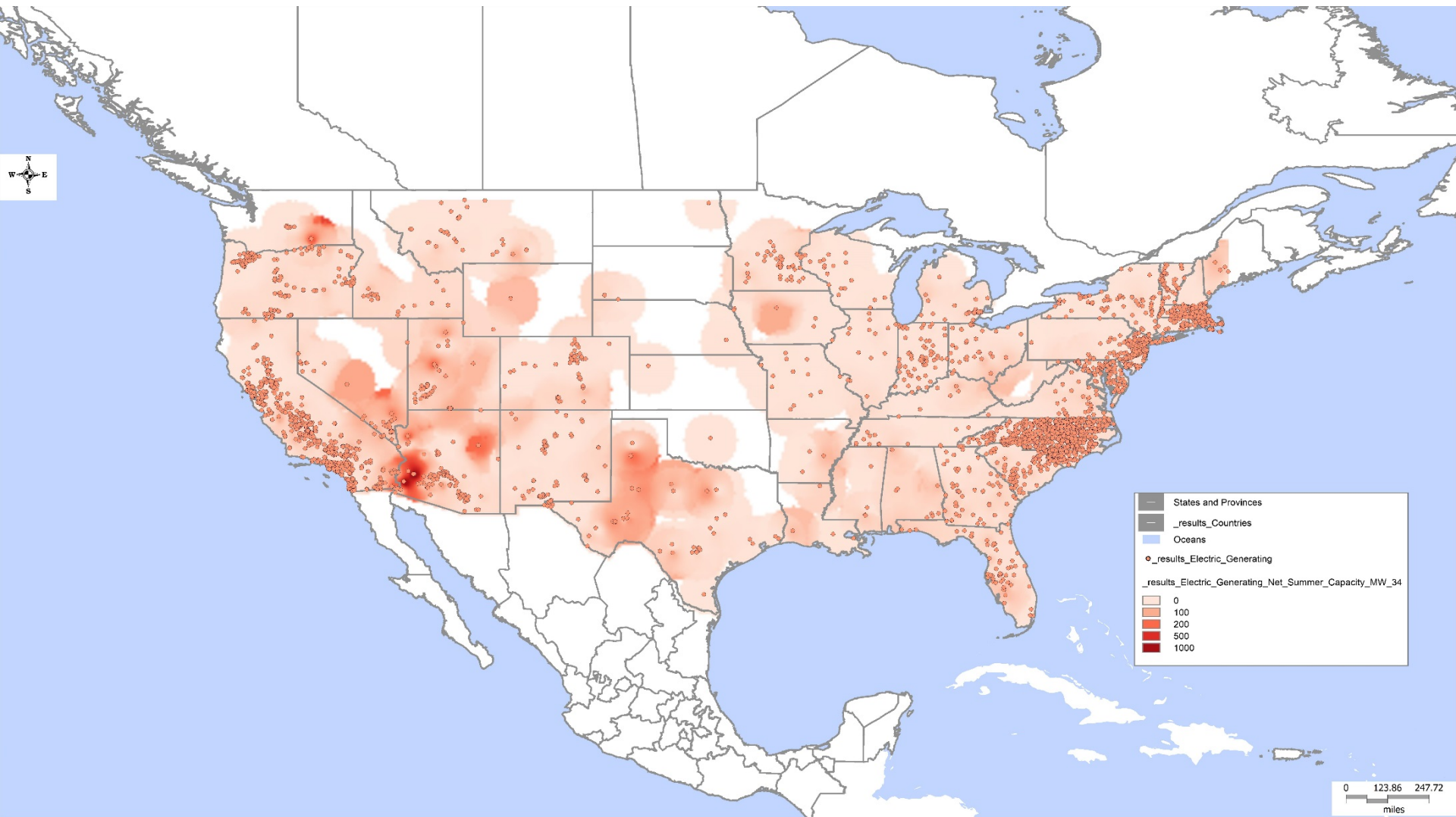
Over 100 MW built in less than 6 months

(Source: GTM Research)

Current Solar Production



Current and Planned Production (Based on 2-3 Year Commitments)

