WELCOME TO TECHNICAL TALK WITH RF – ENERGY POLICY EDITION

February 12, 2024

TECHNICAL TALK WITH RF

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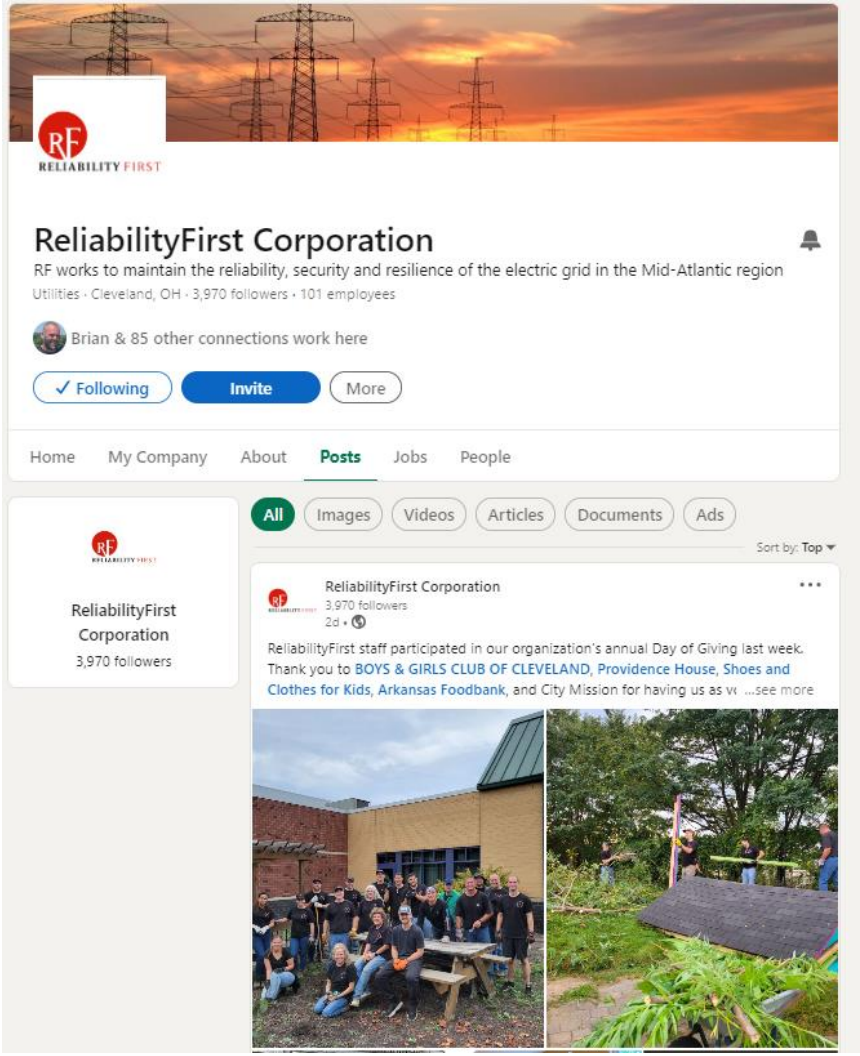

TECH TALK REMINDERS

Please keep your information up-to-date

- CORES, Generation Verification Forms, Entity Profile Questionnaires (quarterly)

Following an event, send EOP-004 or OE-417 forms to disturbance@rfirst.org

CIP-008-6 incident reports are sent to the E-ISAC and the DHS CISA

Read our monthly CMEP update and quarterly newsletter:

- 2023 ERO Periodic Data Submittal schedule
- Timing of Standard effectiveness

BES Cyber System Categorization (CIP-002-5.1a)

- Assess categorization (low, medium, or high) regularly and notify us of changes

CIP Evidence Request Tool V8.1 was released and is on NERC's website

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TECH TALK ANNOUNCEMENT

U.S. DEPARTMENT OF ENERGY
Office of Cybersecurity, Energy Security, and Emergency Response

INL Idaho National Laboratory

Cybersecurity Training for the Utility Workforce

Click here for Registration

Cybersecurity Training for the Utility Wor...

Amherst, NY
Apr 23 - 25, 2024

Register Now

Each training event will provide 3 days of lectures and hands on exercises and challenges. Registration costs for the Cybersecurity Training for the Utility Workforce will be free for participants. Participants will be expected to cover their own costs for travel, lodging, and meals. This training is designed for technical practitioners in electric utilities that require a hybrid set of skills across information technology (IT), industrial control systems and operational technology (ICS/OT), cybersecurity, and electric grid operations.

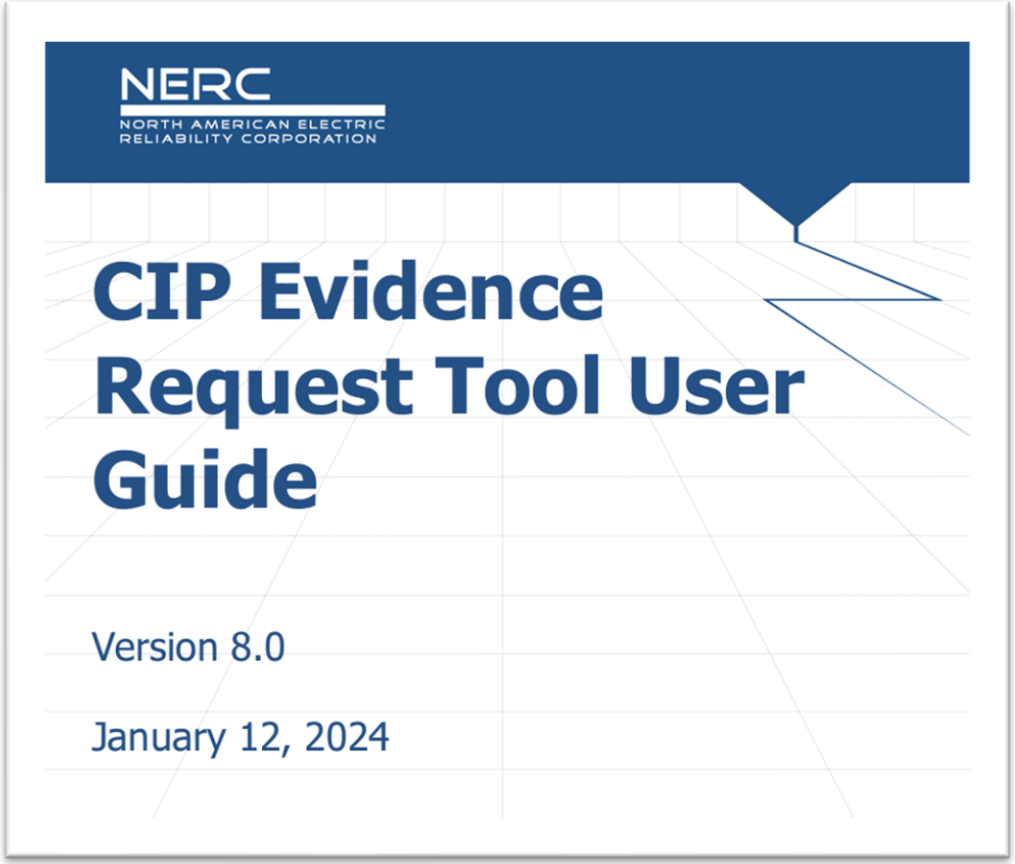
TECH TALK ANNOUNCEMENT

NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Posted ERO Enterprise Revised CIP Evidence Request Tool (ERT) v8.0

Click here for Version 8

NERC posted a revised ERO Enterprise CIP Evidence Request Tool (ERT), which is a common request for information tool for CIP Compliance monitoring engagements. The purpose of the CIP ERT is to help the ERO Enterprise with consistency and transparency in its audit approach. It will also help responsible entities (especially those that operate in multiple regions) fulfill these requests more efficiently, by understanding what types of evidence are useful in preparation for an audit.



