NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

2019 State of Reliability Report

Mark G. Lauby
Senior Vice President and Chief Engineer

RELIABILITY | ACCOUNTABILITY




Key Findings and Recommendations

- High Reliability in 2018, No Non-Weather Category 3, 4, or 5 events
  - Hurricane Michael and Florence Category 3
- Extreme weather events continue to be leading contributor to the largest generation and distribution outages
- Better than expected performance from Texas generation fleet helped meet 2018 summer peak demand; reliability risk in 2019 due to continued capacity deficit
- Continued downward misoperation rate trend
- Improving or stable frequency response performance in all interconnections
- Emerging reliability challenges identified as more inverter-based generation is added

NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

By The Numbers

4,353,740,908 MWh
2018 Actual Energy

1,028,629 MW
2018 Summer Peak Capacity

469,842 mi
Total Transmission Circuit Miles > 100kV

5,816
Number of Conventional Generating Units > 20MW

99.92%
Time with no operator-controlled load shedding

0
Category 3, 4, or 5 Events (non-weather related)

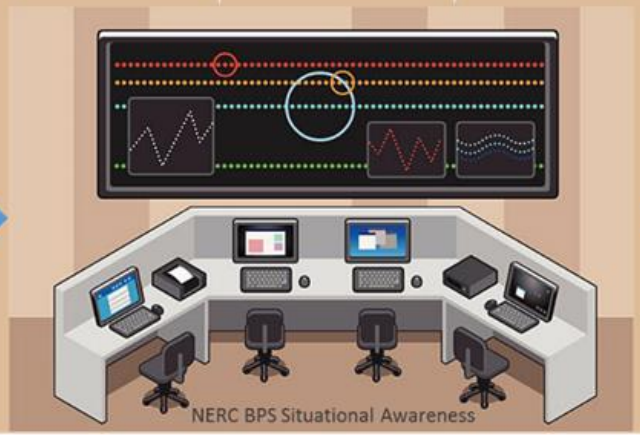
The ERO Enterprise: NERC and 7 Regional Entities

15 Reliability Coordinators
184 Transmission Operators
73 Balancing Authorities
4 Interconnections
991 Generator Owners
398 Distribution Providers

Bulk Power System Situation Awareness Inputs and Products in 2018

2,963 Intelligent Alarms
4,239 FNet Notifications
1,855 RCIS Messages

233 DOE OE-417 Reports
459 EOP-004-3 Reports
2 EOP-002-3 Reports

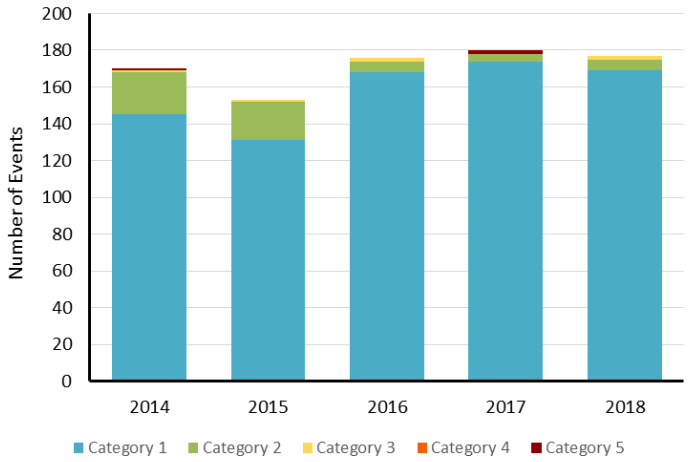


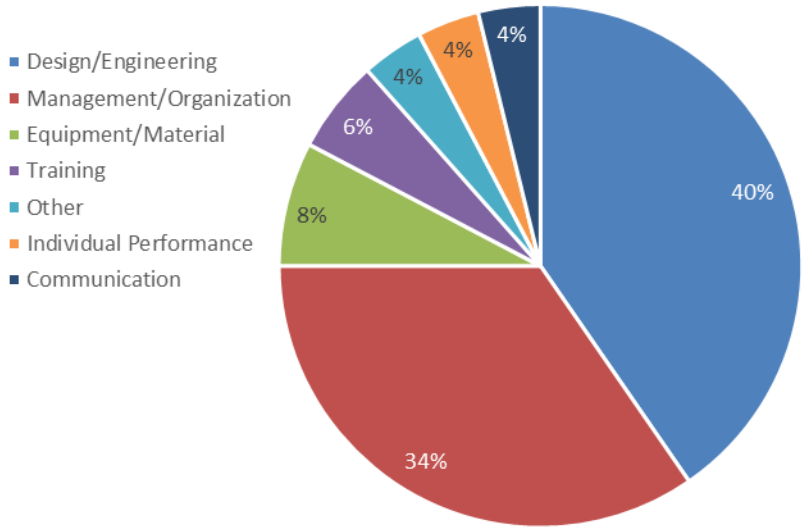
255 Daily Reports
5 Special Reports

0 Level 1 Alert
1 Level 2 Alerts

Event Analysis (2018, Trends, Causes)

