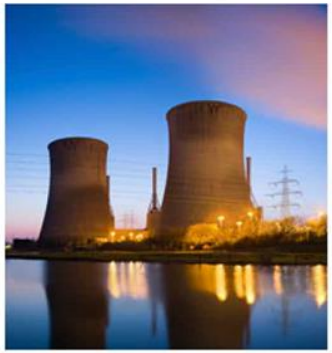
NERC

NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

# Maintaining Electric Reliability with a Changing Resource Mix:

## A North American Bulk Power System Perspective

RELIABILITY | ACCOUNTABILITY

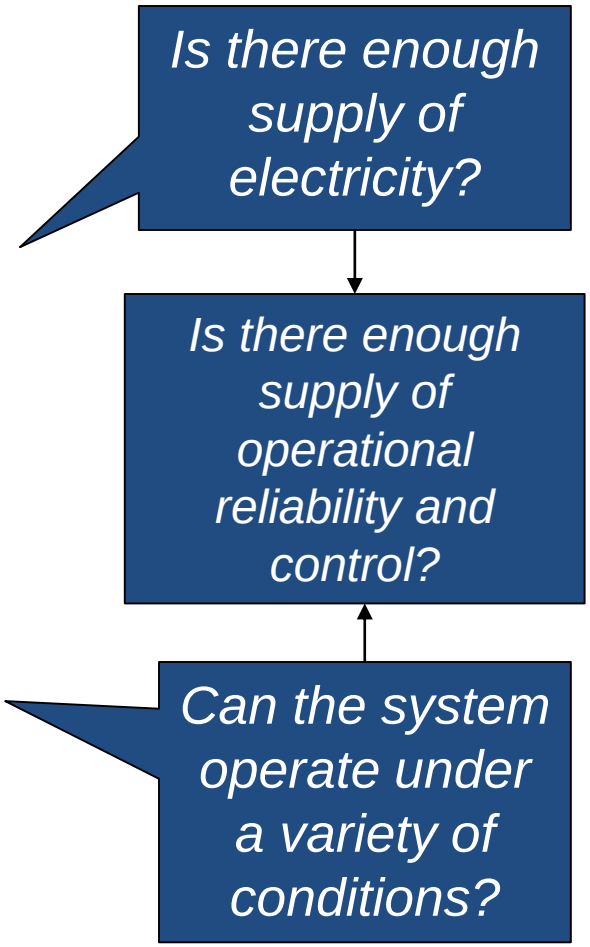
# About NERC: Mission

## To ensure the reliability of the North American bulk power system

- Bulk Power System (BPS)
- Develop and enforce reliability standards
- Assess current and future reliability
- Analyze system events and recommend improved practices
- Encourage active participation by all stakeholders
- Accountable as ERO to regulators in the United States (FERC) and Canada (NEB and provincial governments)

# What is Bulk Power System Reliability?

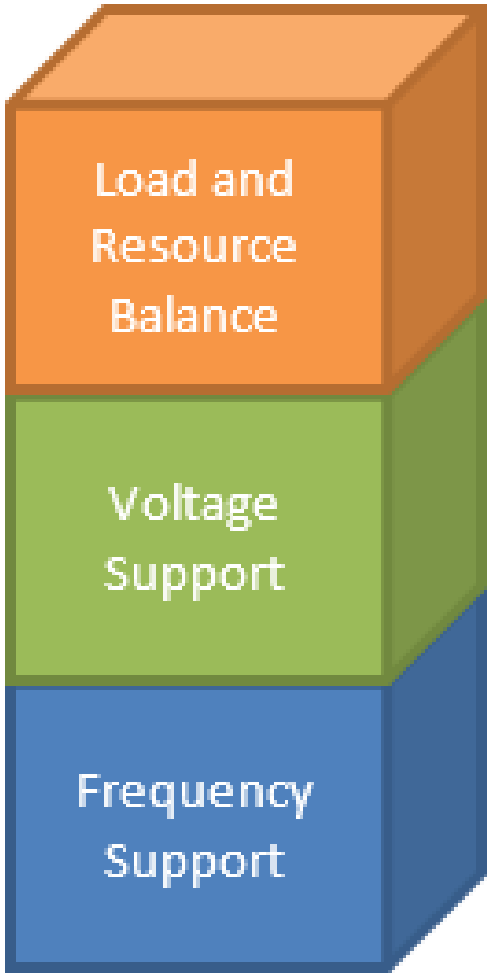
- The ability of the BPS to meet the electricity needs of end-use customers at all times.
  - **Adequacy** — The ability of the bulk power system to supply the aggregate electrical demand and energy requirements of the customers at all times, taking into account scheduled and reasonably expected unscheduled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