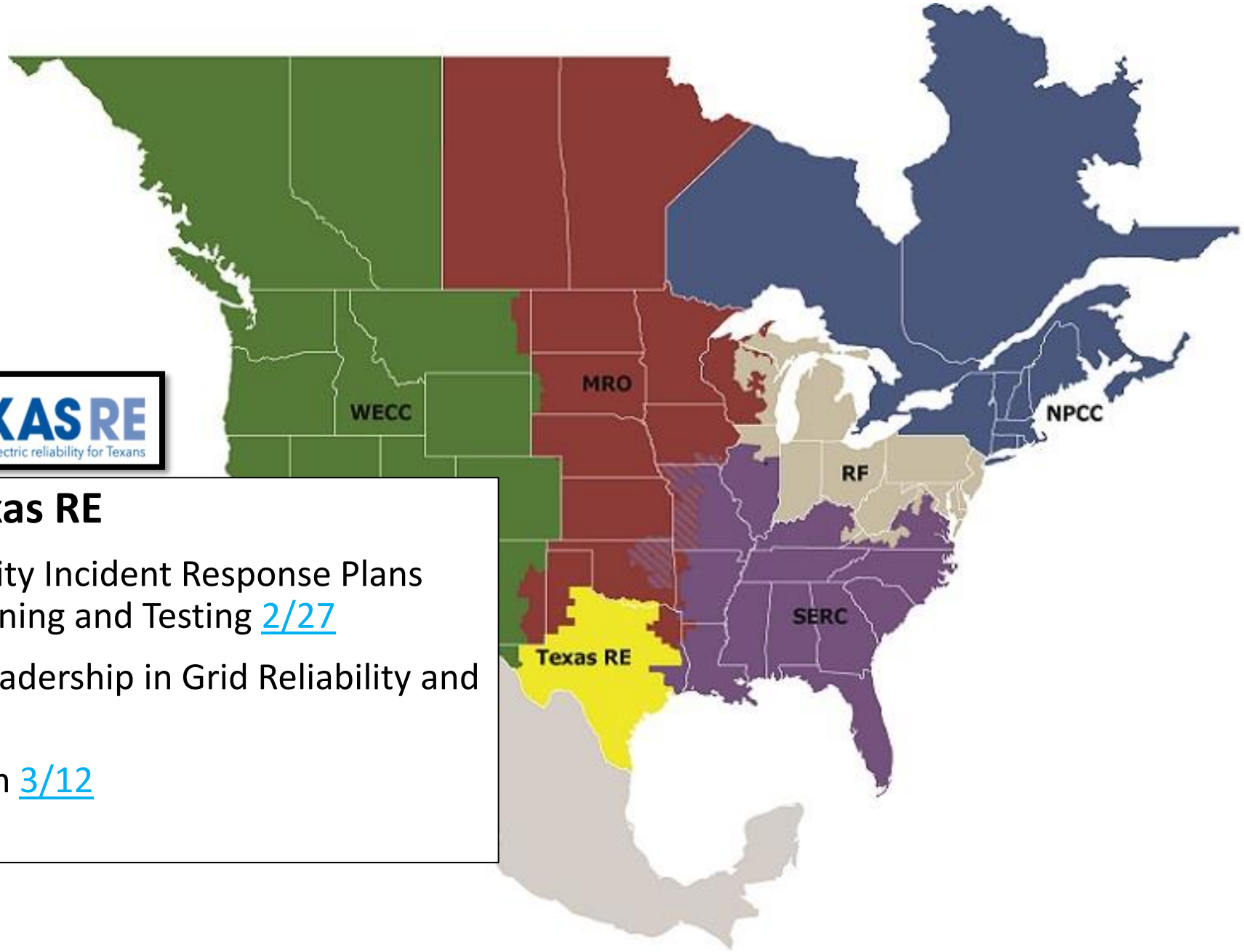
TECH TALK ANNOUNCEMENT

NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

NERC Submitted a Comprehensive Work Plan Addressing FERC Order 901 Directives

Click here to read: Announcement

NERC has submitted a comprehensive Standards Development Work Plan in support of NERC's 2024 work plan priorities around inverter-based resource reliability risks and to address directives from FERC Order 901. The work plan explains how NERC will prioritize the development of projects consistent with the timelines specified in the order, with full implementation of the resulting standards by 2030.



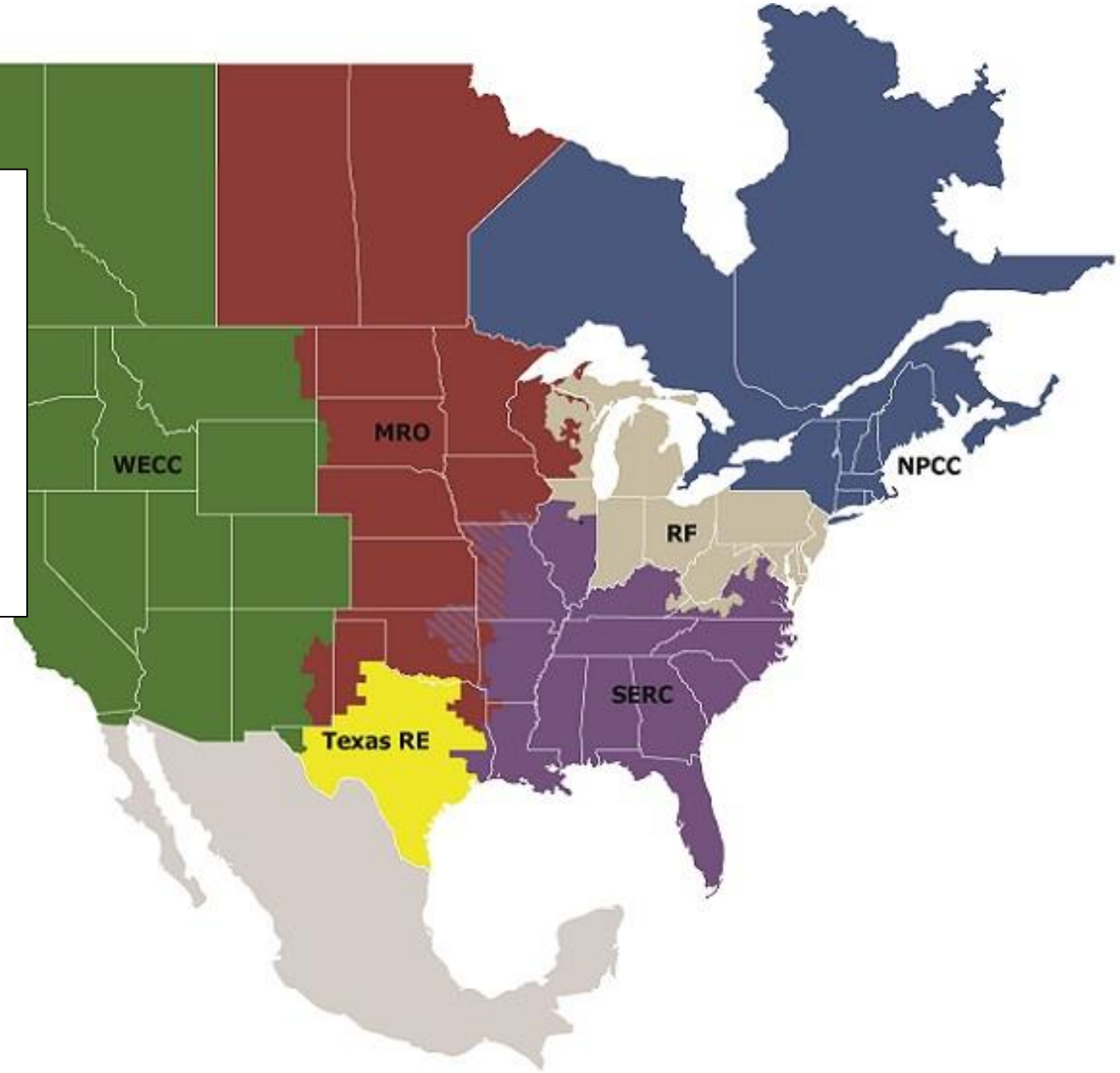
TEXAS RE
Ensuring electric reliability for Texans