Category 1	169	56 — 3 or more BPS facilities lost (1a) 7 — BPS SPS/RAS Misoperation (1c) 1 — Voltage reduction > 3% (1d) 3 — Unintended loss 1,000-1,999MW in ERCOT (1g) 102 — EMS (1h)
Category 2	6	4 — Unintended loss of load (2f) 2 — IROL Violation
Category 3	2	Hurricane Michael Hurricane Florence
Category 4	0	
Category 5	0	





2014-2018 Event Analysis Trends

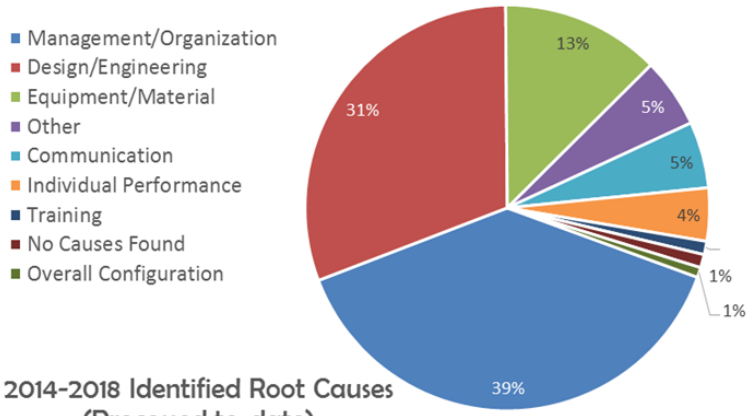
2014-2018 Event Analysis Trends

856 Event Reports

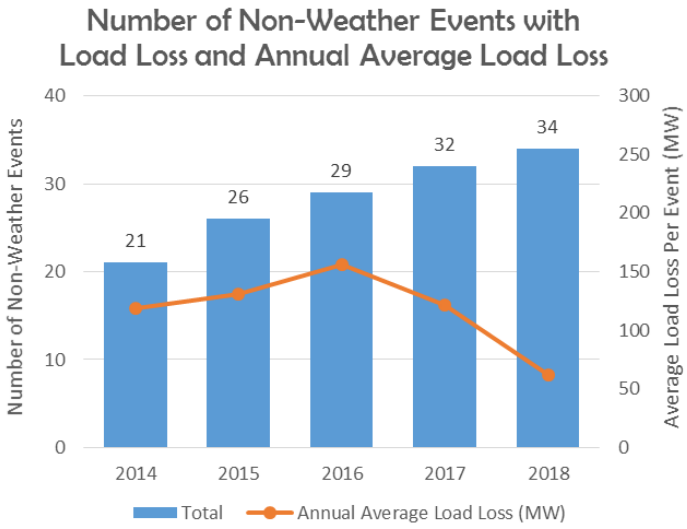
378 Identified Root Causes

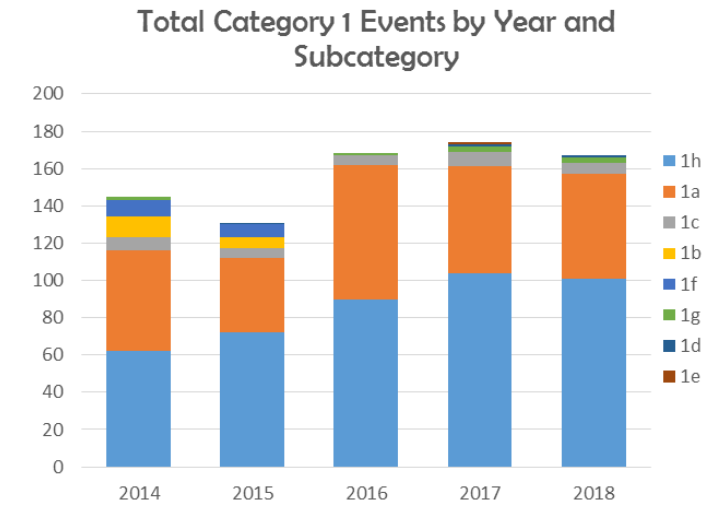
116 MW

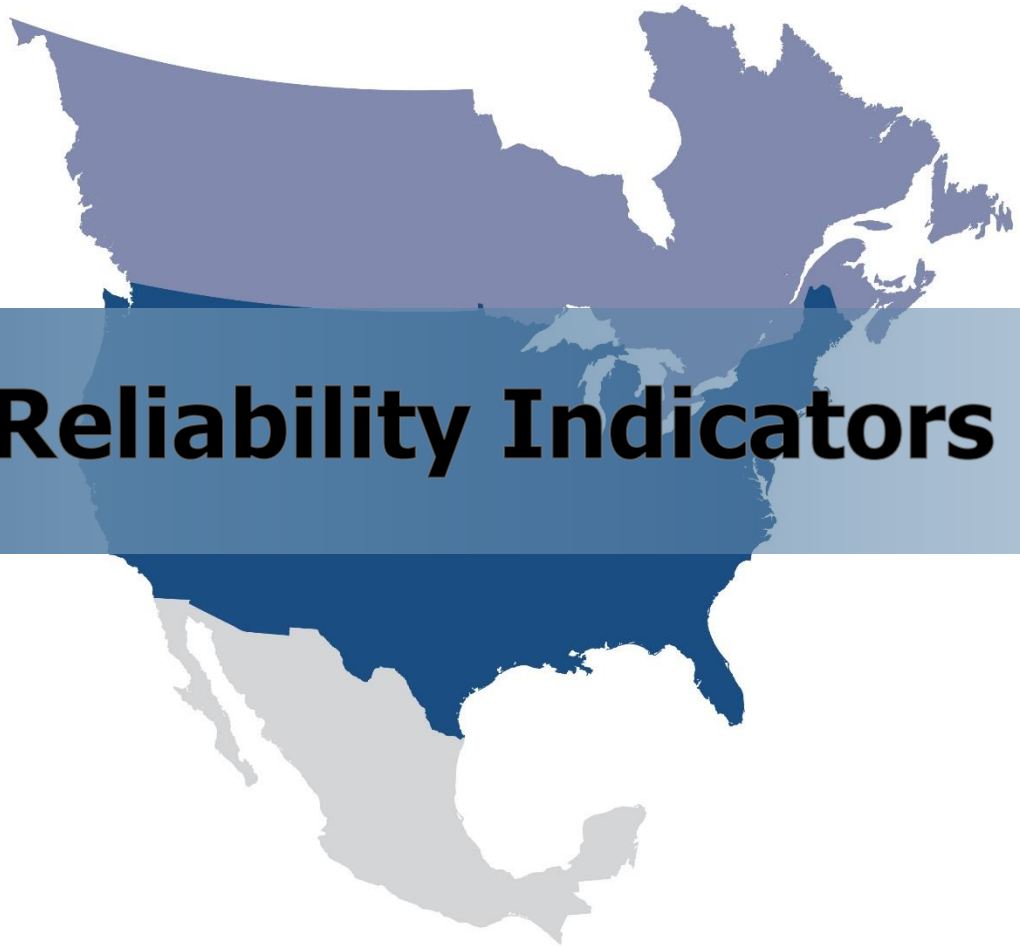
Overall (Five-Year) Average Load Loss of Non-Weather Driven Events with Load Loss



2014-2018 Identified Root Causes (Processed to-date)