# System Dynamic Character is Changing

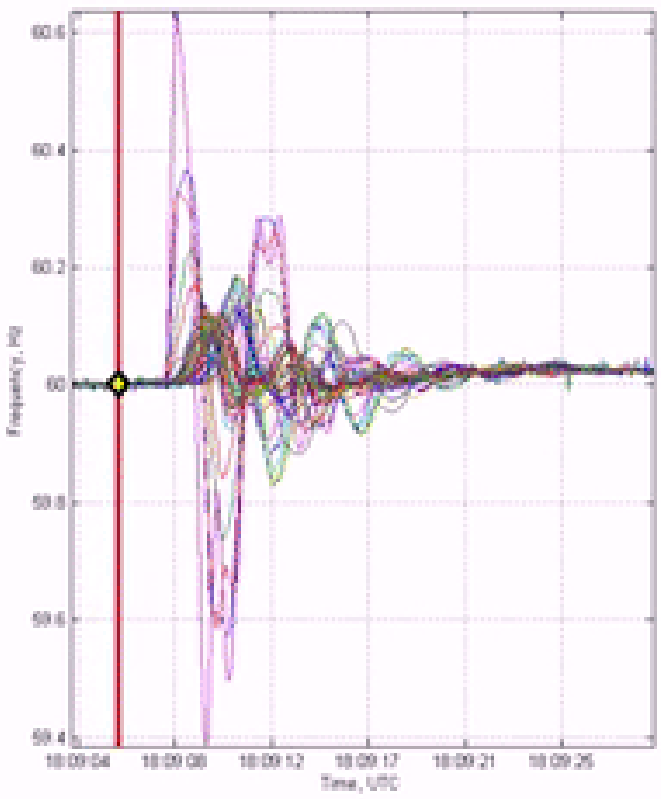
- Retirement/displacement of conventional generation
  - Variable energy resources
  - Rapid penetration of inverter-based and asynchronous resources
- Essential Reliability Services
  - Inertia
  - Frequency Response
  - Voltage Support
  - Ramping and flexibility
- New load characteristics
- System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

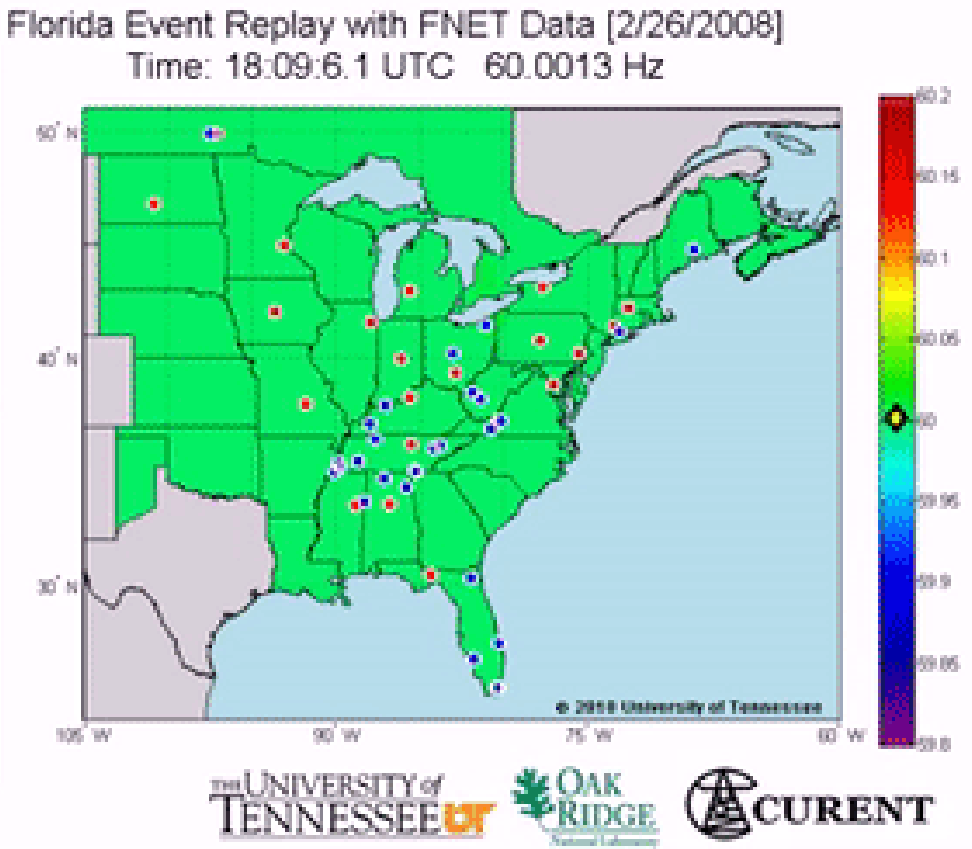
# Essential Reliability Service Fundamentals



