

NERC

NORTH AMERICAN ELECTRIC
RELIABILITY CORPORATION

A Changing Risk Environment Requires Extraordinary Action

A Bulk Power System Reliability Perspective

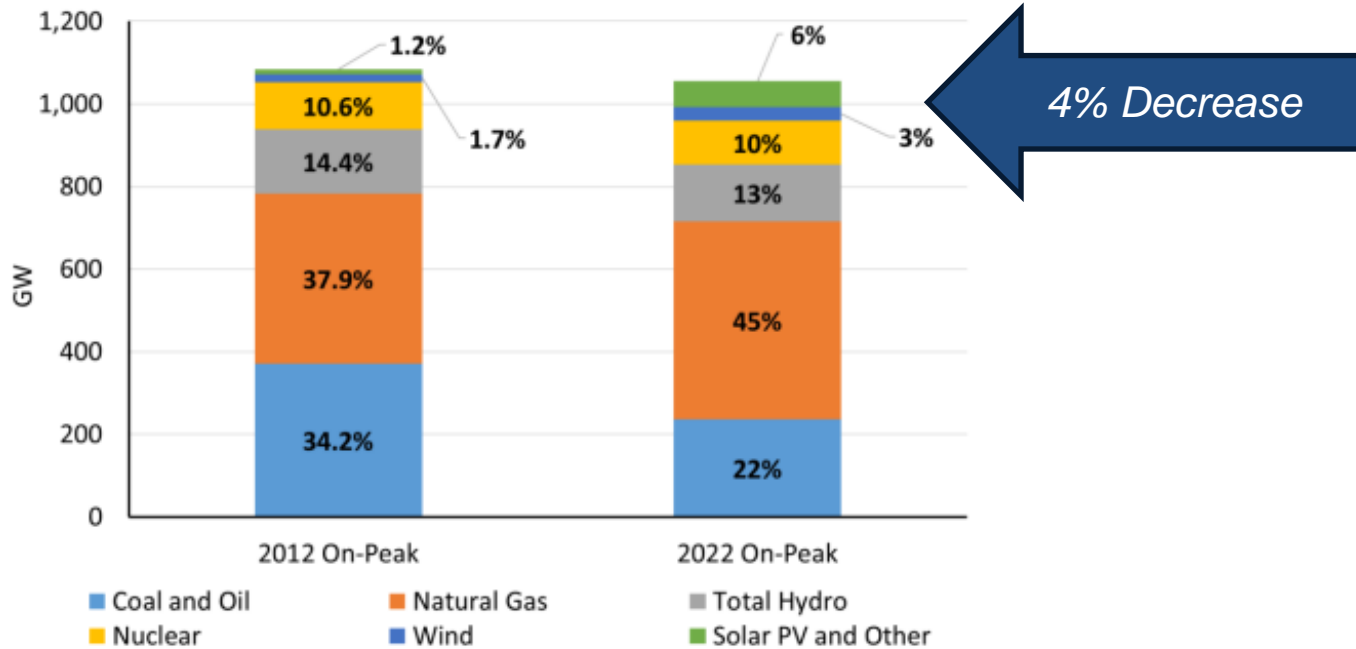
John Moura, Director - Reliability Assessment and Performance Analysis

