



NARUC

Winter Committee Meetings

Committee on Electricity

Electricity Committee: Business Meeting

- ▶ Welcome: *Hon. Ed Finley*,
North Carolina
- ▶ *John Moura*, Director of
Reliability Assessment and
System Analysis, NERC
- ▶ Consideration of Resolutions

NERC

NORTH AMERICAN ELECTRIC
RELIABILITY CORPORATION

Accommodating High Levels of Distributed Energy Resources

John Moura, Director of Reliability Assessment and System Analysis
2017 NARUC Winter Committee Meetings
February 14, 2017

RELIABILITY | ACCOUNTABILITY



- Task Force formed December 2015
- Membership: representatives from
 - Transmission planning and operations
 - Renewable developers
 - Regulatory organizations
 - Distribution utility
 - Researchers, equipment and control vendors
- Final report to NERC Technical Committees in December 2016
 - Recommendations to NERC, industry, and regulators
- NERC Board of Trustees approved report February 9, 2017

What is Bulk Power System (BPS) Reliability?

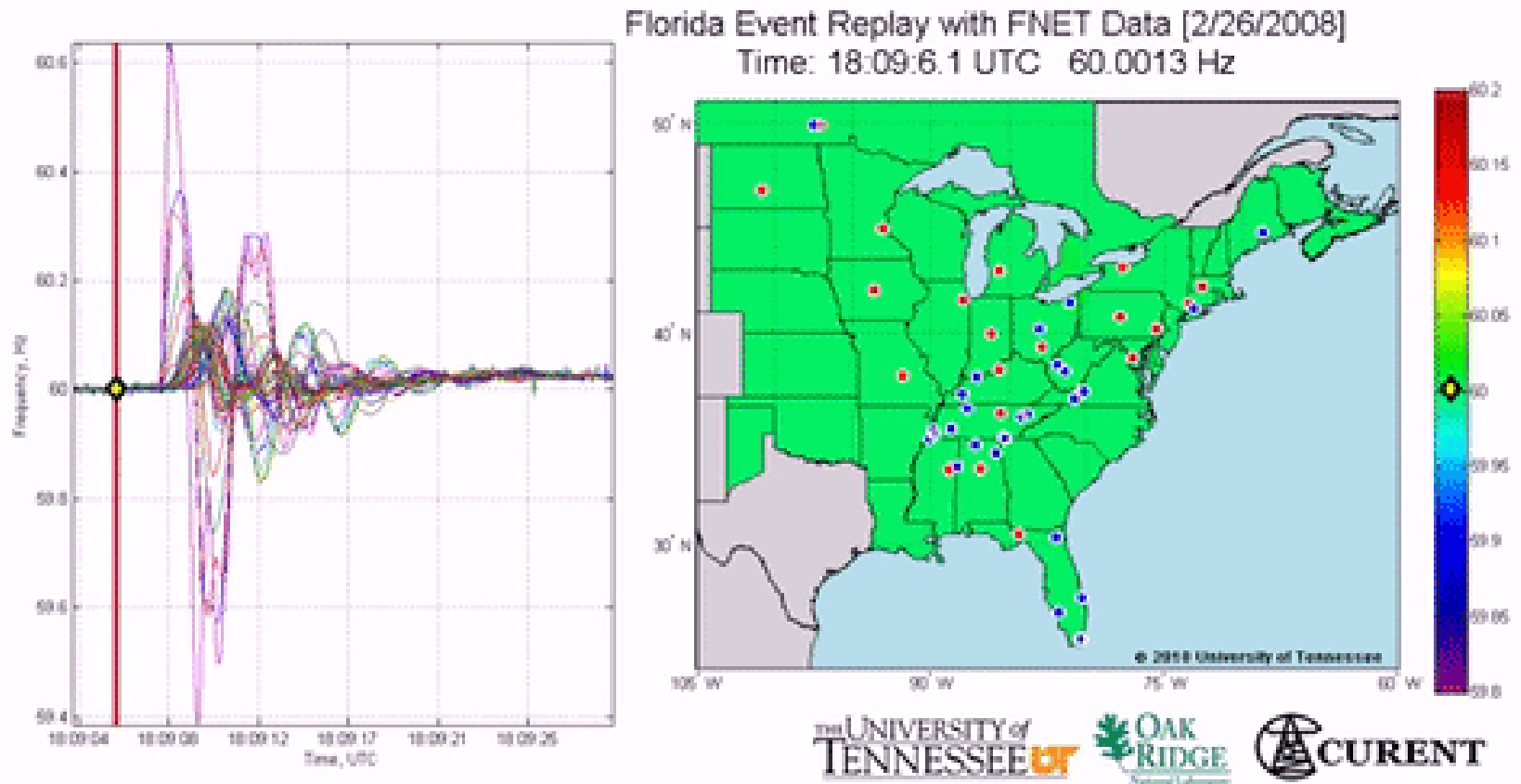
The ability of the BPS to meet the electricity needs of end-use customers at all times.