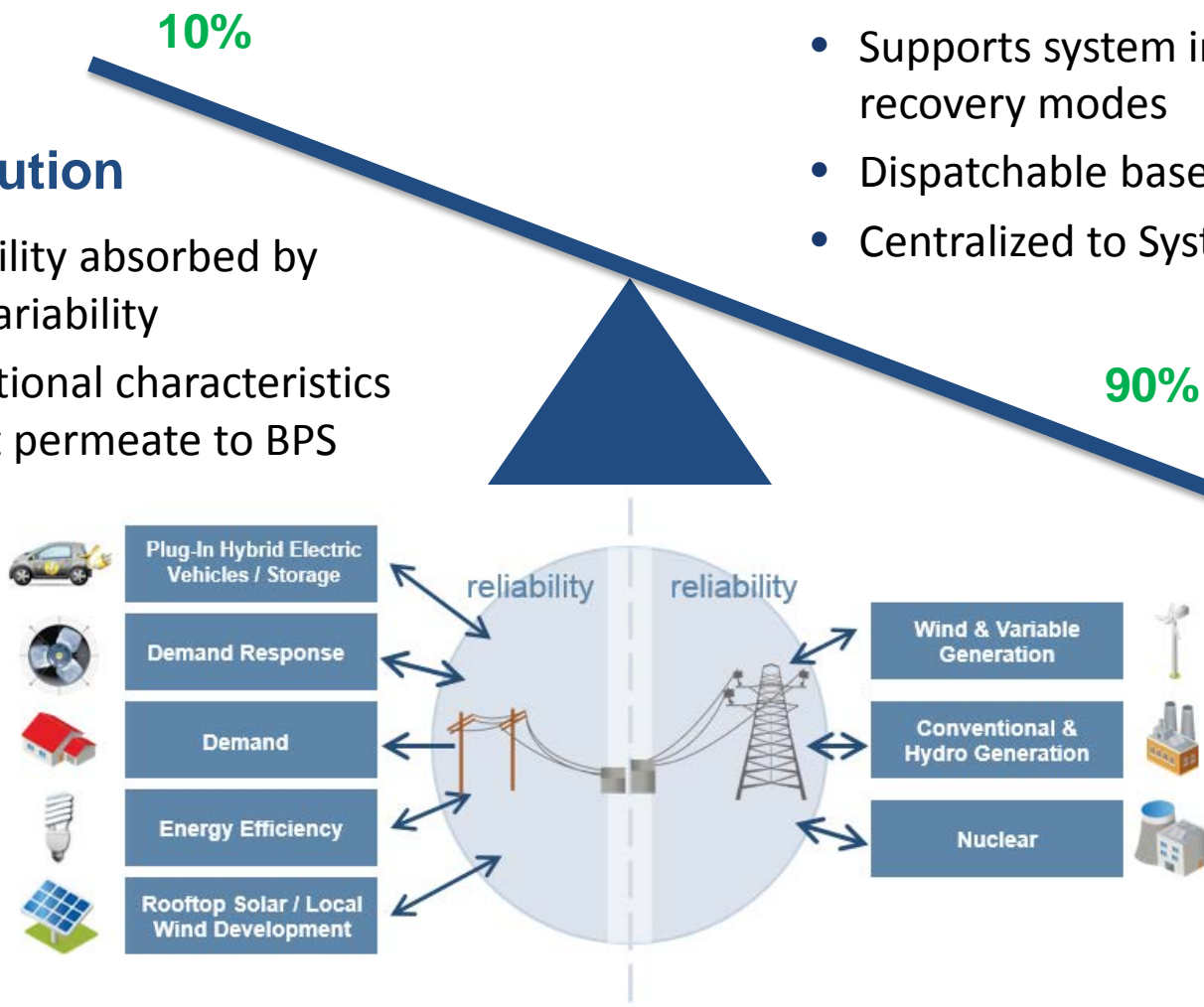


Distribution

- Variability absorbed by load variability
- Operational characteristics do not permeate to BPS

Bulk-Power System

- Supports system inertia and recovery modes
- Dispatchable based on demand
- Centralized to System Operator



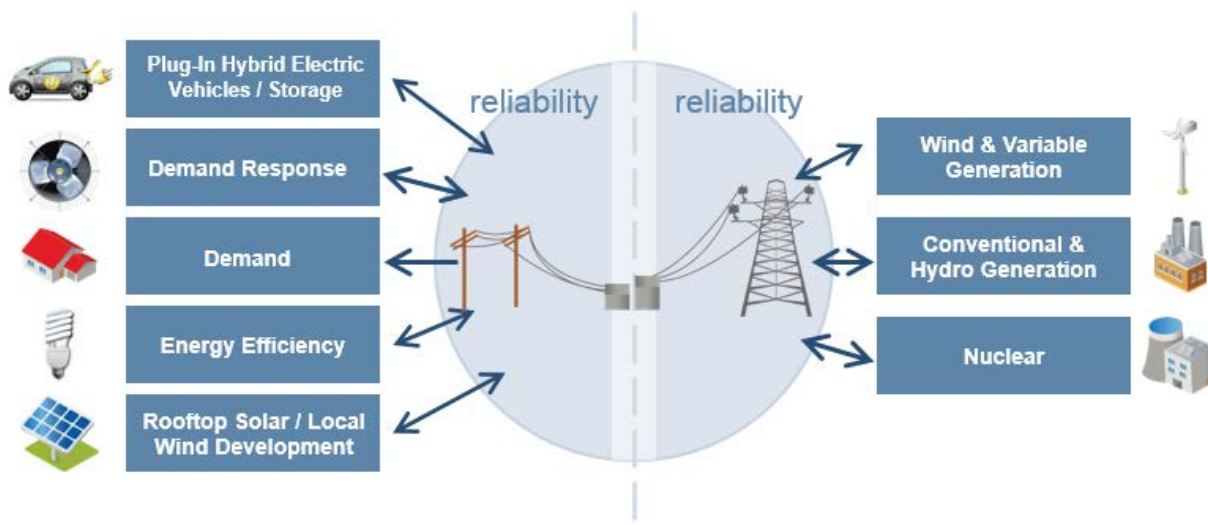
Distribution 30%

- Disturbances permeate to BPS (common-mode)
- Dynamic and fast demand response
- Potential for over generation

