

# NERC

NORTH AMERICAN ELECTRIC  
RELIABILITY CORPORATION

# The Brave New World of Resilience

Renewables, Reliability, and Resilience

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MRO Board of Directors Meeting  
June 23, 2022

RELIABILITY | RESILIENCE | SECURITY

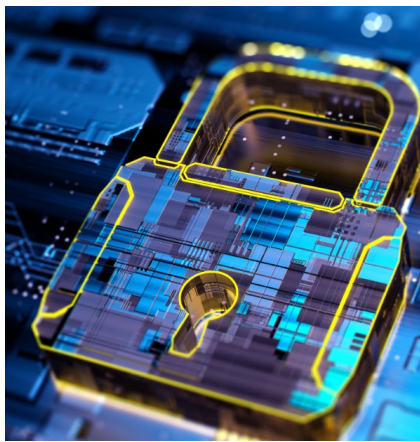


- Assure the reliability, resilience, and security of the North American Bulk Power System (BPS)
  - Develops and Enforces Reliability Standards
  - Annually assesses seasonal and long-term reliability
  - Monitors the BPS through system awareness
  - Educates, trains, and certifies industry personnel

Critical Infrastructure  
Interdependencies



Security Risks



Extreme Events



Grid Transformation



# A Reliable System is a Resilient System

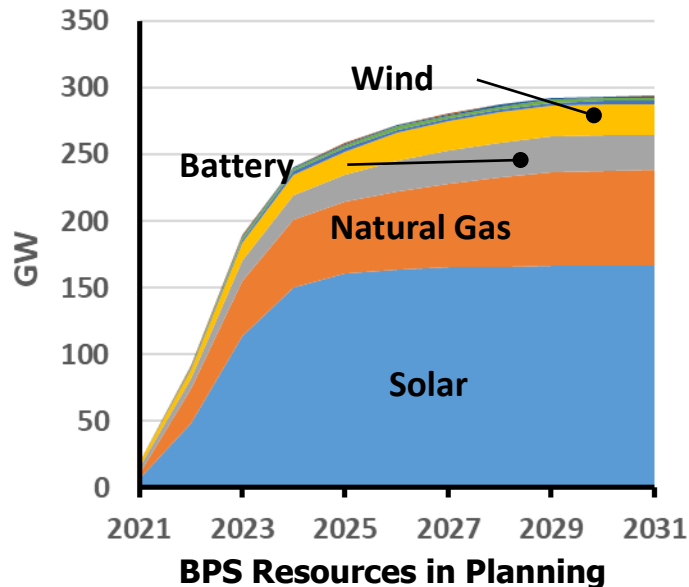
- System with an Adequate Level of Reliability (ALR) is resilient
  - Industry has designed a reliable Bulk Power System that is robust, resourcefully operated, and rapidly recovers
  - Lessons learned are actively considered during and after an event



- **D**ecarbonization
  - Inverter-based resources, accelerated synchronous retirements; variability, uncertainty, and the need for flexibility
- **D**ecentralization
  - Distributed Energy Resources (DER), DER aggregators, microgrids
  - Grid Edge Technologies
  - Internet of Things and Industrial Internet of Things
- Transportation electrification and multi-sector electrification
  - Growth of EVs; electricity usage across industries; load composition
- Critical Infrastructure Interdependence
  - Energy, telecoms, natural gas/oil
- **D**igitalization