- **Resource Adequacy** — The ability of the BPS to supply the aggregate electrical demand and energy requirements of the customers at all times, taking into account scheduled and reasonably expected unscheduled outages of system elements.
- **Operating Reliability** — The ability of the BPS to withstand sudden disturbances such as electric short circuits or unanticipated loss of system elements from creditable contingencies.

Is there enough supply of electricity?

Is there enough supply of operational reliability and control?

Can the system operate under a variety of conditions?





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

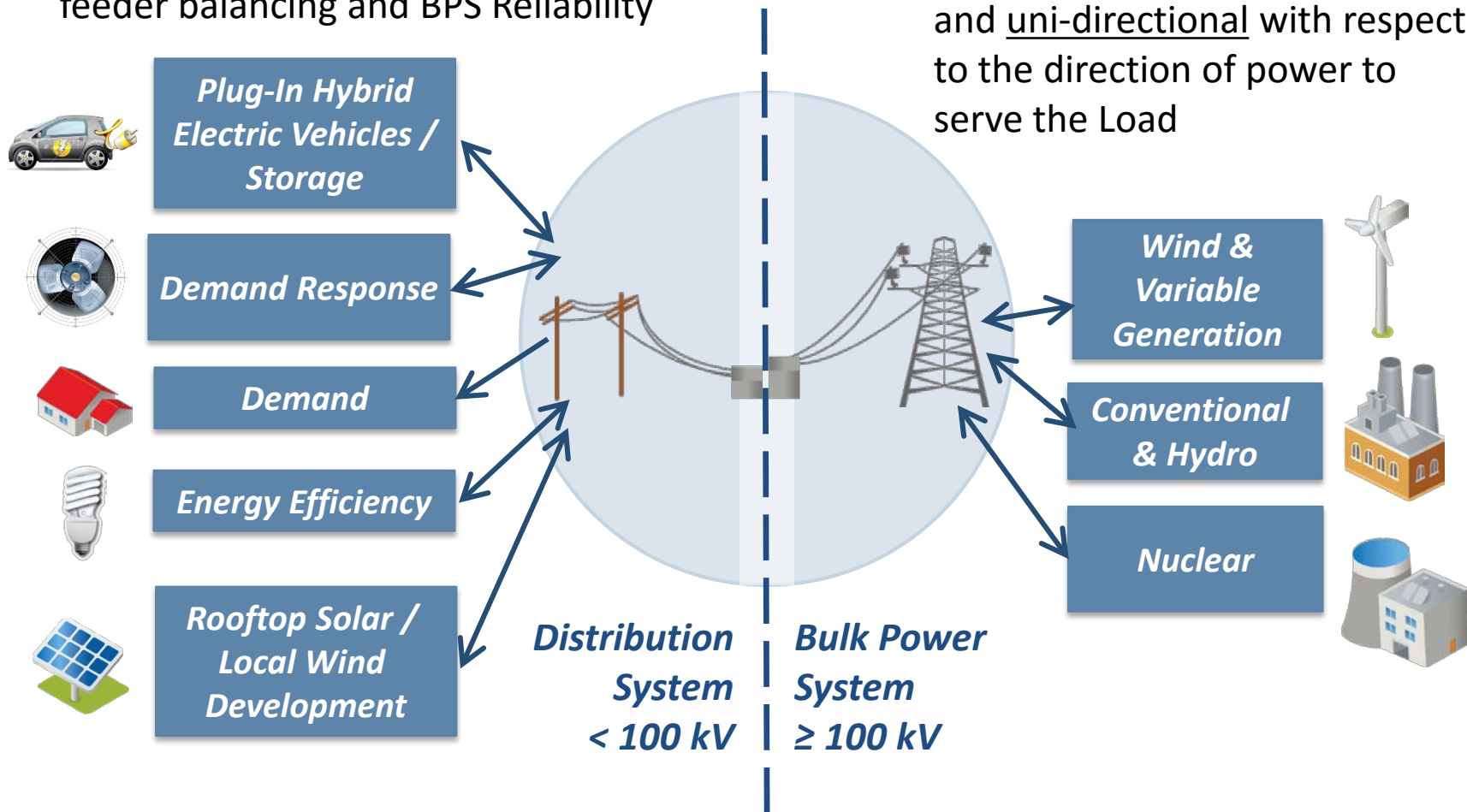
Some Problem Complexities:

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

DER & BPS Power Flow Changes

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

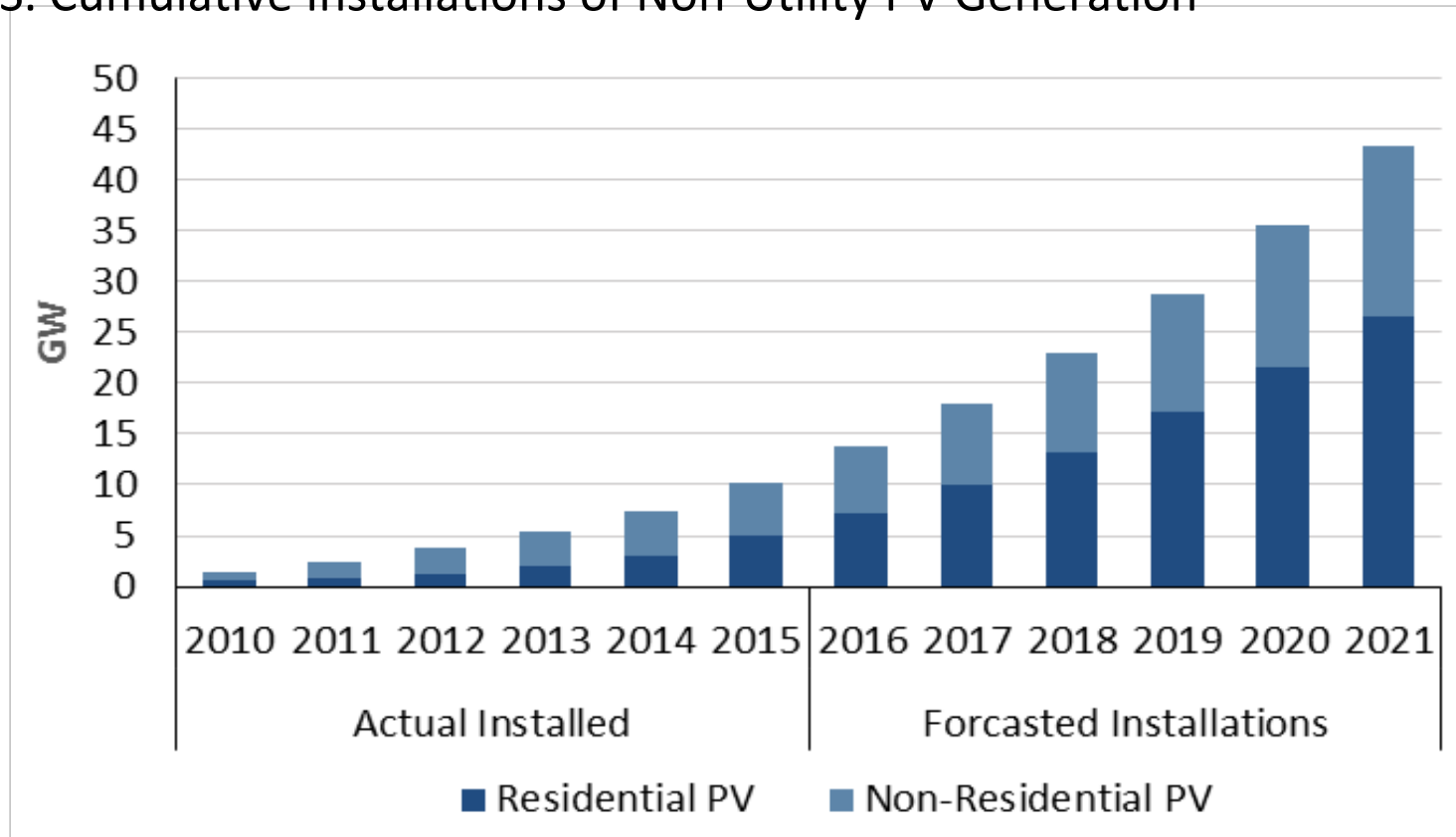
- BPS previously considered the Distribution System as balanced and uni-directional with respect to the direction of power to serve the Load