Talk with Texas RE

- Cyber Security Incident Response Plans (CSIRP) Planning and Testing 2/27
- Women's Leadership in Grid Reliability and Security 3/5
- Policy Forum 3/12

Monthly Reliability and Security Monthly Webinar

- February 15



MIDWEST RELIABILITY ORGANIZATION

2023 Long-Term Reliability

MRO's Regional Risk Assessment

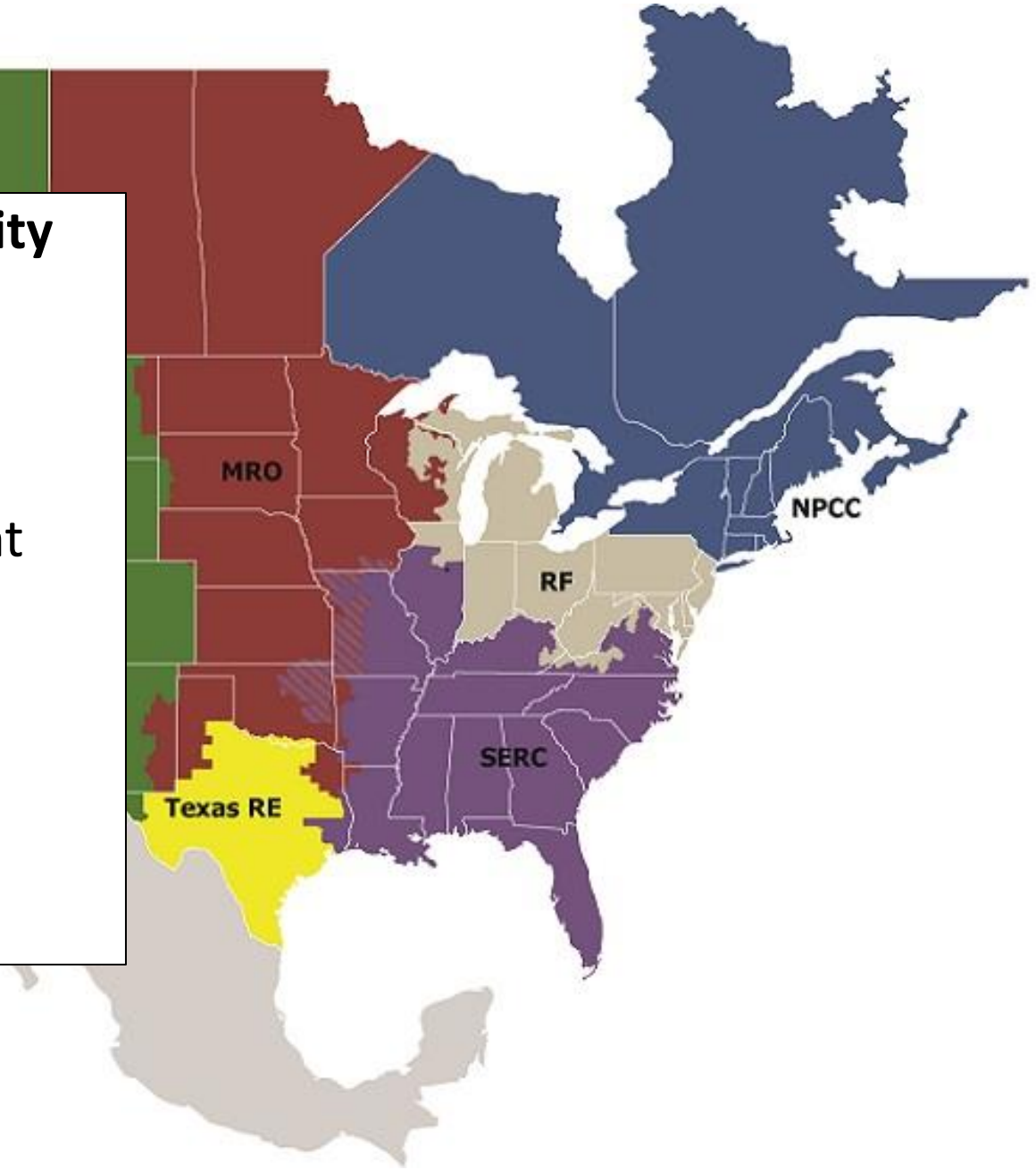
- February 28th

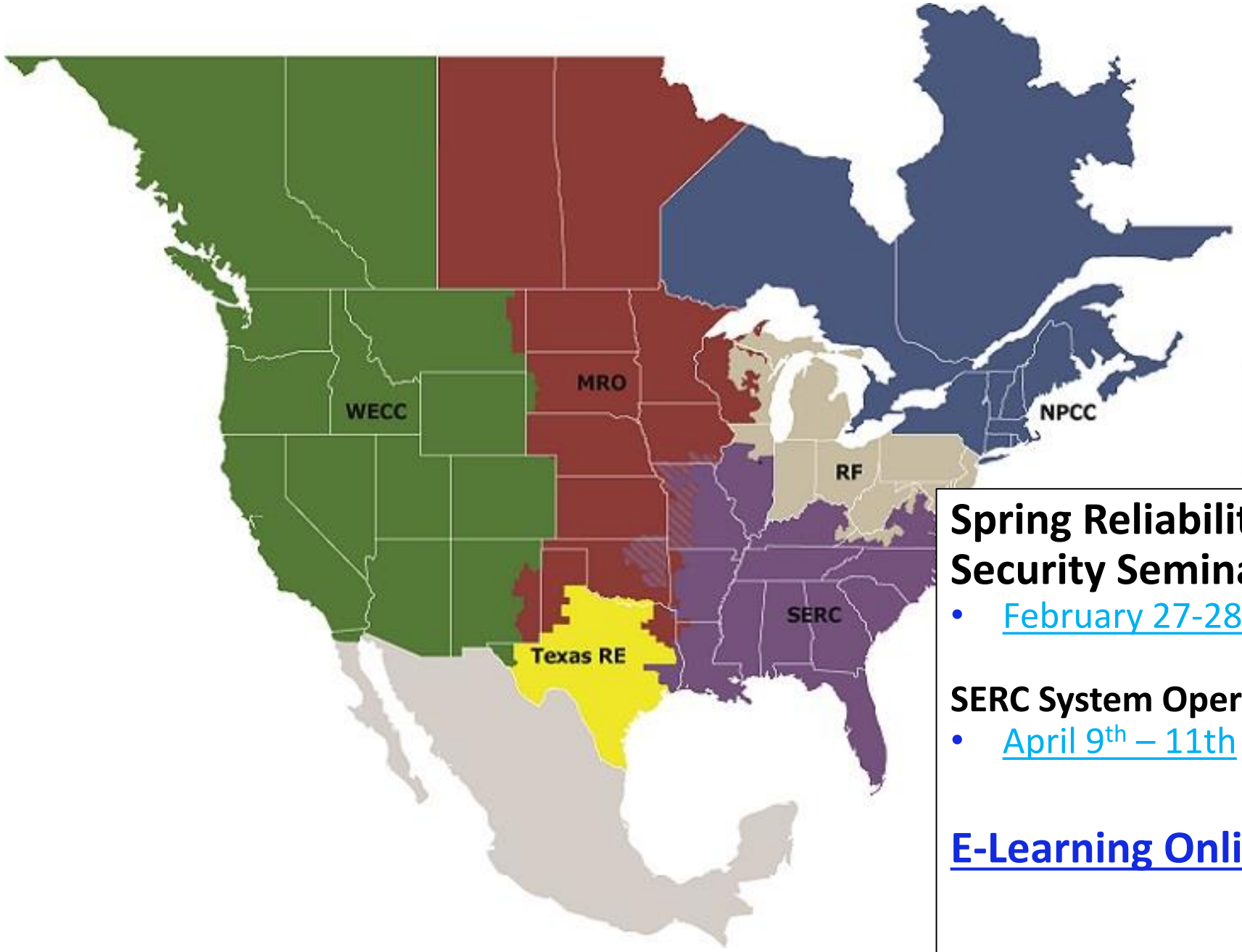
Compliance Management Tools

- February 28th

Defending Against Ransomware

- February 29th





SERC Reliability Corporation

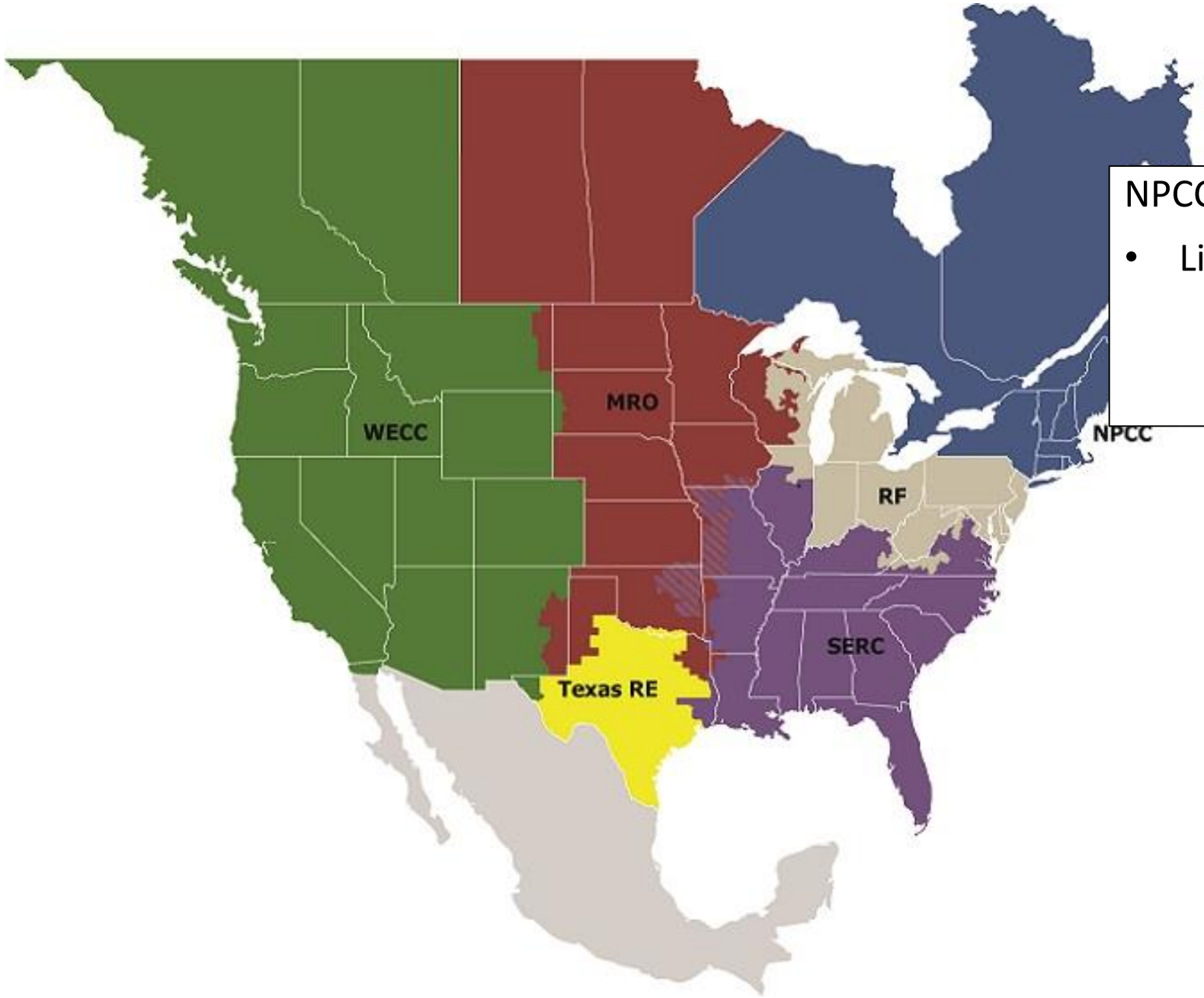
Spring Reliability and Security Seminar

- February 27-28