- Future resource mix will be ***more variable*** and ***less fuel-diverse***

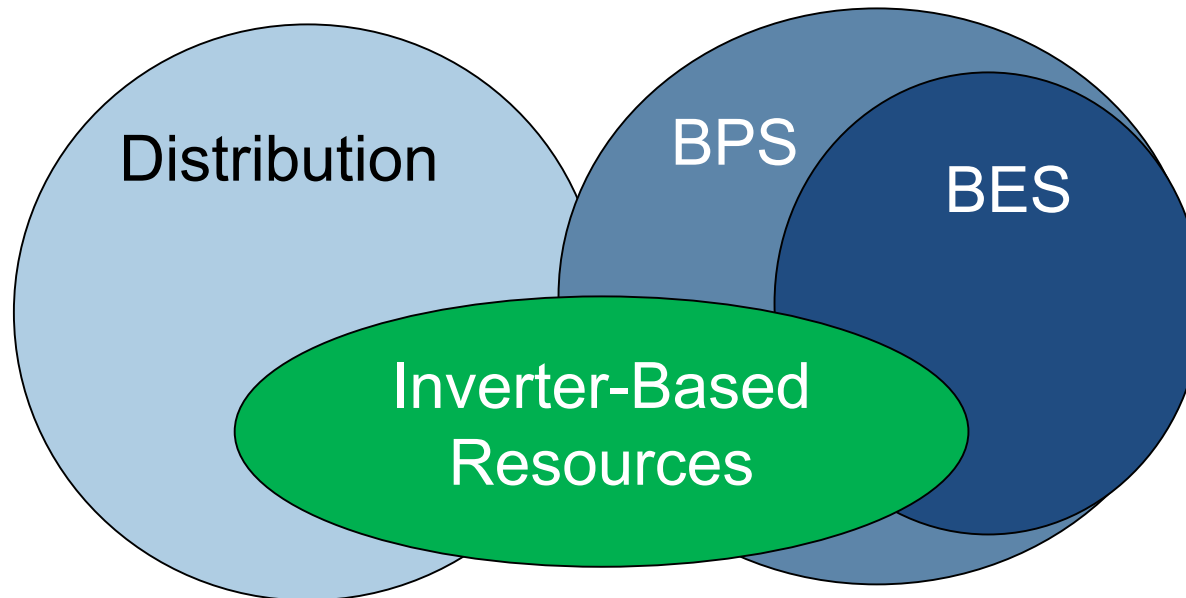


## 2021 Capacity at Peak Demand

Type	Capacity (GW)	Contribution %
Natural Gas	467	47%
Coal	220	22%
Nuclear	108	11%
Solar and Wind	60	6%
All others	136	14%

Contributions at hour of peak demand. Variable energy resource (solar, wind, and some hydro) typically count less than installed nameplate capacity.

- NERC priorities for reducing risks during grid transformation
  - Improve Bulk Electric System (BES) resilience for wide area long-duration extreme temperatures
  - Focus on energy sufficiency
  - Enhance suite of reliability standards