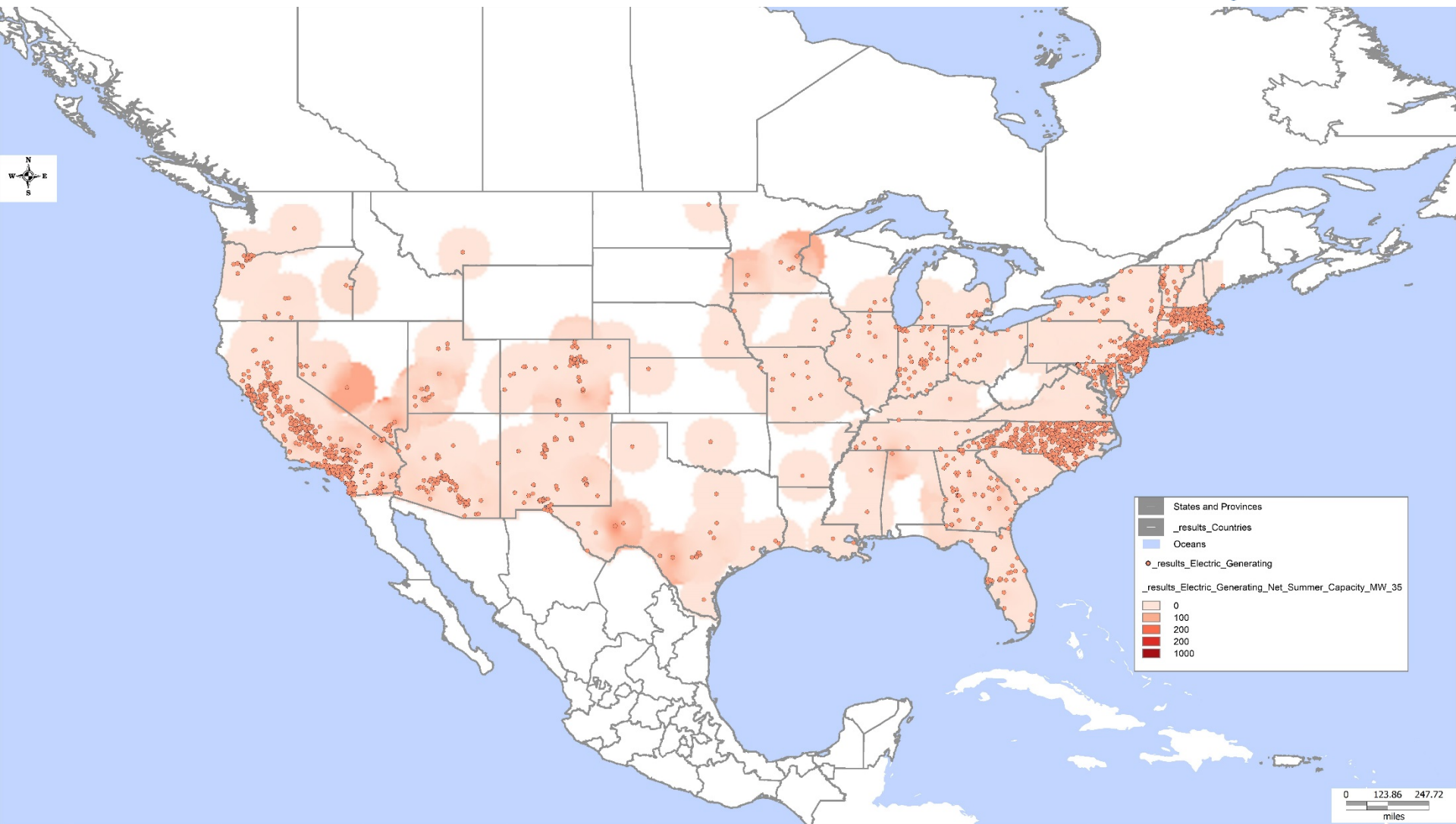


Trending and Forecasting DER:

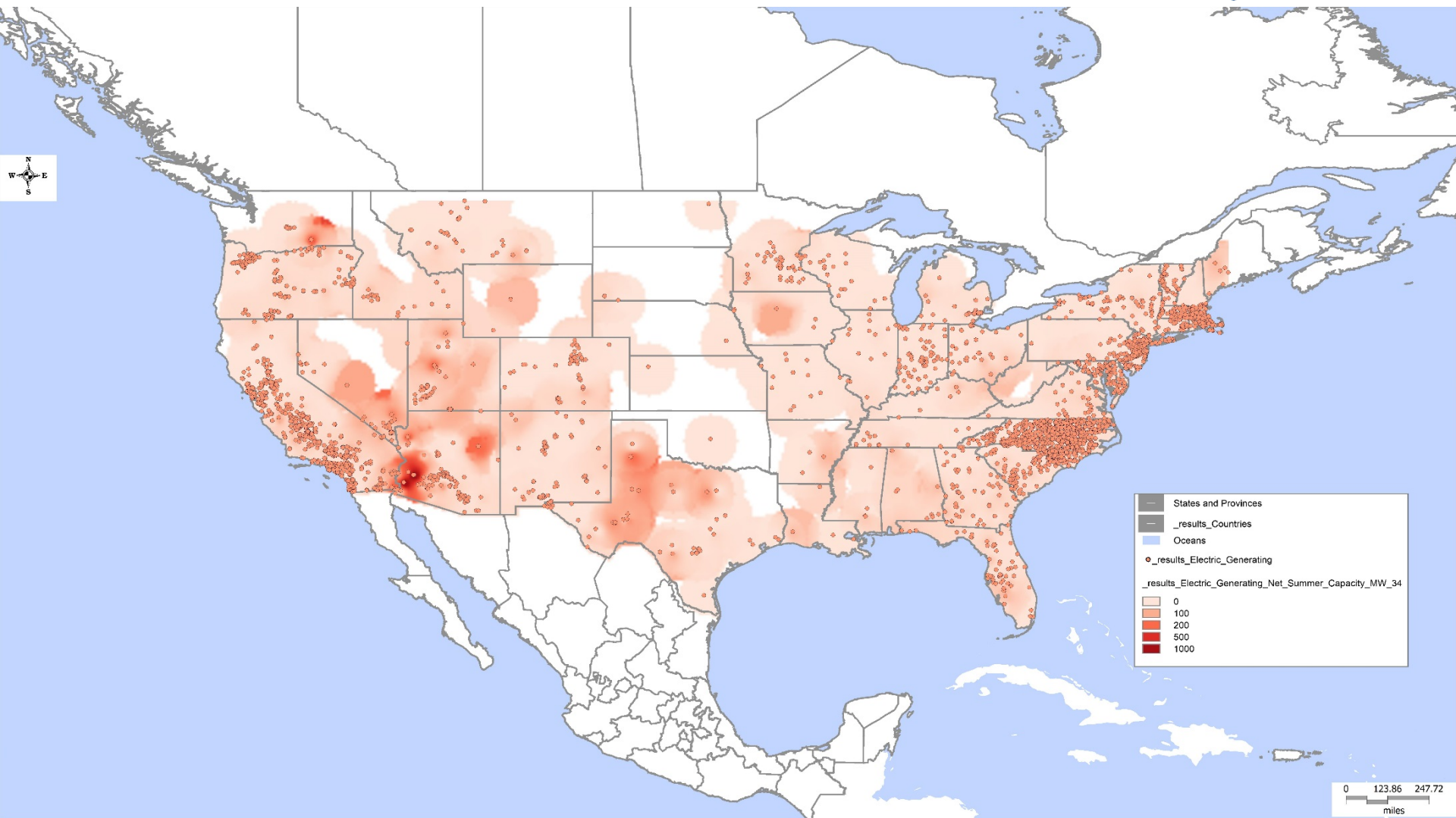
U.S. Cumulative Installations of Non-Utility PV Generation