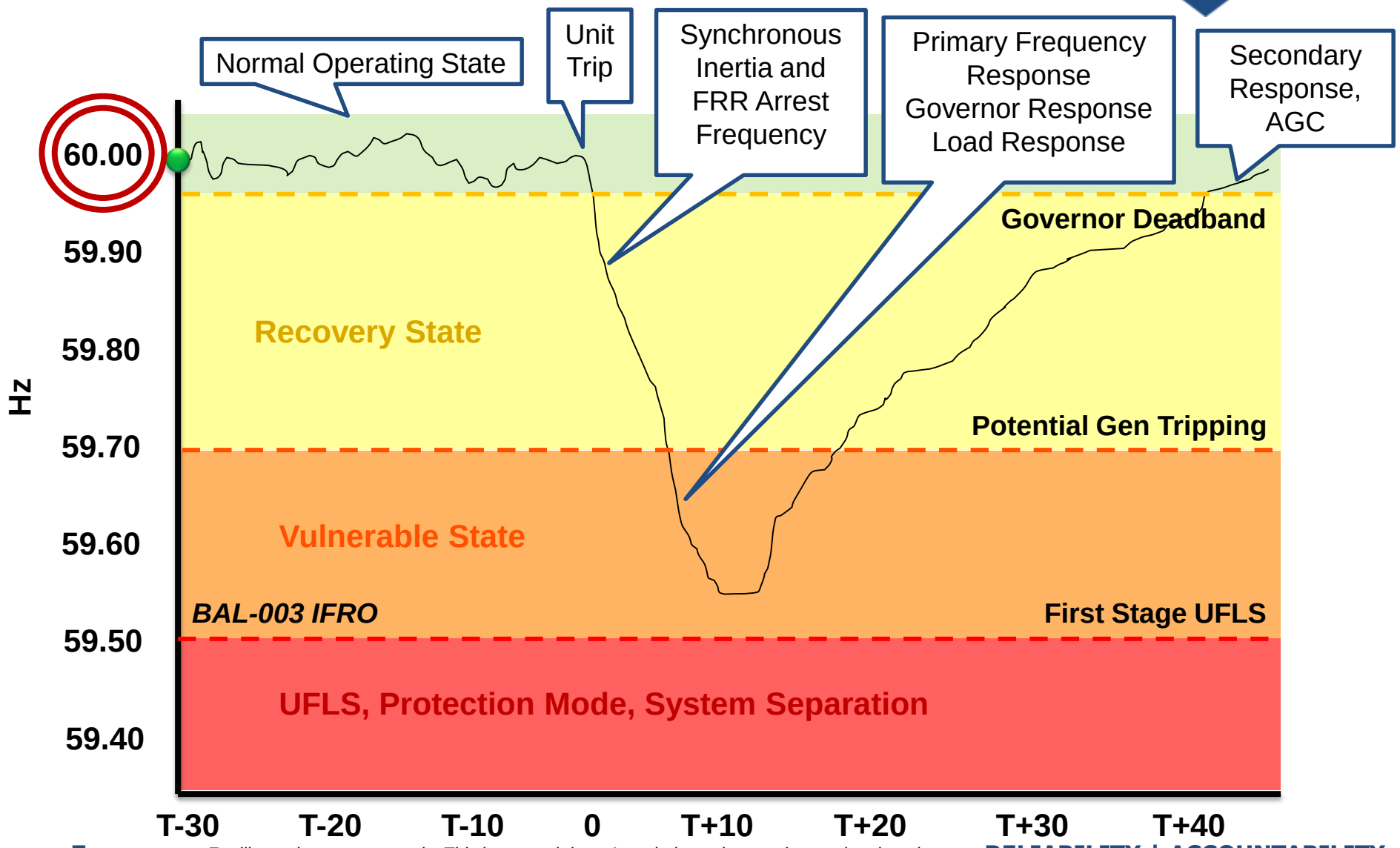

- "Building blocks" of physical capabilities
- Accentuated by resource changes
- Not all MWs are equal
- Retired services/characteristics need to be replaced
- Some partly covered through ancillary services
- Accommodate local/regional needs