SERC System Operator Conference

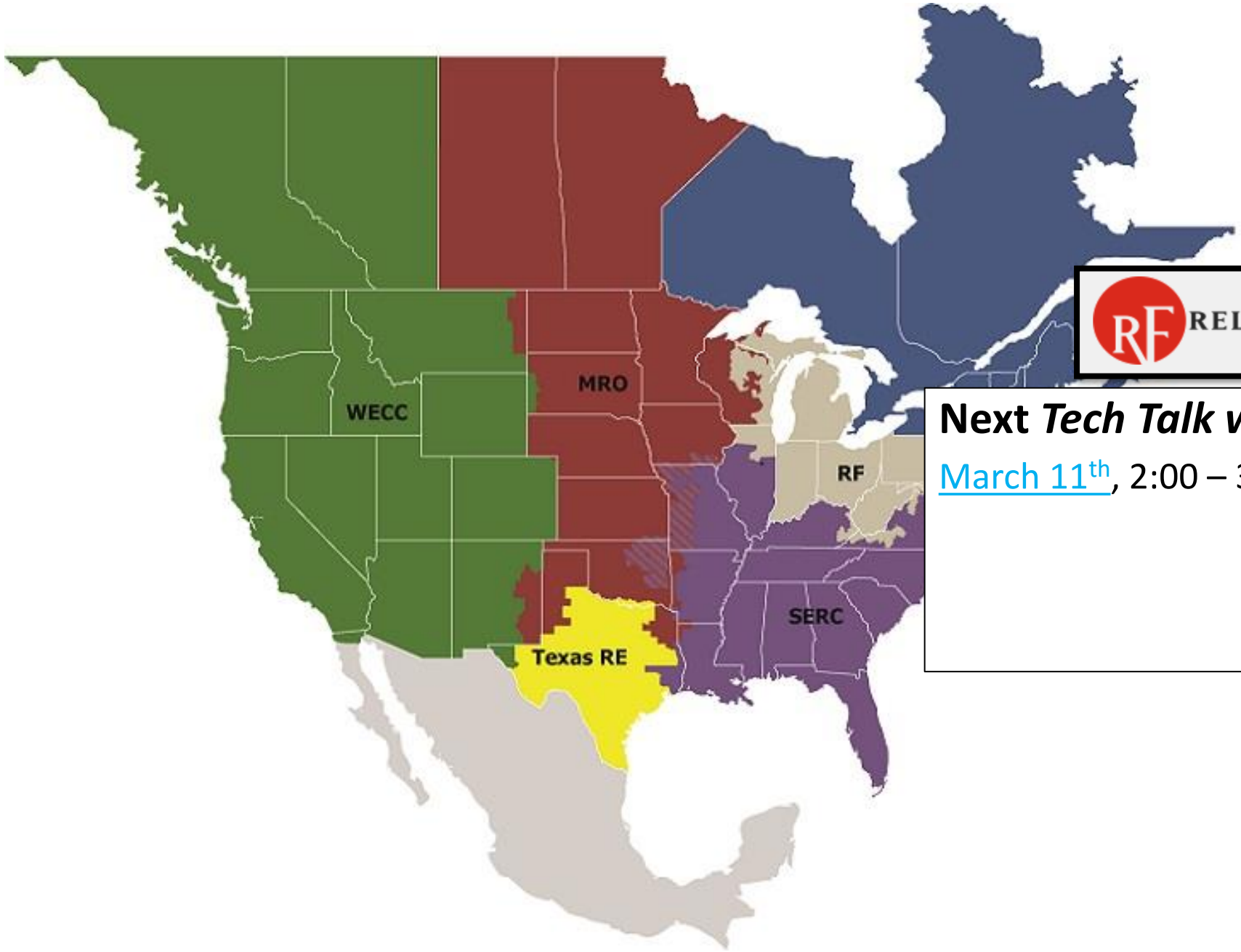
- April 9th – 11th

E-Learning Online Courses



NPCC TPL-001 Webinar

- Link to Recording



RELIABILITYFIRST

Next *Tech Talk with RF*

March 11th, 2:00 – 3:30 PM

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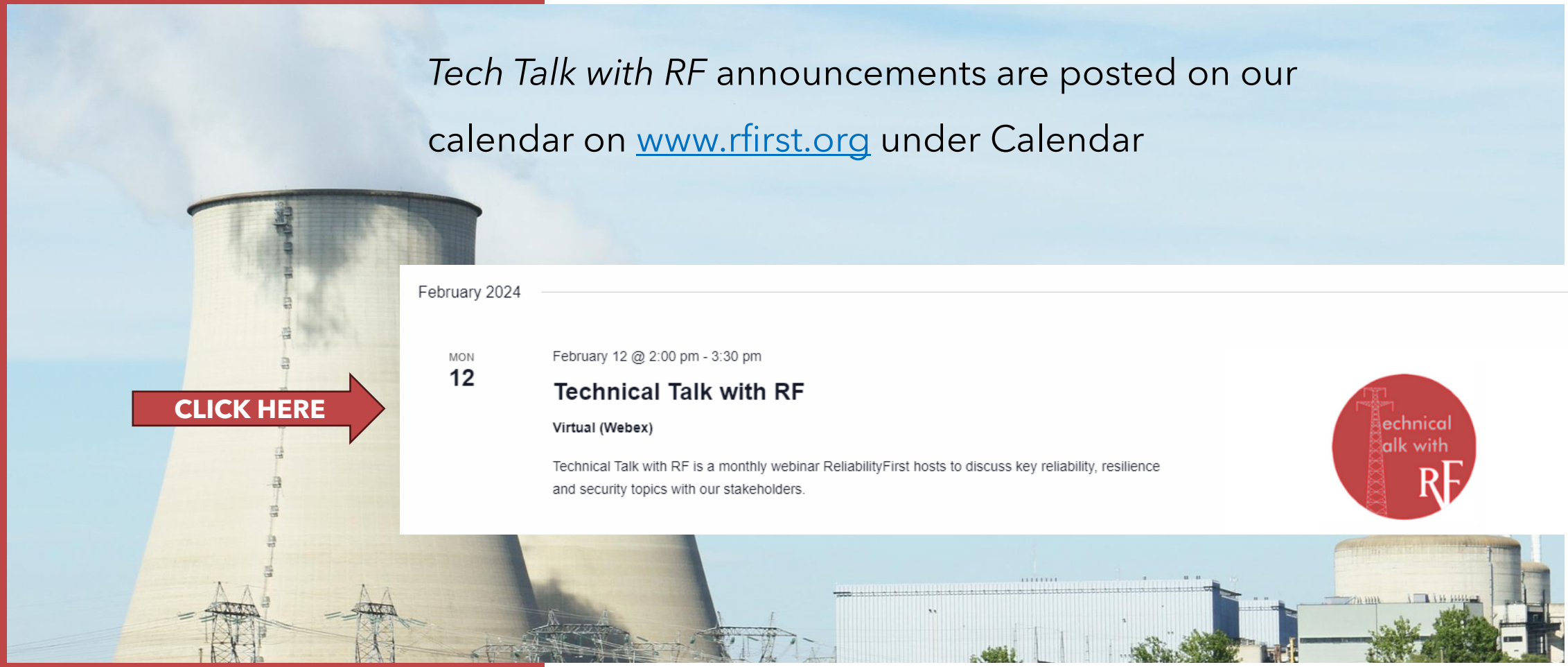
TECH TALK REMINDER

FORWARD TOGETHER RELIABILITYFIRST

Tech Talk with RF announcements are posted on our calendar on www.rfirst.org under Calendar

CLICK HERE



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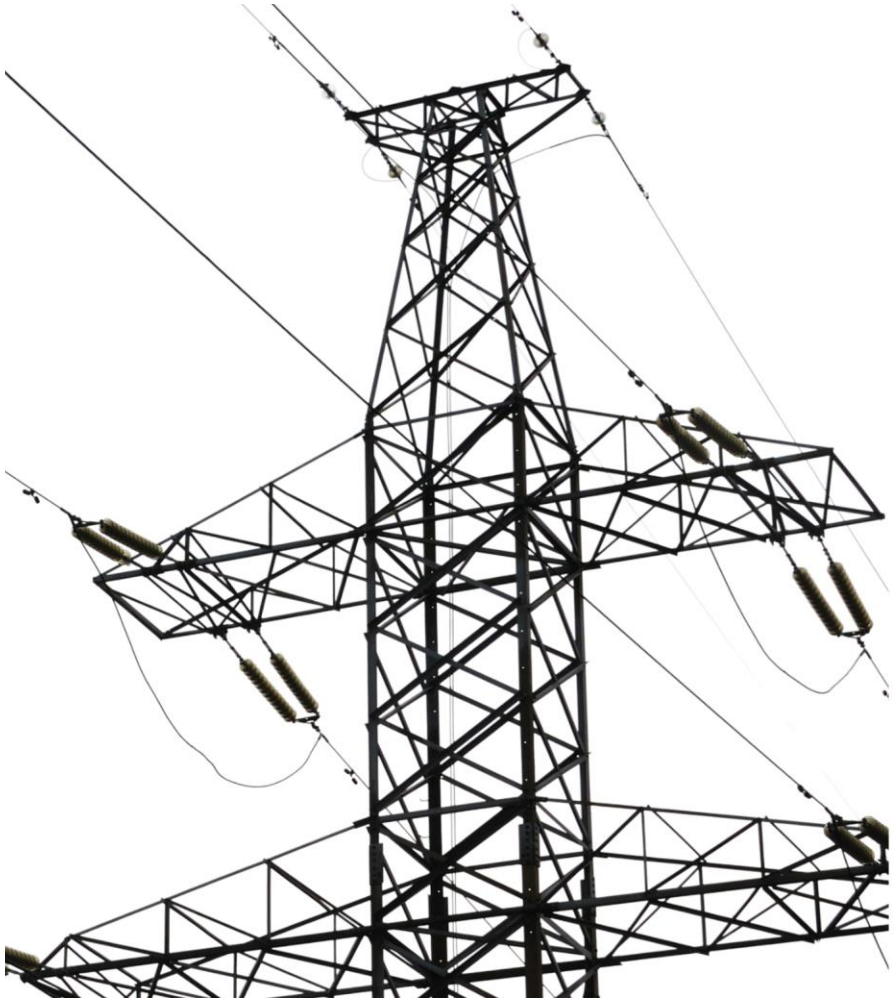
Anti-Trust Statement

It is ReliabilityFirst's policy and practice to obey the antitrust laws and to avoid all conduct that unreasonably restrains competition. This policy requires the avoidance of any conduct which violates, or which might appear to violate, the antitrust laws. Among other things, the antitrust laws forbid any agreement between or among competitors regarding prices, availability of service, product design, terms of sale, division of markets, allocation of customers or any other activity that unreasonably restrains competition.

It is the responsibility of every ReliabilityFirst participant and employee who may in any way affect ReliabilityFirst's compliance with the antitrust laws to carry out this policy.