MGA MID-GRID 2035 2.0 Quarterly Meeting

September 28, 2023

RELIABILITY | RESILIENCE | SECURITY

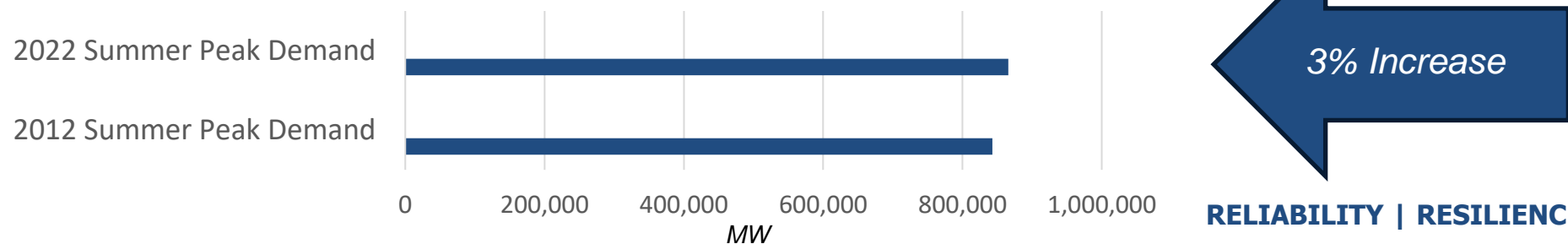
2012 and 2022 Peak Capacity Resource Mix NERC-Wide



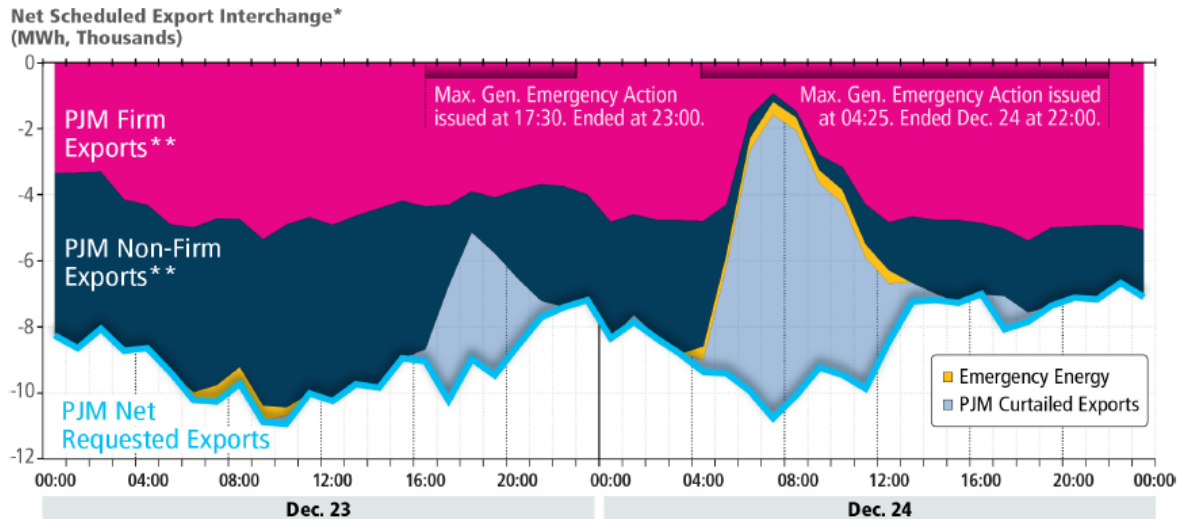
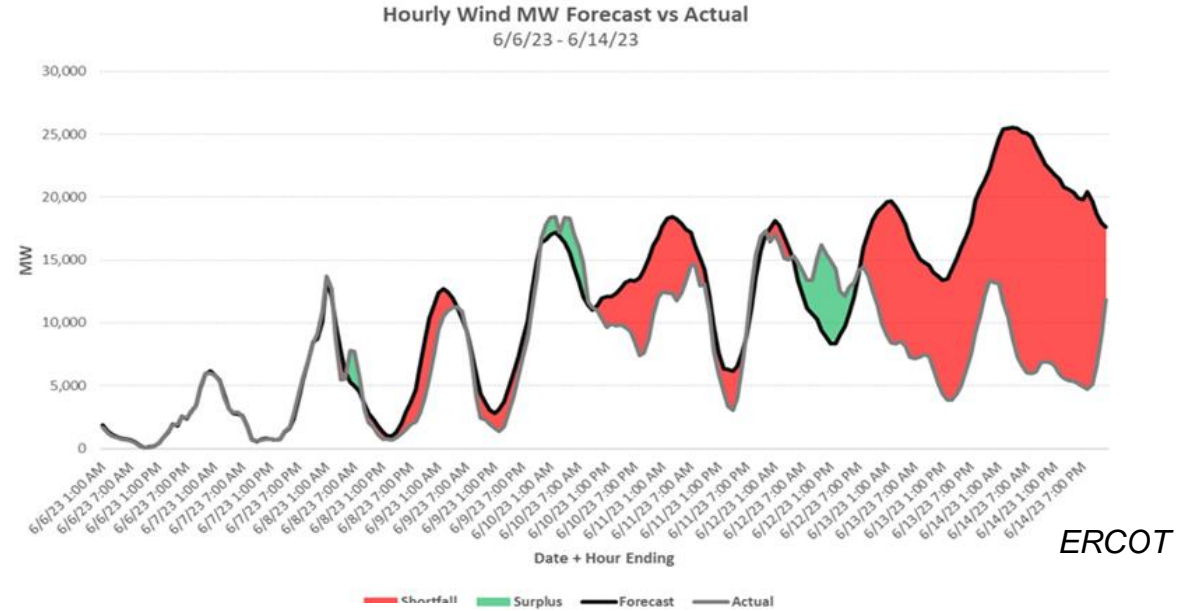
2025 Risk Areas