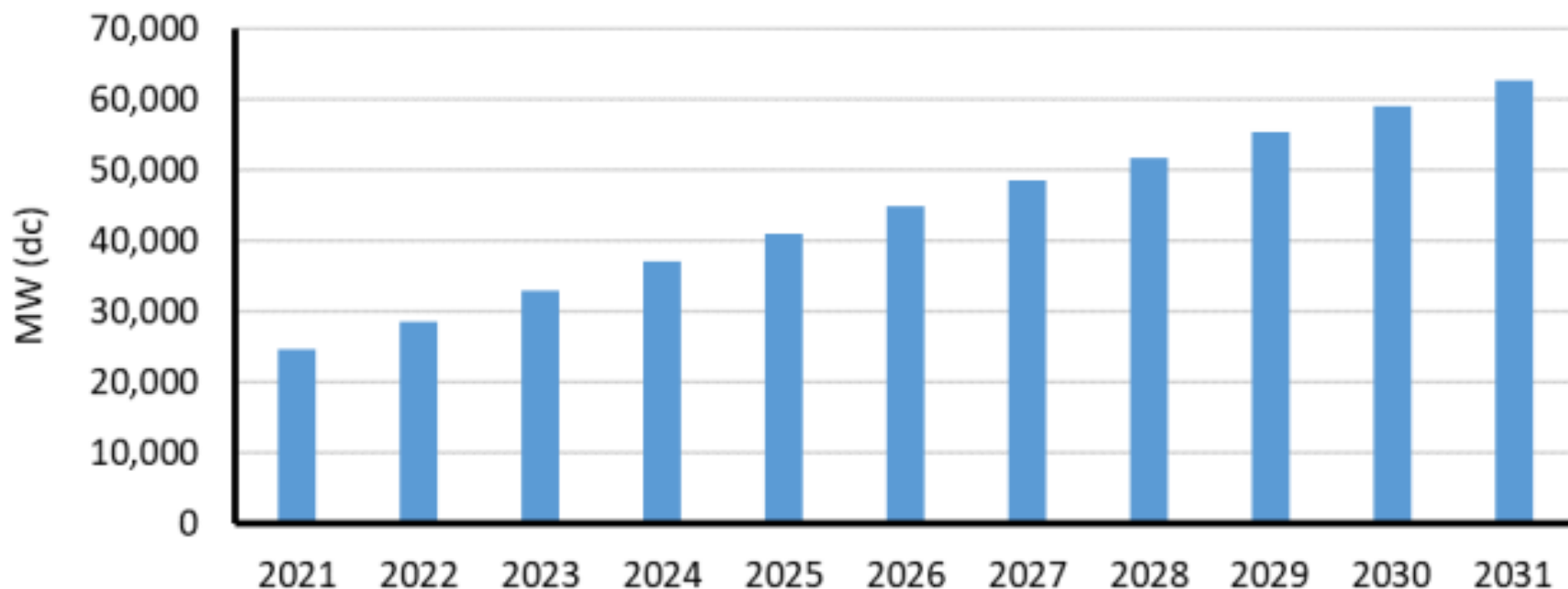


## Class I: Generators on Distribution System

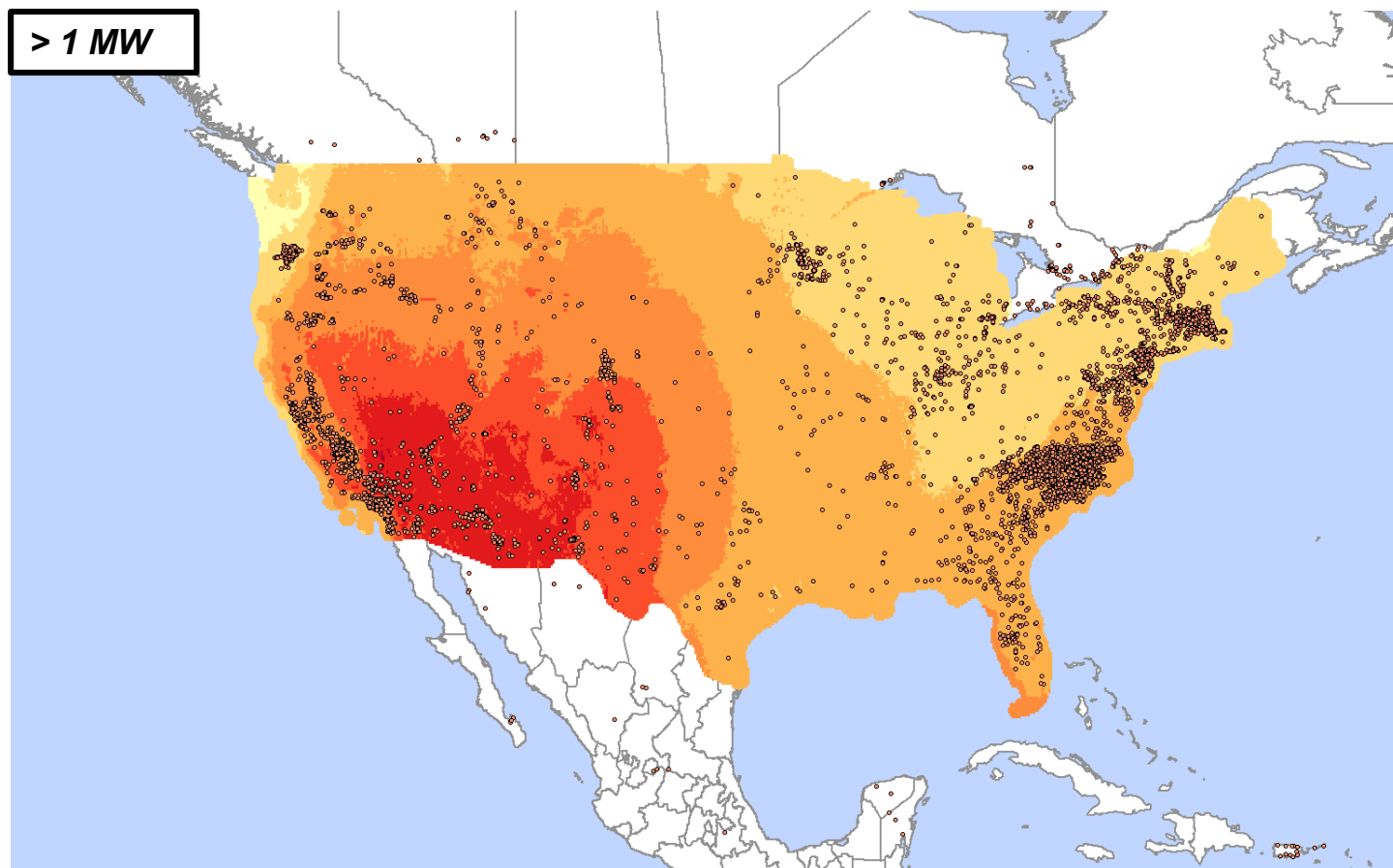
- “Behind-the-Meter” generation
- Community or Residential