AGENDA

TECHNOLOGIES SUPPORTING THE GRID TRANSFORMATION

- AMORY LOVINS, ADJUNCT PROFESSOR AT STANFORD UNIVERSITY, AUTHOR, PHYSICIST, CO-FOUNDER AND FORMER CEO OF THE ROCKY MOUNTAIN INSTITUTE (RMI)

UPDATE ON FERC ACTIVITIES AND PRIORITIES

- ERIC VANDENBERG, DEPUTY DIRECTOR, FERC OFFICE OF ELECTRIC RELIABILITY

FERC, Reliability, and the Resource Transition

Eric Vandenberg, Deputy Director, Office of Electric Reliability

February 9, 2023

The views expressed in this presentation are my own and do not represent those of the Commission or any individual Commissioner.

FERC Overview: Who We Are

- FERC
  - Rates, terms, and conditions of interstate wholesale electric sales
  - Non-federal hydro, natural gas rates and siting, oil rates
  - Authority for reliability of bulk-power system added in 2005
- Office of Electric Reliability (OER)
  - Oversees and implements FERC reliability program
  - 87 staff; mostly engineers and cybersecurity experts

Office Of Electric Reliability

The Office of Electric Reliability (OER) helps protect and improve the reliability and security of the nation's bulk power system through effective regulatory oversight as established in the Energy Policy Act of 2005. OER Oversees the development and review of mandatory reliability and security standards. Oversees compliance with the mandatory standards by the users, owners, and operators of the bulk power system

Key Priorities for Office of Electric Reliability

- **Cyber and Physical Security**
  - Protections for Low Impact Assets
  - Supply Chain Compromise
  - Physical Security
- **Resource transition**
  - Resource/Energy Adequacy
  - Priority System Attributes (e.g., quick start, ramping)
  - Inverter Based Resources
- **Extreme Weather**
  - Asset Hardening (e.g., generator freeze protection)
  - System Planning and Design

Resource Transition and FERC Jurisdiction

- Federal Power Act Section 215
  - FERC oversees the development and enforcement of reliability standards for reliable operation of the bulk-power system
  - 215(i)(2) – FERC cannot “order the construction of additional generation or transmission capacity or to set and enforce compliance with standards for adequacy or safety of electric facilities or services.”

- Federal Power Act Sections 205 and 206
  - Gives FERC authority over wholesale sales of energy or capacity and transmission service by public utilities
  - Limited to ensuring just & reasonable rates, terms, and conditions of service; also practices “affecting” a rate

What's Driving Resource Adequacy Risk: Retirements

- Resource retirements
  - Aging infrastructure
  - Economics
  - State policies
  - Corporate Goals
  - Other policies
- Drivers and magnitude vary by region
- Many retirements not set in stone – some flexibility
- Timing of retirements vis a vis new entry becomes increasingly important

2023 NERC Long-term Reliability Assessment

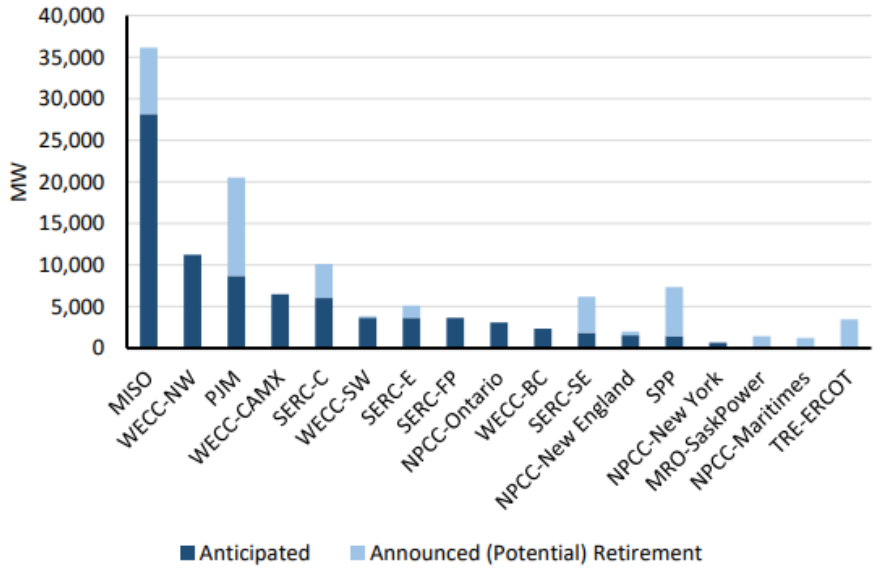
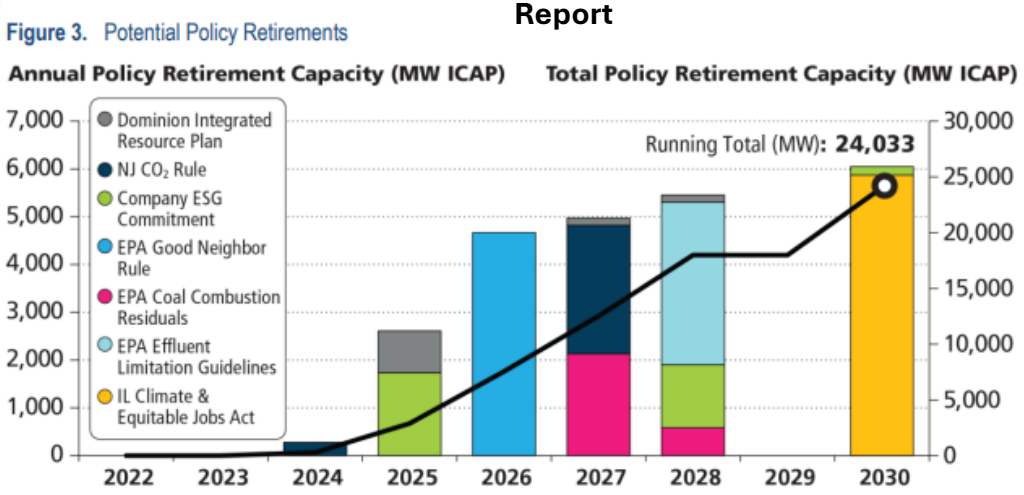


Figure 23: Projected Retiring Nuclear and Fossil Generation Capacity 2023–2033

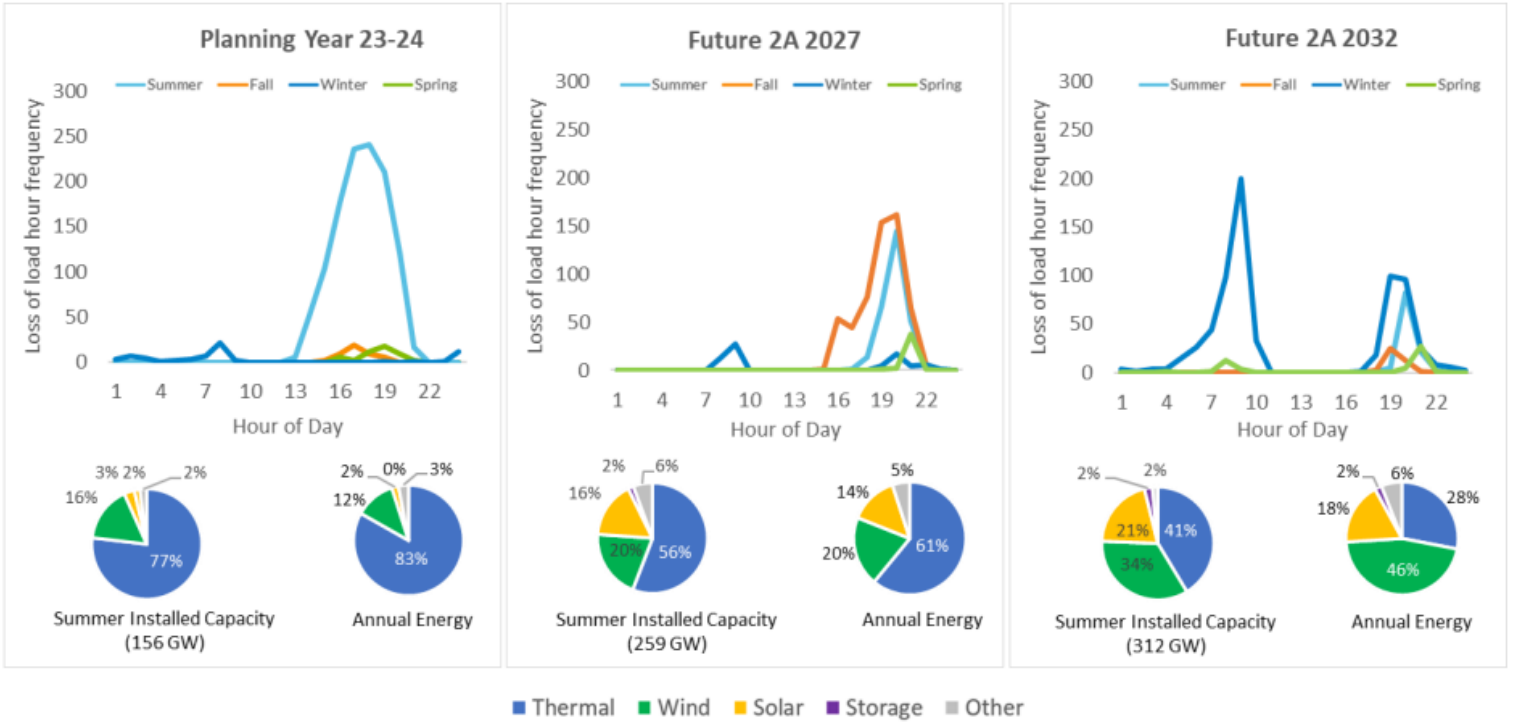
2023 PJM Retirement, Replacements, and Risks Report