NERC-Wide Summer Peak Demand Changes 2012 and 2022



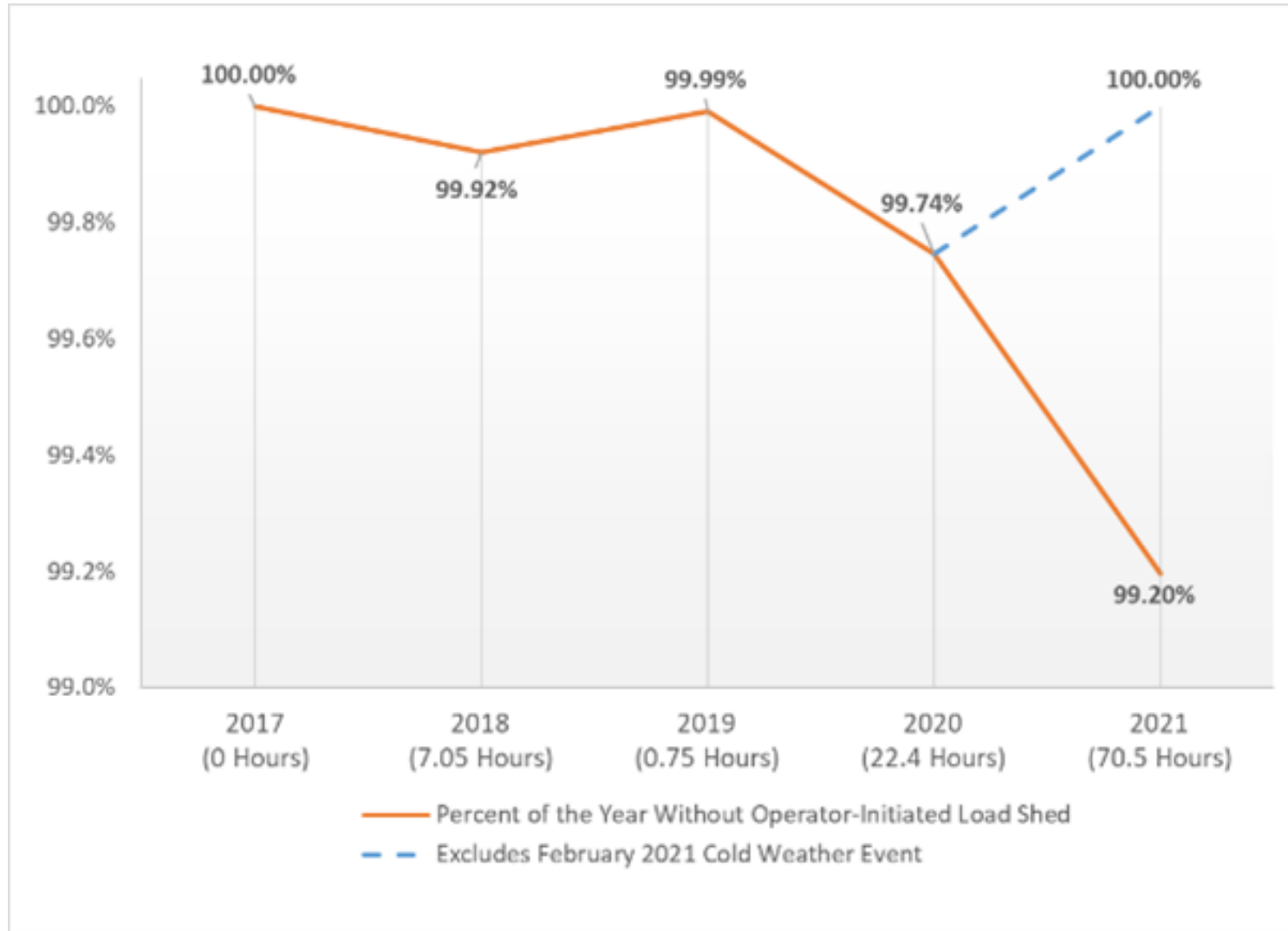
ERCOT, SPP, MISO: A “wind drought” caused 60 GW of installed wind capacity to generate 300 MW