## Class II: Non-BES Generation on Transmission System

- <75MVA, Non-BES
- Connected to Transmission System



**Figure 21: Cumulative Distributed Solar PV Capacity in Assessment Areas**



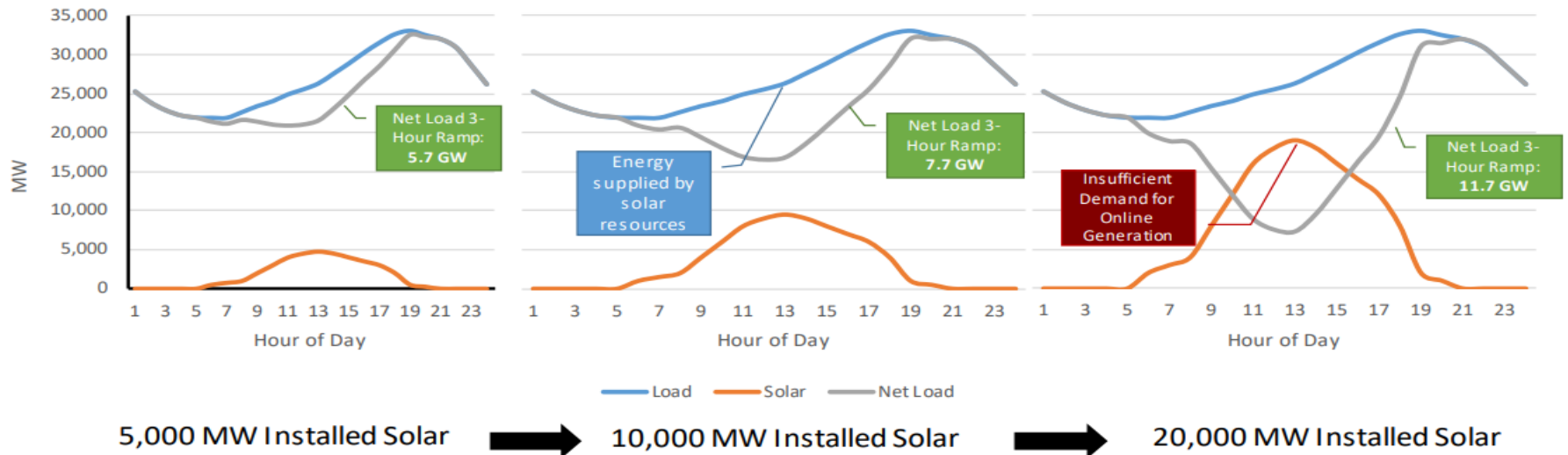
*Unofficial - Illustration Purposes Only*

*~20 GW, over 1,000 facilities*



# Important Point on Solar Resources

- **Installed** capacity mix is not constant year-round
- Example:
  - **System A** has 60,000 MW of peak internal demand and builds 20,000 MW of DER.
  - As a percentage of peak internal demand, DER is 25%
  - However; the instantaneous maximum, which occurs during a period of high production coinciding with low demand (spring and fall, no clouds), can be as high as **60-80%**.
  - DER provides no Essential Reliability Services (ERS)
  - At high penetration hours, system operators will have less control and situational awareness
  - **Gas generation is fastest ramping available resource**





[https://www.nerc.com/pa/rrm/ea/Documents/Odessa\\_Disturbance\\_Report.pdf](https://www.nerc.com/pa/rrm/ea/Documents/Odessa_Disturbance_Report.pdf)

- Magnitude of reduction highlights importance of ensuring all BPS-connected inverter-based resources are operating in a manner that ensures reliable operation of the BPS
- **Time of Event:** 7,200 MW solar PV resources in ERCOT
  - Additional 790 MW in commissioning process
- **End of August:** 8,900 MW solar PV resources in the ERCOT
  - Additional 1,000 MW in commissioning process
- **Near Future:** 25,000 MW solar PV resources with signed interconnection agreements in ERCOT generation interconnection queue between August 2021 and 2023

- Traditional model out the window
  - Historically Generation  $\rightarrow$  Transmission  $\rightarrow$  Distribution
  - Emerging Generation  $\rightarrow$  Transmission  $\leftrightarrow$  Distribution  $\leftarrow$  Generation
- System protection with fault levels  $\approx$  load levels
- Adequate reactive resources
- Under frequency load shedding settings

- Operator visibility into distributed energy resources
- Distribution impacts on transmission system
- Voltage regulation
- Under frequency load shedding
- Regulating reserves
- Cyber security of distributed energy resources

- Ride through standard (PRC-024)
- Potential FAC-001 and FAC-002 modifications
- Model verification
- TPL-001 modification
- Definition of BES





# Questions and Answers