[4 GTM Research: Solar Market Insight Report 2016 Q2](#)



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

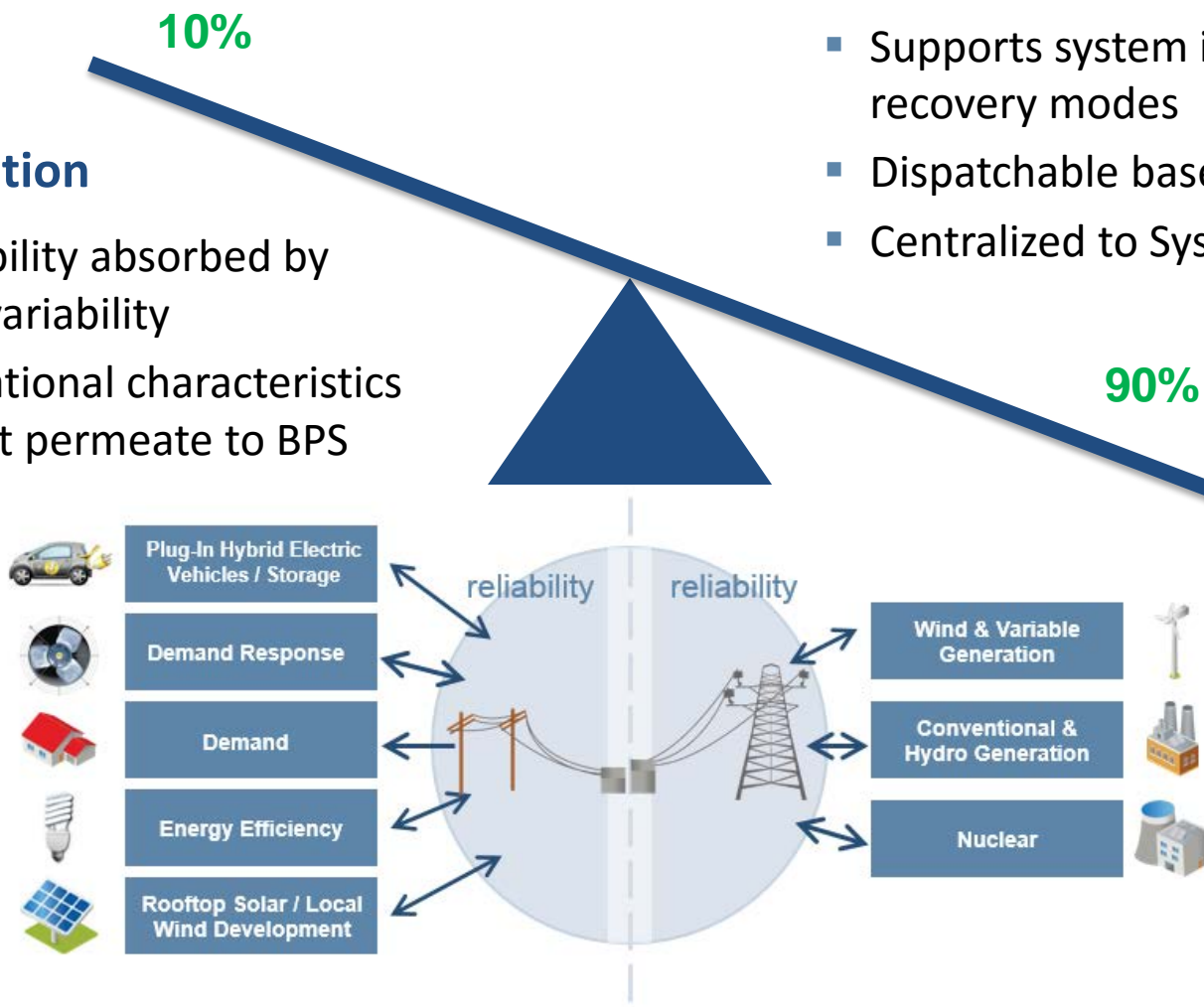


Distribution

- 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



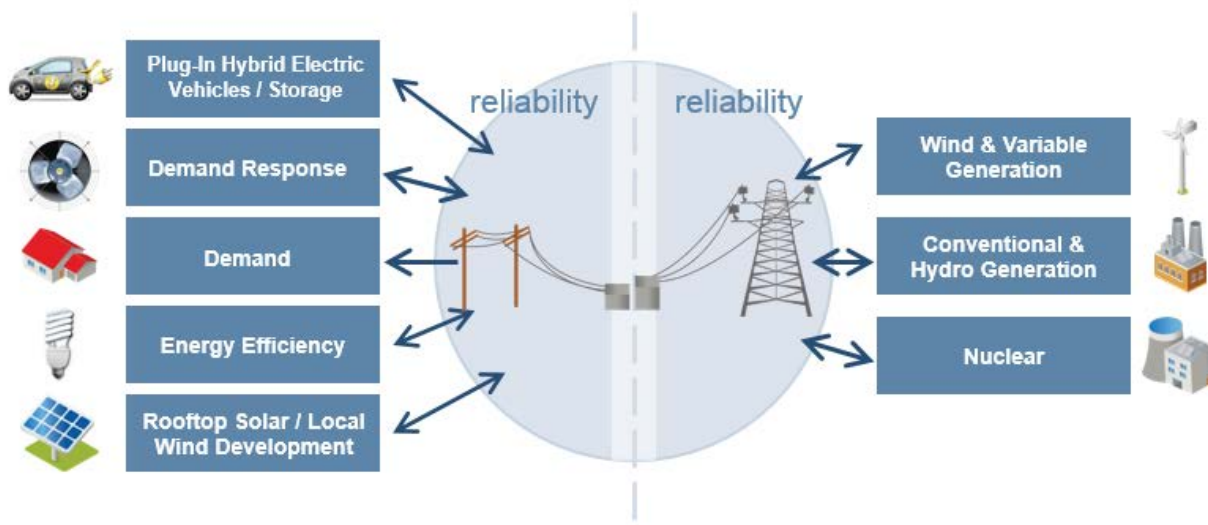
Distribution 30%

- 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

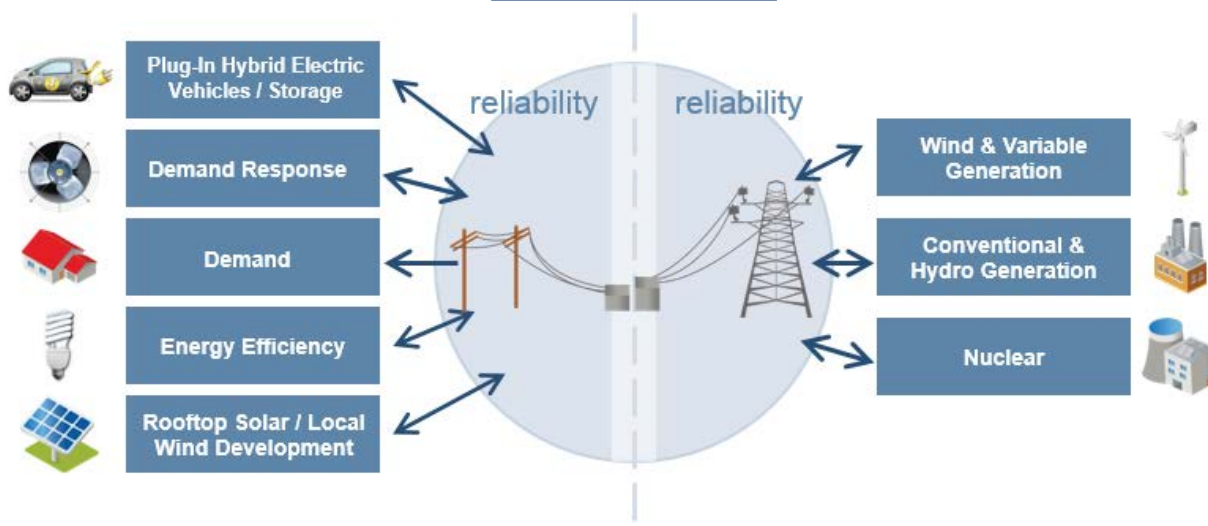
- DER must act as a system resource
- Storage, curtailment, coordination, grid support, and control
- Operator or aggregator function is needed

Bulk-Power System

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

50%

50%





As the CONTROL paradigm shifts, the following questions arise:

- **How should DER be included in planning and operating models?**
 - How many are there, can DER be aggregated and where should they be modeled?
 - What level of detail of each type of DER model is needed for reliability?
 - What level of control is needed for reliable system operations?
 - What level of visibility do system operators require?

NERC and the Industry are collaborating in order to:

- Determine how DER characteristics contribute to and/or impact BPS reliability
- Quantify the DER characteristics and effects to steady state and dynamic analysis
- Investigate DER modeling, develop guidelines, revise and/or create standards
- Identifying actions for the Electric Reliability Organization (ERO) needed to adapt?



- The impact of DER on the BPS is not a simple issue
 - At lower penetration levels, the overall impact of DER is minor and can be managed by existing BPS resources
 - At higher penetration levels, issues may develop in transmission line loading, grid voltage, and system frequency during normal or disturbed operation
- DER penetration is rapidly increasing and altering the load mix
- Technical and engineering challenges of integrating DERs on distribution system are well understood, but the reliability implications on the Bulk Electric System are less so
- DERs will increasingly have capabilities for active power control and reliability services
- Fundamental changes to modeling, planning and operations, and conventional assumptions

- Inverter-based, asynchronous resources (e.g., solar PV) have different characteristics than conventional generation
- Similar to the Bulk Power System and federally interconnected generation, resources must be “grid-friendly” and support the needs of the local Transmission Planner (e.g., ISO/RTO)
 - Maintain “ride-through” capability through implementation of new interconnection standard IEEE 1547 (updated version, NOT 2003 VERSION)
 - Supported by California’s Rule 21 (review for best practices)
- NERC Reliability Standards exist to address BPS reliability needs, but do not impose requirements to any specific DER
- Rapid deployment means closer coordination with electric industry transmission planners and operators
 - Wide-area and interconnection reliability versus local reliability



Questions and Answers

Resolutions to Honor:

- ▶ Beverly Heydinger, Minn.
- ▶ Brian Kalk, North Dakota
- ▶ Ann McCabe, Illinois
- ▶ David Noble, Nevada
- ▶ Audrey Zibelman, New York

Resolution EL-1 by Commissioner Britton

*Opposing DOE's Use of
Section 1222 of the Energy
Policy Act of 2005 to
Circumvent State Siting
Laws and Regulations*



NARUC

Winter Committee Meetings

Committee on Electricity