PJM: Transmission system during extreme cold weather limited the ability to export to support southern neighbors



Hours Without Operator-Initiated Firm Load Shed (%/year)



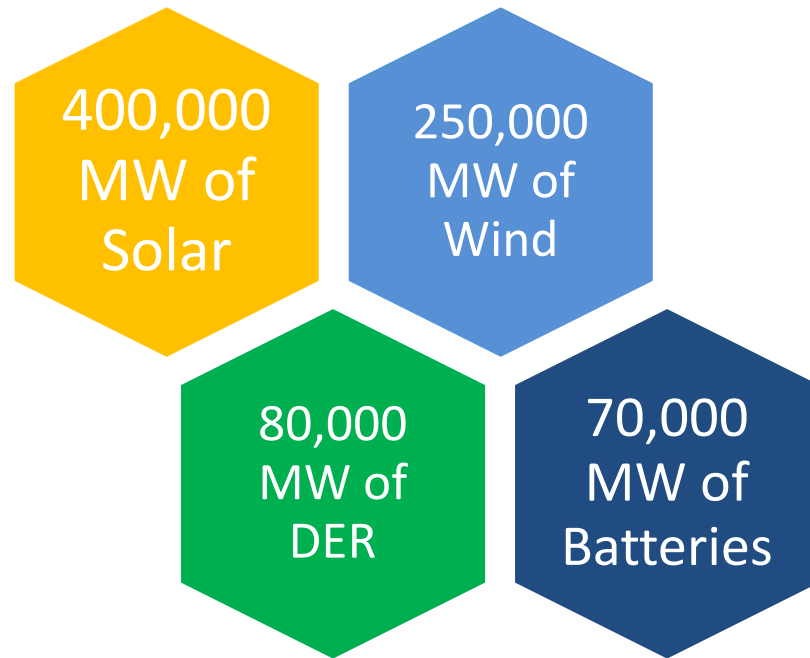
2021

- 10 EEA-3 Alerts
- 1,015 GWh unserved energy
- Occurred February

Similarities to Past Extreme Cold Weather Events

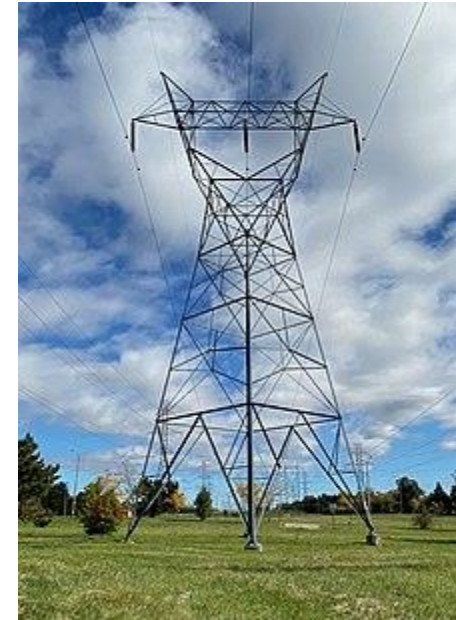
	2011 Event	2014 Event	2018 Event	2021 Event	2022 Event
Significant levels of incremental unplanned electric generating unit losses with top causes found to be mechanical/electrical, freezing, and fuel issues.	✓	✓	✓	✓	✓
Significant natural gas production decreases occurred, with some areas of the country more severely affected.	✓			✓	✓
Short-range forecasts of peak electricity demands were less than actual demands for some BAs in event area	✓		✓	✓	✓

How are we going to integrate...



without more of this....

Through 2033



Planned Upcoming Reports:

- BESS-Related Events in California in 2022
- UT Wind - First event outside California and Texas (Recently Published)



<https://www.nerc.com/pa/rrm/ea/Pages/Major-Event-Reports.aspx>



Rapidly Changing Resource Mix

- Retirements of traditional generation
- Natural gas interdependencies
- Inverter-Based Resource (IBR) integration
- DER performance and visibility



Extreme Weather Complexities

- Extreme not infrequent
- Broader deeper longer



Energy & Environmental Policy

- Electrification
- Emissions
- Transmission

8



Rapidly Evolving Threat Landscape

- S/W vulnerabilities
- Supply chain
- Ransomware
- Physical attacks



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Rapidly Evolving Threat Landscape

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Fuel assurance/uncertainties