What's Driving Resource Adequacy Risk: Correlated Unavailability and Outages

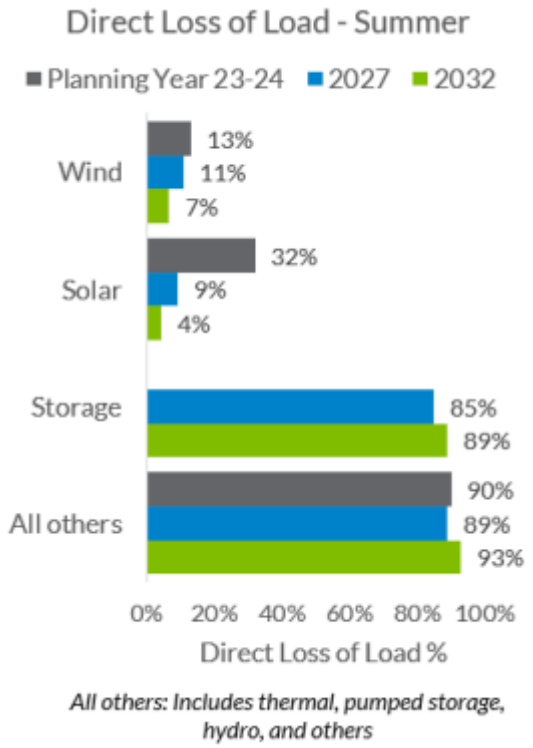
- Unavailability among thermal resources generally (but not always) independent; correlated unavailability among resources (e.g., sun sets, wind doesn't blow, gas outage, extreme weather) creates new risk patterns
- Variability/uncertainty of new resources plus changes in load can shift highest risk hours from traditional summer late-afternoon

MISO 2023 Attributes Road Map



Correlated Unavailability and Outages (con't)

- **Capacity Accreditation** Allows for "apples-to-apples" comparison of resource adequacy contribution across resource types
- Accounts for correlated unavailability in a systematic way – the more outages are correlated, the more their accreditation declines
- Different possible methods:
  - Effective Load Carrying Capability – approved in PJM and NYISO; under development in SPP and ISO-NE
  - Historic Performance in Key Hours – approved in MISO; modifications under development (see figure)
  - "Slice of Day" – under development in CAISO



Estimated winter season, class-level accreditation values for the three portfolios (today, 2027, and 2032) by fuel type using Direct Loss of Load Methodology.
MISO 2023 Attributes Analysis

What's Driving Resource Adequacy Risk: Load

- Load growth accelerating primarily due to data centers and electrification
  - AI based search requires approximately 10x traditional indexed search algorithms
  - PJM projects summer and winter peak load will grow by 1.7% and 2% a year through 2034, up from 0.4% and 0.7% growth, respectively, in last year's forecast
  - WECC now projecting 16.8% load growth over 10 years – up from 9.6% projected in 2022

- Electrification also reshapes the hourly load profile which can increase risk
  - PJM decarbonizing grid whitepaper projects that aggressive electrification could shift 80% of at-risk hours to winter
  - Retail rate design changes could have significant effect

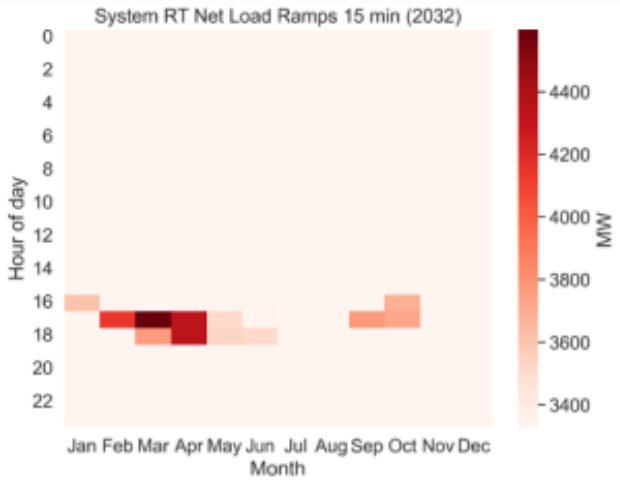
FERC, NERC, States, and Utilities pursuing various approaches

- Adjust accredited capacity of resources to better reflect availability risk
  - Previously approved accreditation methodologies for PJM, NYISO and MISO
  - Rejected SPP accreditation methodology on procedural grounds; encouraged SPP to continue developing
- Reduce likelihood of correlated outages (e.g., FERC/NERC Cold Weather Inquiry Findings)
  - Freeze protection – NERC standard EOP-012
  - Improve availability of natural gas (e.g., Texas Railroad Commission requirements for producers, NARUC gas-electric task force)
- Reduce time to interconnect new resources
  - FERC Order No. 2023 Interconnection Reforms
- Increase import capacity
  - FERC/NERC examining opportunities for increased interregional transfer capability
- Improve Risk Modeling
  - ISO-NE working with EPRI to examine advanced tools for modeling
- NERC Developing Reliability Standard on Energy Adequacy – aiming for completion by end of 2024

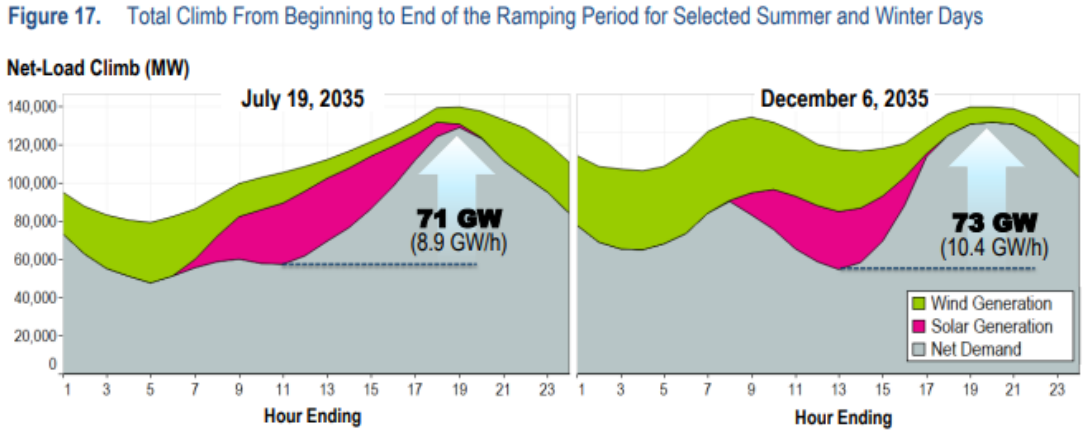
Priority System Attributes

Studies show clear future need for flexibility

- PJM Study estimates 2035 net load ramps up to 70 GW
- MISO identifies similar need for flexibility; recommends optimizing ramping products/short-term reserves; dynamic reserve requirements; explore new product for uncertainty management.