# Frequency Excursion – Interconnection-wide Phenomena



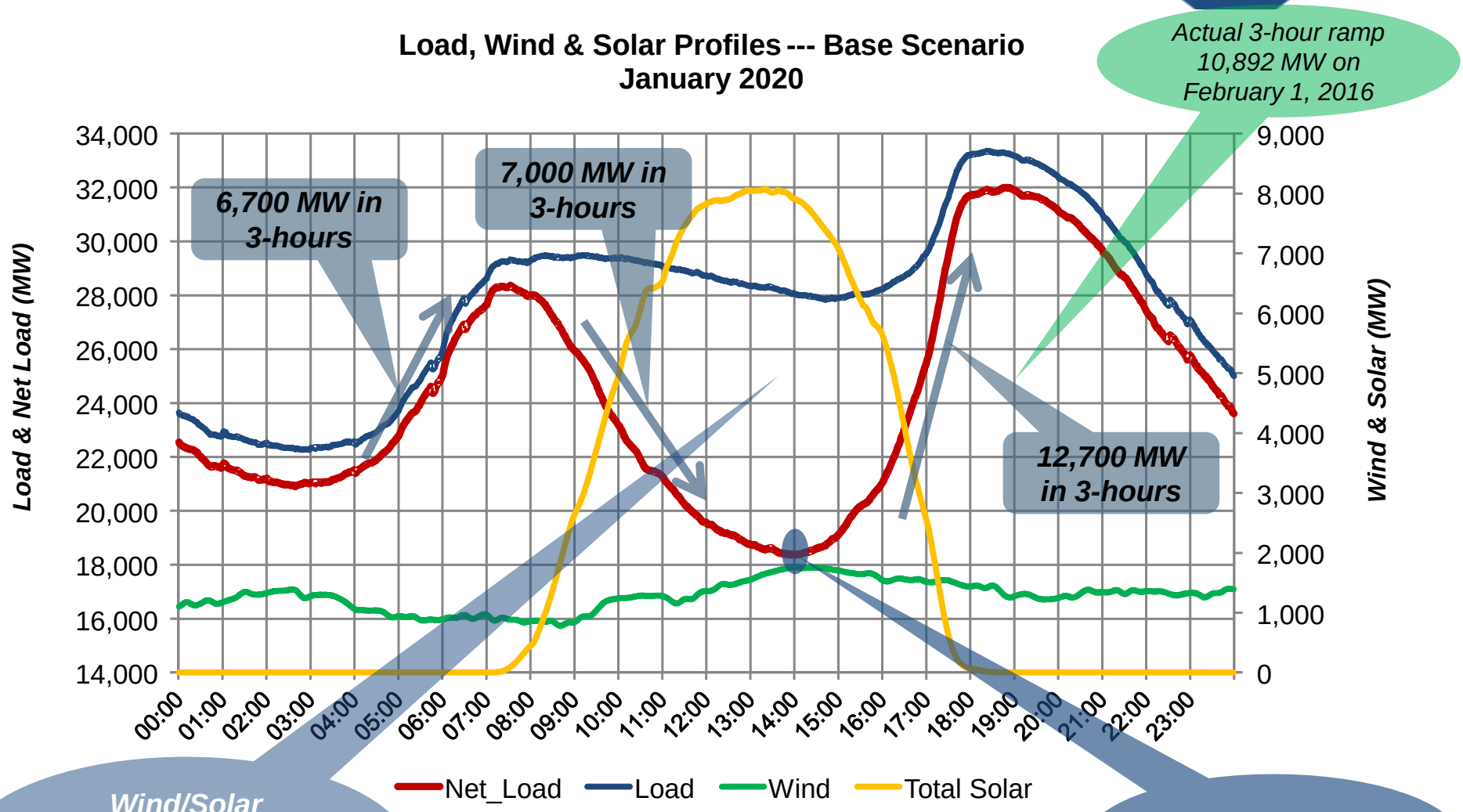


# Anatomy of a Frequency Excursion with Recovery




*For illustrative purposes only. This is not real data. Actual trip settings and operational modes are different for each interconnection and not fixed at the levels shown.*

# The Need For Flexibility



# Closing Remarks

- Profound changes occurring on the BPS—resources and policies
- Lots of uncertainty in the future
  - Nuclear generation, carbon regulation, increasing dependency on natural gas, climate change initiatives, transmission expansion
- Maintaining a diverse resource mix can increase resilience, flexibility, and reliability
- New system behaviors and characteristics require new measurements for reliability
  - Reserve Margin may not be the most important metric
- Changes occurring irrespective of environmental regulations, but rules exacerbate the potential reliability impacts
- NERC Reliability Standards must be maintained
- Time needed to engineer the solutions!

# Questions and Answers