- Natural gas
- Renewables

Loss of key “essential reliability services” with retirements

- Inertia/frequency response
- Reactive Power/voltage support
- Dispatchability

Appropriate level of investment in infrastructure for hardening & resilience

- Extreme weather
- Coordinated Physical attack
- Insufficient transfers

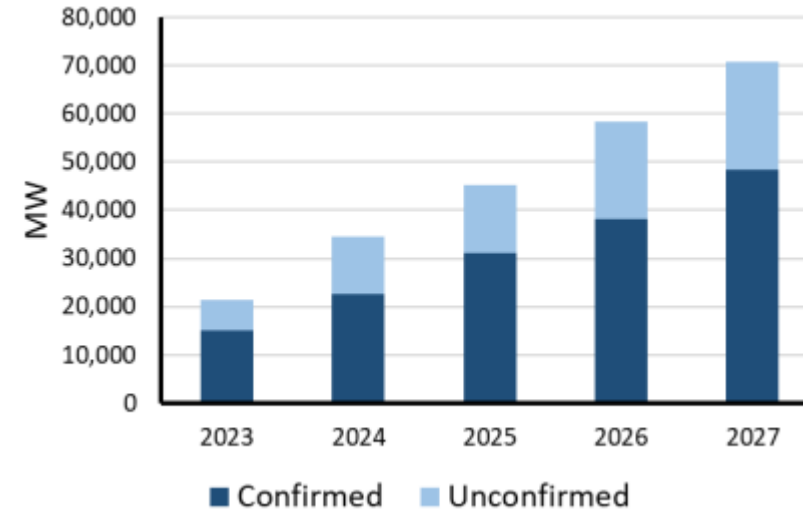
Expanding cyber attack surface

- Industry Control Systems (ICSs)
- IBRs/DERs/EV Charging

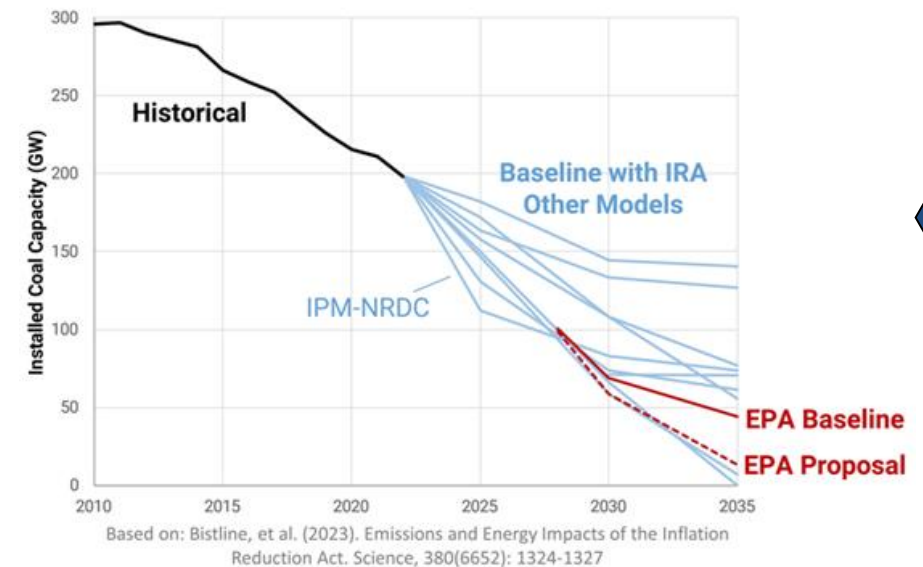
Sophistication of recent cyber attacks

- SolarWinds (one to many)
- Pipedream, Industroyer malware

- Known generator retirements totaling over 110 GW