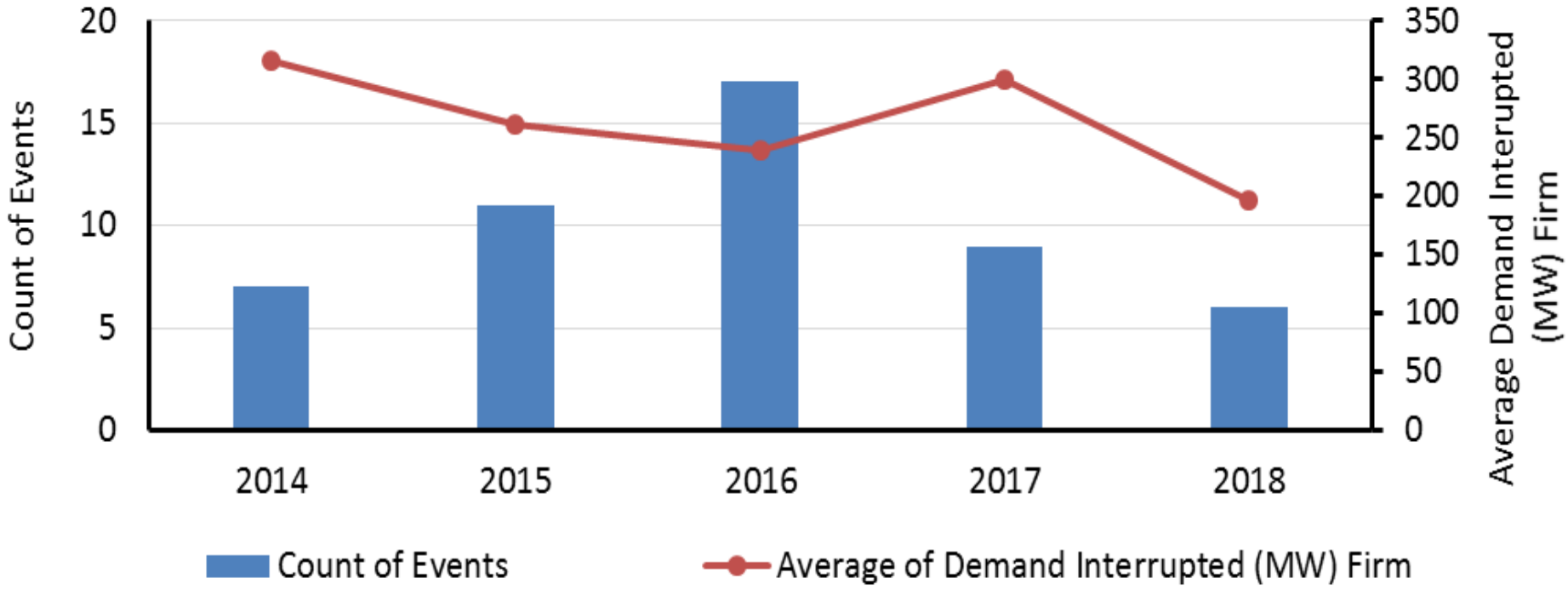




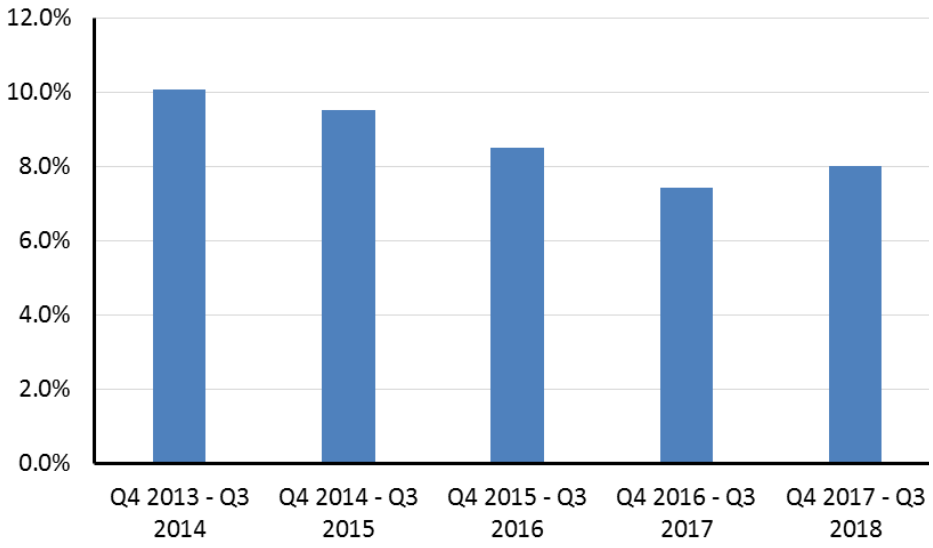


Reliability Indicators

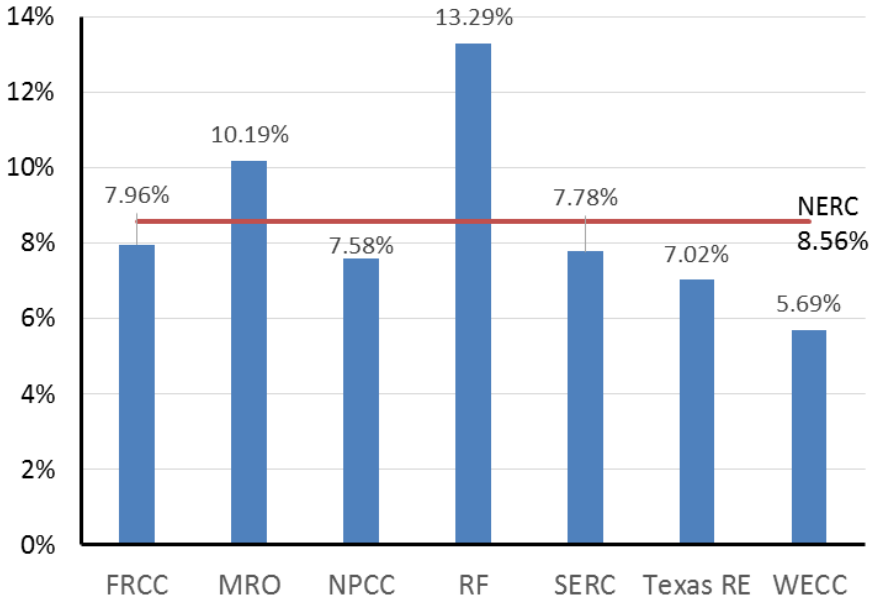
Reliability Indicator – Transmission Related Events Results in Loss of Load