Highest 10 percentile of short duration net load up-ramps
MISO 2023 Attributes Analysis



Highest 10 percentile of short duration net load up-ramps
MISO 2023 Attributes Analysis

Inverter Based Resources

- Tripping *en masse*
  - NERC has documented many instances of IBRs temporarily disconnecting during routine disturbances
  - In October, FERC issued Order No. 901 directing NERC to develop standards on ride-through and modeling
- Dynamic Stability Issues
  - Increase with number of IBRs
  - Mitigate with software upgrades; advanced inverter technology (e.g.,grid forming); system upgrades

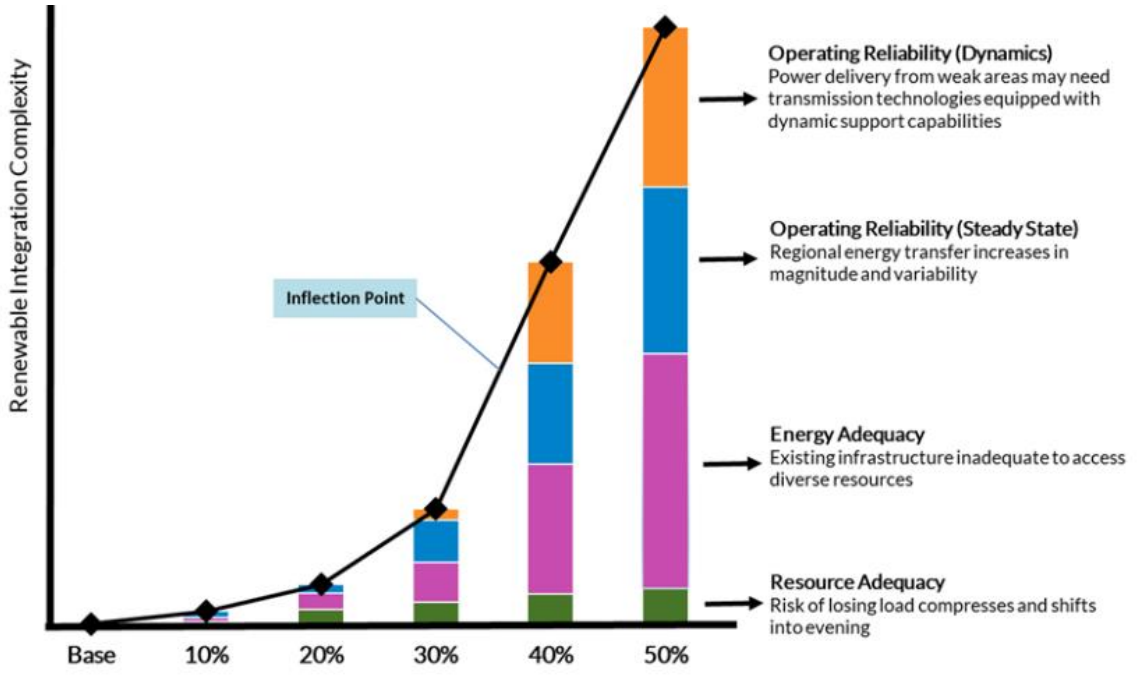
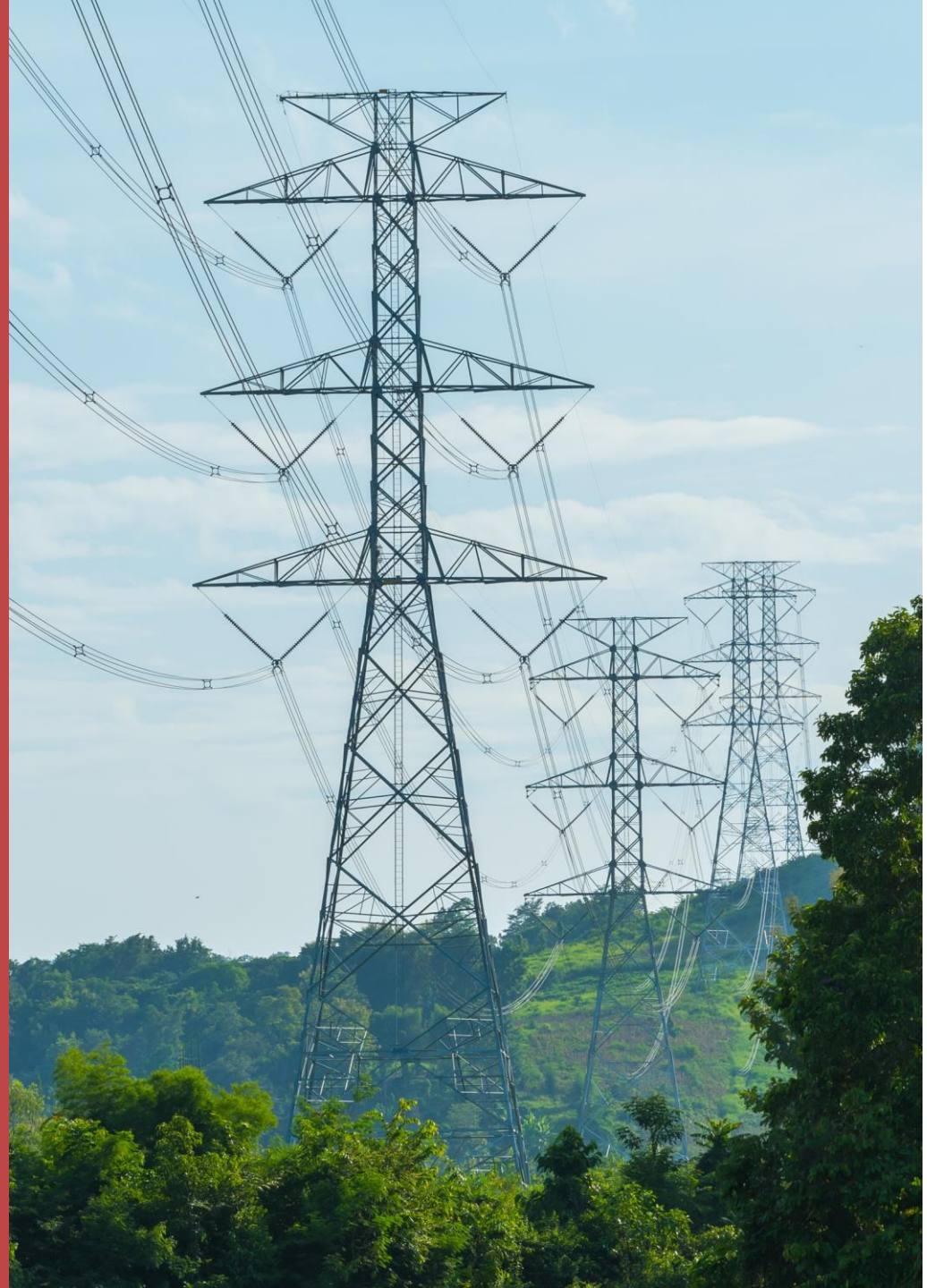


Figure UC-1: Inflection point of renewable integration complexity identified by RIIA

MISO 2021 Renewable Integration Impact Analysis

Questions?



THANK YOU

Join us for our next Tech Talk – March 11th

Latrice Harkness and Jamie Calderon, NERC – New Standards effective April 1st

Johnny Gest RF – RF's Reliability Risk Assessment

Webinar Link