- New and proposed U.S. EPA regulations are expected to further accelerate retirements
- **2023 Long-Term Reliability Assessment will consider updated retirement information and scenarios for assessing future resource adequacy and reliability risks**

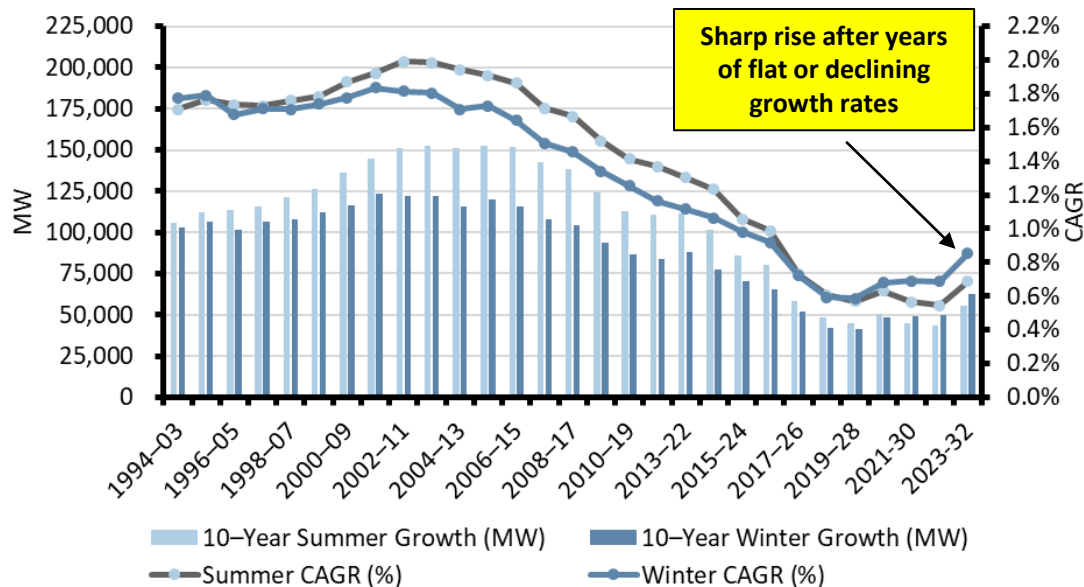


2022
NERC
LTRA



2023
EPRI

- 10-year Peak Demand and Energy growth showed largest increases in years
 - Further increases from electrification and EV adoption are anticipated
- Peak demand growth is accelerating
- **Growth in some areas is affecting adequacy of reserves and seasonal energy risks**