Reliability Indicator – Protection System Misoperation Rate



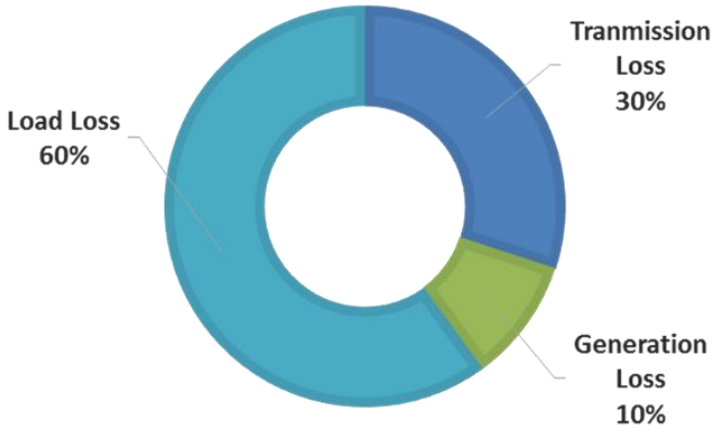
Annual Protection System Misoperation Rate



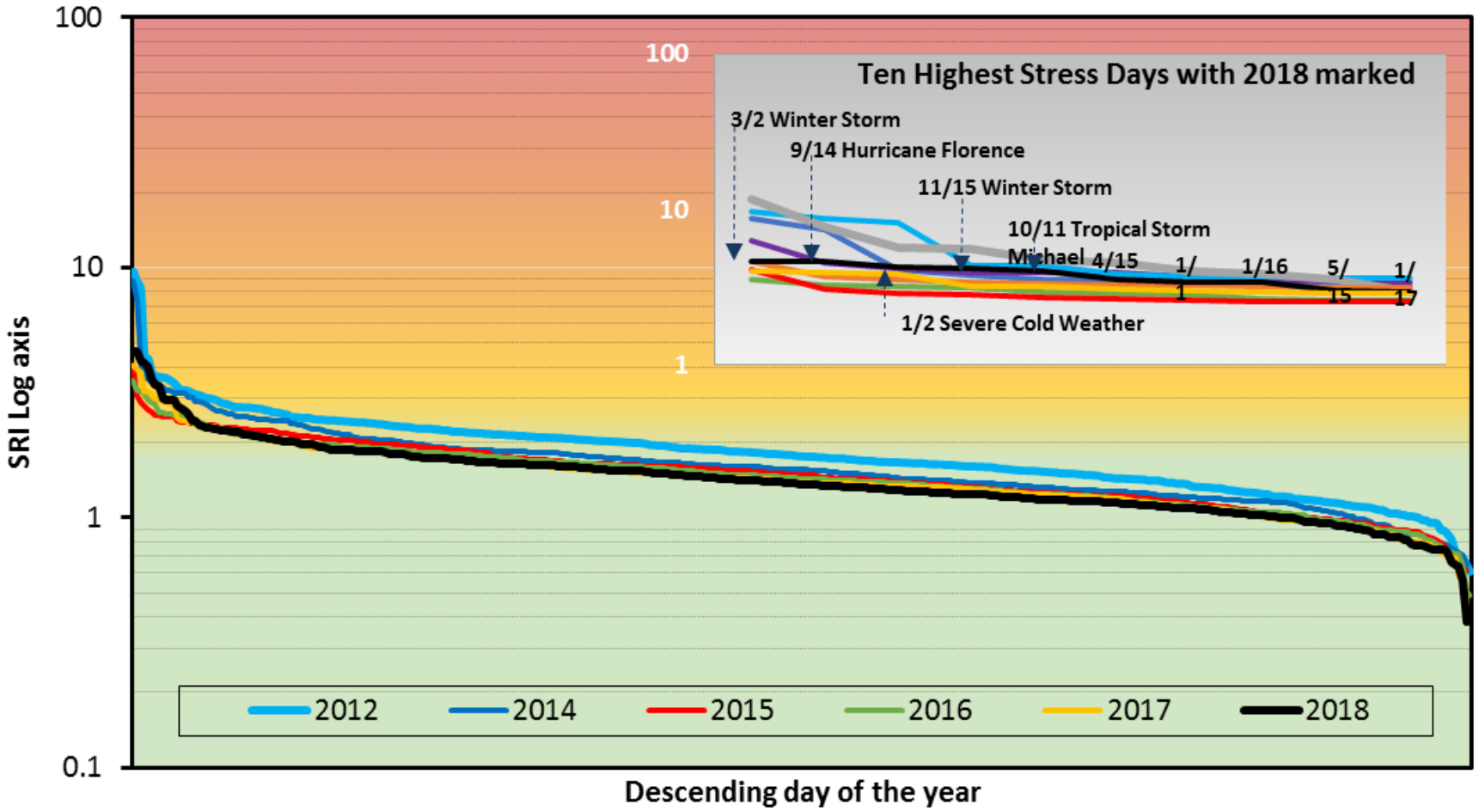
Five-Year Protection System Misoperation Rate by Region