Bulk-Power System

- More rigorous generator control and dispatch ability
- Increased reliance on BPS generation
- Additional equipment to control local voltages

70%



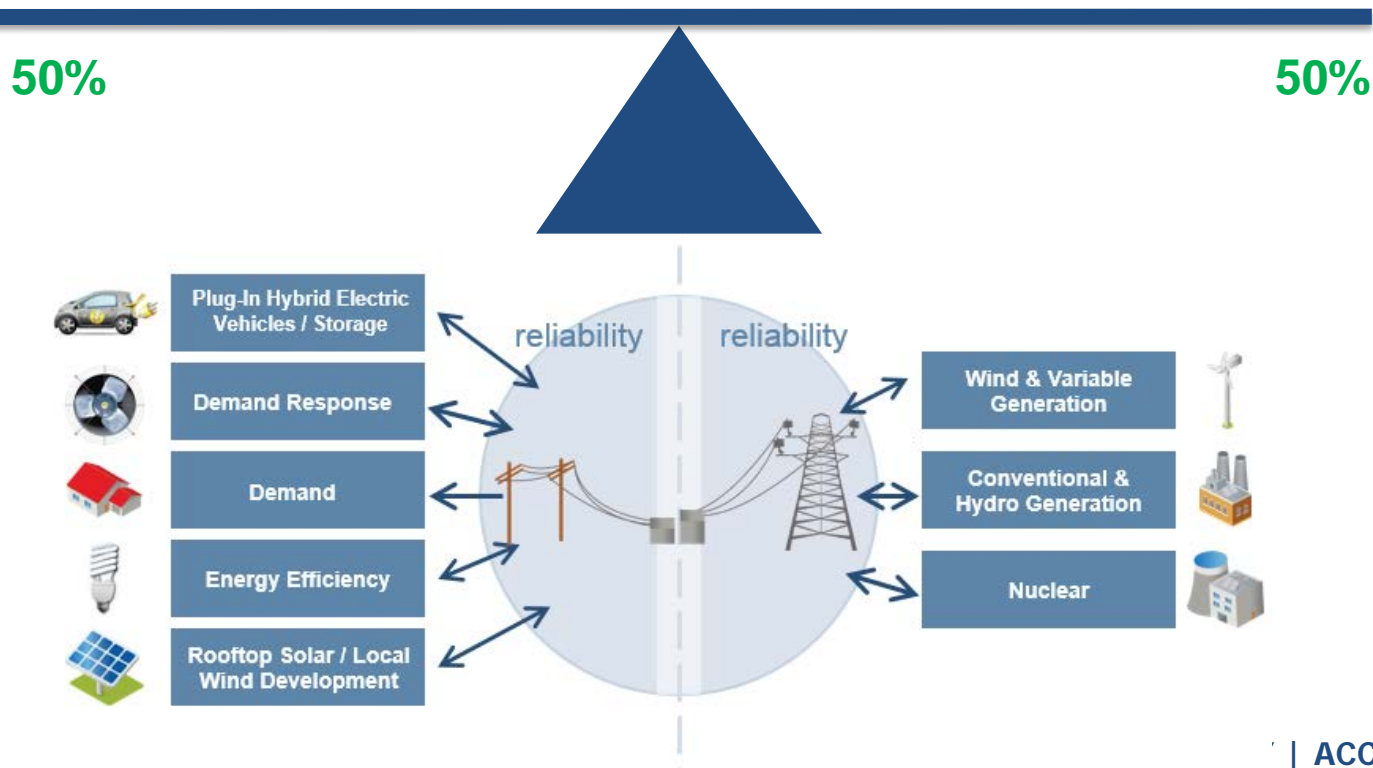
Integrated Power System

Distribution

- DER must act as a system resource
- Storage, curtailment, coordination, grid support, and control
- Operator or aggregator function is needed

Bulk-Power System

- Supports electricity services
- Long-haul power transfers provider
- Reliability backbone



- Profound changes occurring on the BPS—resources and policies
- Lots of uncertainty in the future
- Diverse resource mix for resilience, flexibility, and reliability
- New system behaviors require new measurements for reliability
- Changes occurring irrespective of environmental regulations, but rules exacerbate the potential reliability impacts
- NERC Reliability Standards must be maintained
- Speed of change needs to be matched with sound engineering
- Its all about the Jurisdictions



Questions and Answers