2022 LTRA 10-year Summer and Winter Peak Demand Growth

Largest 10-year Winter Peak Demand Growth		Largest 10-year Summer Peak Demand Growth	
Assessment Area	Demand Change	Assessment Area	Demand Change
NPCC-New York	2.36%	WECC-SRSG	1.69%
WECC-SRSG	2.06%	NPCC-Ontario	1.27%
NPCC-New England	1.95%	WECC-CAMX	1.19%
NPCC-Ontario	1.32%	MRO-SaskPower	1.05%
Texas RE-ERCOT	1.30%	NPCC-Maritimes	1.03%



Energy: Tackle the challenge of grid transformation and climate change-driven, extreme weather



Security: Move the needle by focusing on supply chain, Information Technology (IT) and Operational Technology (OT) system monitoring, cyber design, and evolution of the Critical Infrastructure Protection (CIP) Standards



Agility: Tool the company to be more nimble in key areas, particularly standards development, internal operational processes



Sustainability: Invest in ERO systematic controls, eliminate single points of failure, strengthen succession planning, and ensure robust cyber security protections for all systems



Reliability Guideline

Suggested approaches or behavior in a given technical area for the purpose of improving reliability. Guidelines are not enforceable, but may be adopted by a responsible entity in accordance with its own policies, practices, and conditions.



NERC Alert: Level 2-3

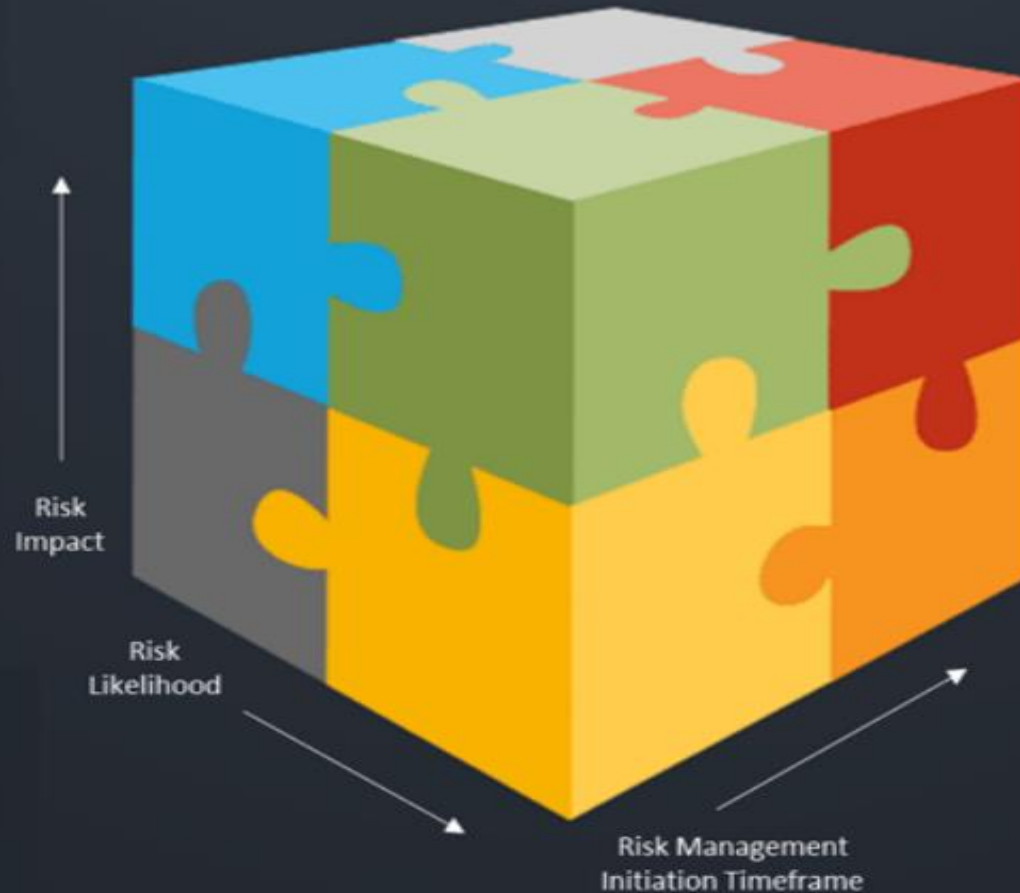
NERC alerts are divided into three distinct levels, 1) Industry Advisory, 2) Recommendation to Industry, and 3) Essential Action, which identifies actions to be taken and require the industry to respond to the ERO.