Q4 2013 through Q3 2018

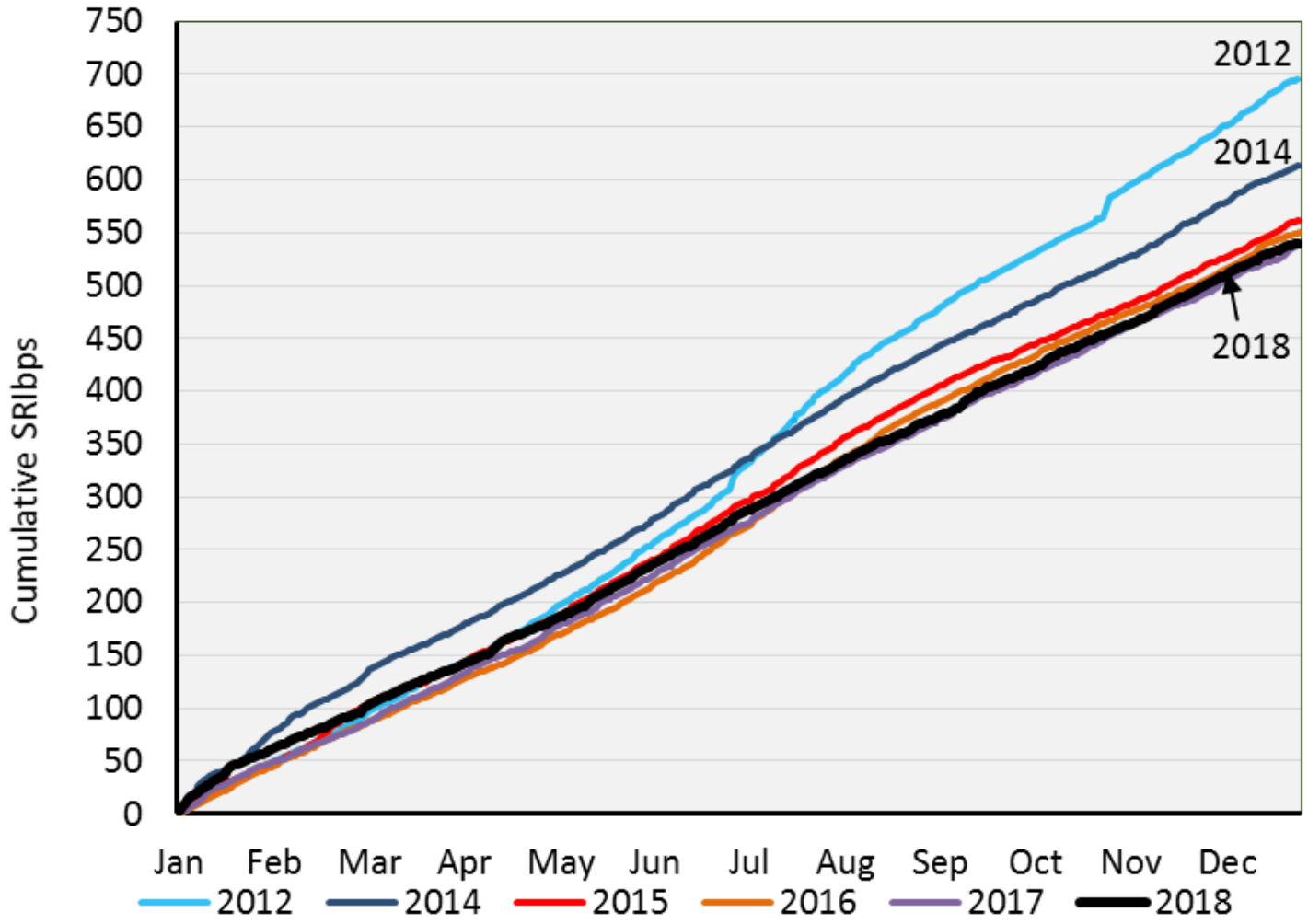
Severity Risk Index



Severity Risk Index (SRI) - Sorted

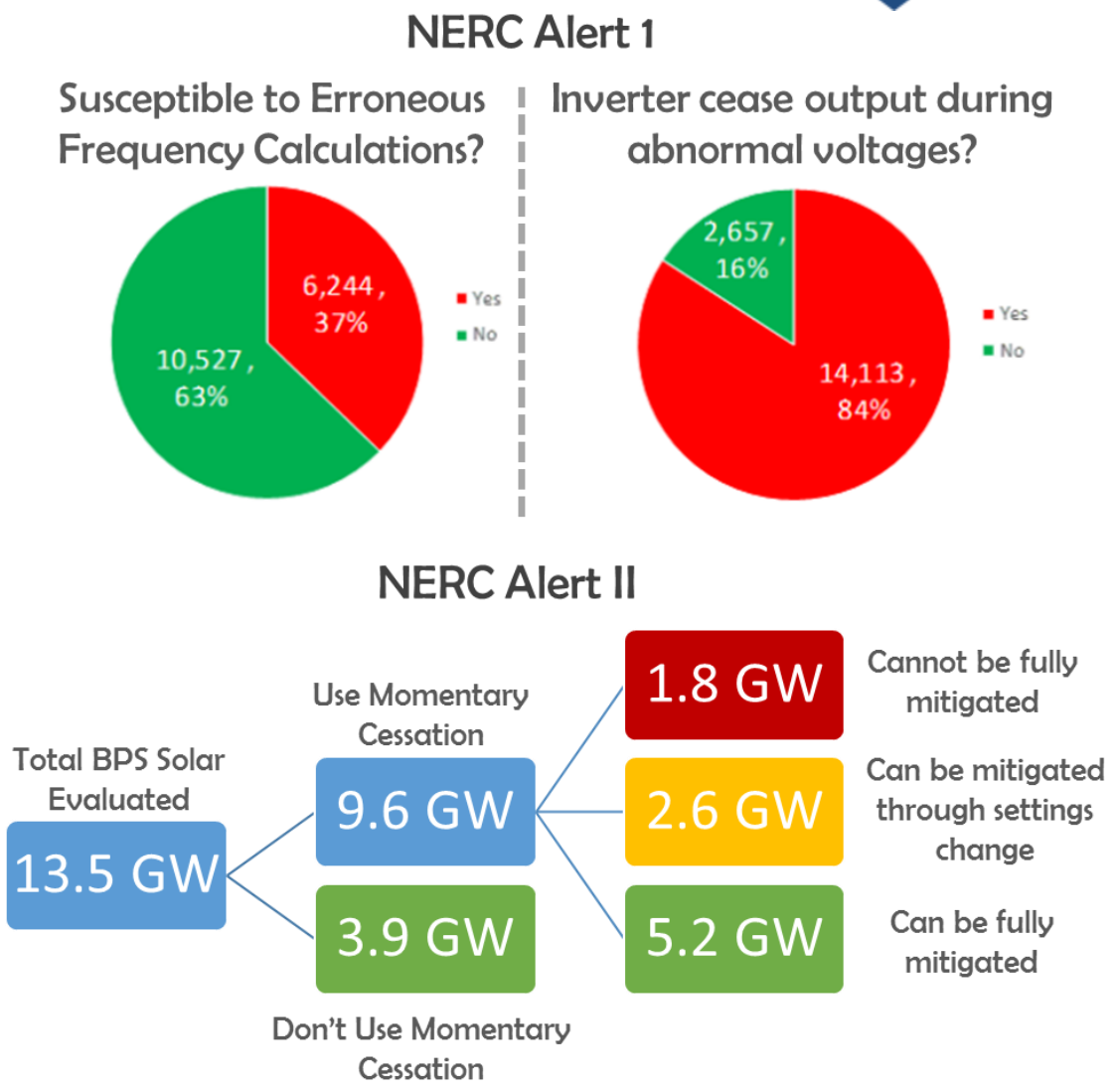


Severity Risk Index (SRI) – Cumulative



BPS Planning and Adapting to a Changing Resource Mix

- Concerns with inverter-based resource persist and mitigation strategies are being developed by the NERC Inverter-Based Resources Task Force.
- NERC Alert helped inform industry of the vulnerabilities associated with momentary cessation.



NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Recommendations
The ERO and Industry should:

1 - Continue improving their ability to understand, model, and plan for a system with a significantly different resource mix. Priority should be given to:

- Frequency response under low inertia conditions
- Contributions of inverter-based resources to essential reliability services
- Increasing protection system and restoration complexities with increased inverter-based resources
- Resource adequacy with increasing energy constraints

2 - Develop comparative metrics to understand the different dimensions of resilience during extreme events and system performance changes over time.

3 - Better understand and share information on cyber and physical security threats and mitigate the risks through a variety of approaches, including resilient system design, consequence-informed planning and operation, and practicing response and recovery processes.

NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

EMP Task Force Status Update

NRC

Mark Lauby, Senior Vice President and Chief Engineer

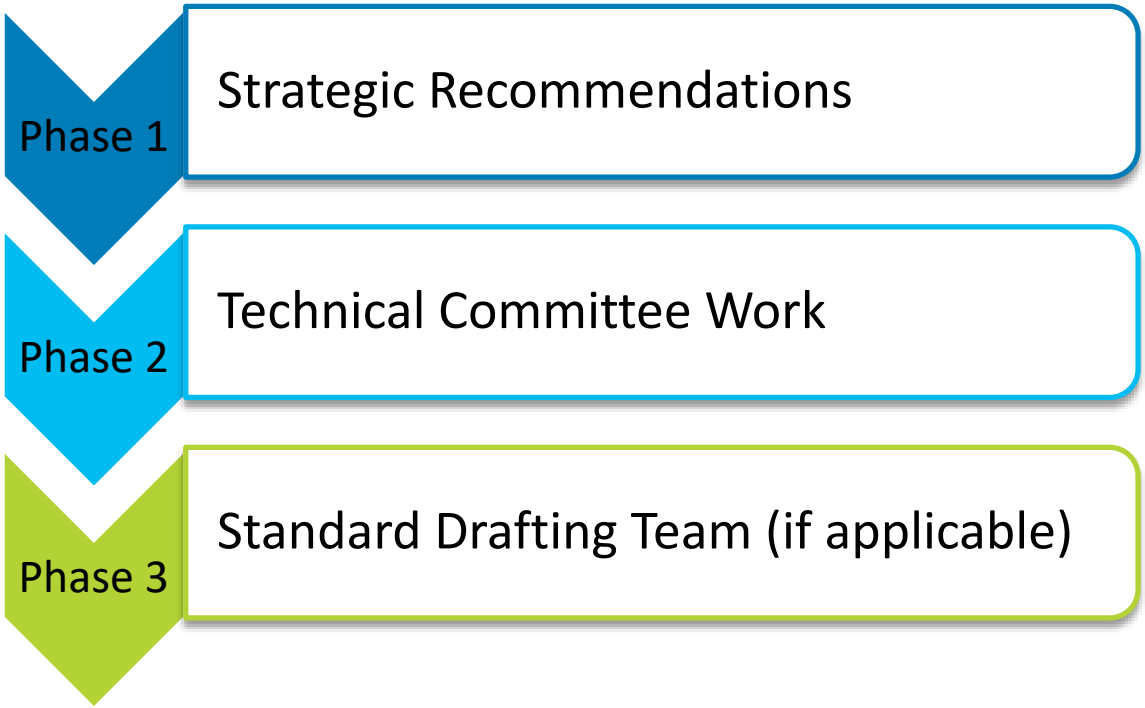
RELIABILITY | ACCOUNTABILITY




Purpose

- **May 2019:** NERC launched a Task Force to identify reliability concerns associated with EMPs and potential methods for promoting resilience
- The Task Force advises NERC, regulators, Regional Entities, and industry stakeholders to establish a common understanding of the scope, priority, and goals for the development of next-steps to address resilience to HEMP events

EMP Task Force: Phased Approach



EMP Task Force: Report Structure

- The Task Force has broken up the topic of EMP as it relates to the utility industry in the following categories:
  - **Policy –** What needs to be clearly defined by industry and federal government
  - **Research –** What research is needed to prudently inform utilities that need to make decisions
  - **Vulnerability Assessments –** How does the utility industry take the policy and research to understand its vulnerability
  - **Mitigation Guidelines –** Fundamental suggestions and guidelines on prudent mitigation strategies
  - **Response and Recovery –** Based on the vulnerability assessments and any mitigation guidelines, for any impacted facilities, how does a utility respond and recover

Questions and Answers