Technical Engagement

Technical Engagement is a catch-all for a variety of technical activity that is conducted between the ERO and entities. This includes, technical committee activities, technical reference documents, workshops and conferences, assist visits, joint and special studies, etc.

Electric Reliability Organization: Reliability Risk Mitigation Toolkit



Reliability Standards



NERC Reliability Standards define the mandatory reliability requirements for planning and operating the North American BPS and are developed using a results-based approach focusing on performance, risk management, and entity capabilities.

Reliability Assessment

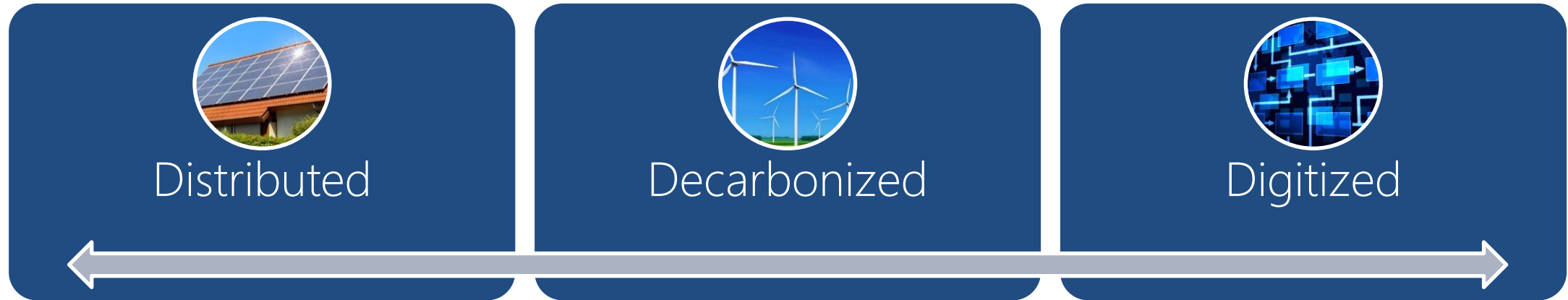


NERC independently assesses and reports on the overall reliability, adequacy, and associated risks that could impact BPS reliability. Long-term assessments identify emerging reliability issues that support public policy input, improved planning and operations, and general public awareness.

NERC Alert: Level 1



NERC Alerts are divided into three distinct levels, 1) Industry Advisory, 2) Recommendation to Industry, and 3) Essential Action, which identifies actions to be taken and require the industry to respond to the ERO.



Must Wins:

1. **Manage the pace of transformation** through market mechanisms and inter-agency coordination on policies that impact generation
2. Develop sufficient **transmission**, to integrate renewables and distribute them, make the system more resilient
3. Maintain a robust fleet of **balancing resources**, with an ability to provide **Essential Reliability Services**
4. Ensure a robust **energy supply chain** for the balancing resources, with sufficient access to fuel and stored energy to withstand long-duration, wide-spread extreme weather events
5. **STATES:** Refine resource adequacy requirements that preserves energy assurance



Questions and Answers