TEXAS RE

talk with TEXAS RE

2022 Reliability Performance Reports

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May 23, 2023

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Upcoming Texas RE Events

May 30, 2023

Summer Outlook

June 2023

Reliability 101 & 201 Webinar Series

July 20, 2023

Grid Transformation Workshop

Upcoming ERO Events

May 25, 2023

NPCC DER VER Forum

June 8, 2023

Resource Adequacy Discussion Series

June 12, 2023

Technical Talk with RF

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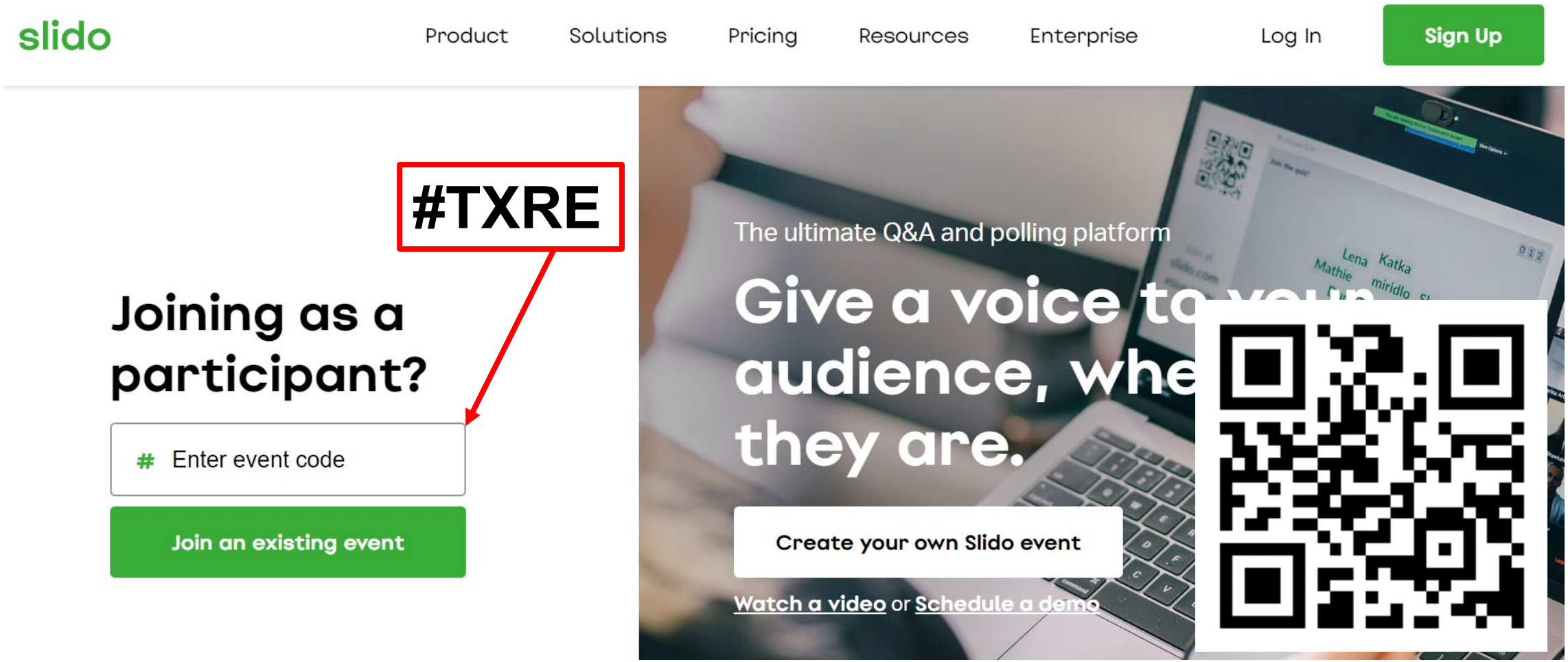
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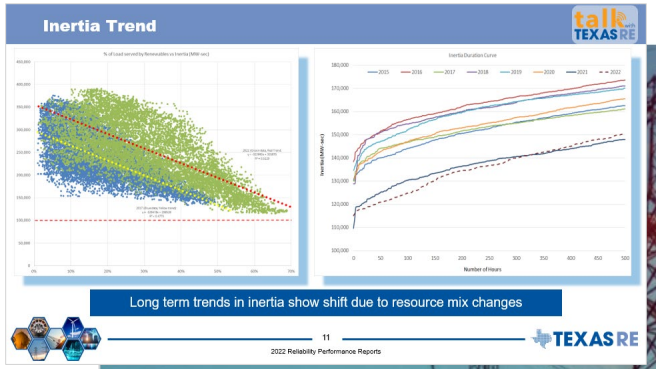
NERC and Texas RE Performance Monitoring Objectives

Provide objective, credible, and concise information to policy makers, industry leaders, and the NERC Board of Trustees on issues affecting the reliability and resilience of the North American bulk power system (BPS)

- Identify system performance trends and emerging reliability risks
- Determine the relative health of the interconnected system
- Measure the success of mitigation activities deployed

Evaluates the 2022 Operating Year and Historical Trends

2022 Reports



2022 ASSESSMENT OF RELIABILITY PERFORMANCE

MAY 2023

NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

DRAFT

2023 State of Reliability Overview

June 2023

Assessment Overview of 2022 Bulk Power System Performance

2022 Assessment of Reliability Performance Coverage

Performance Analysis of Key Risk Areas

- Event Analysis
- Resource Adequacy and Performance
- System Resilience
- Grid Transformation
- Human Performance
- Bulk Power System Planning
- Situational Awareness
- Protection System Performance
- Physical and Cyber Security

Key Preliminary Findings - NERC State of Reliability Report

Conventional generation reliability is challenged during extreme weather events and other high-demand conditions

Grid disturbances continue to highlight solar photovoltaic (PV) resources' inconsistent "ride through" functionality

Security threat landscape relentlessly evolves and continues to present new challenges to the electricity industry

The BES transmission system continues to demonstrate significantly improved reliability for the fifth year in a row

2022 Assessment of Reliability Performance Findings

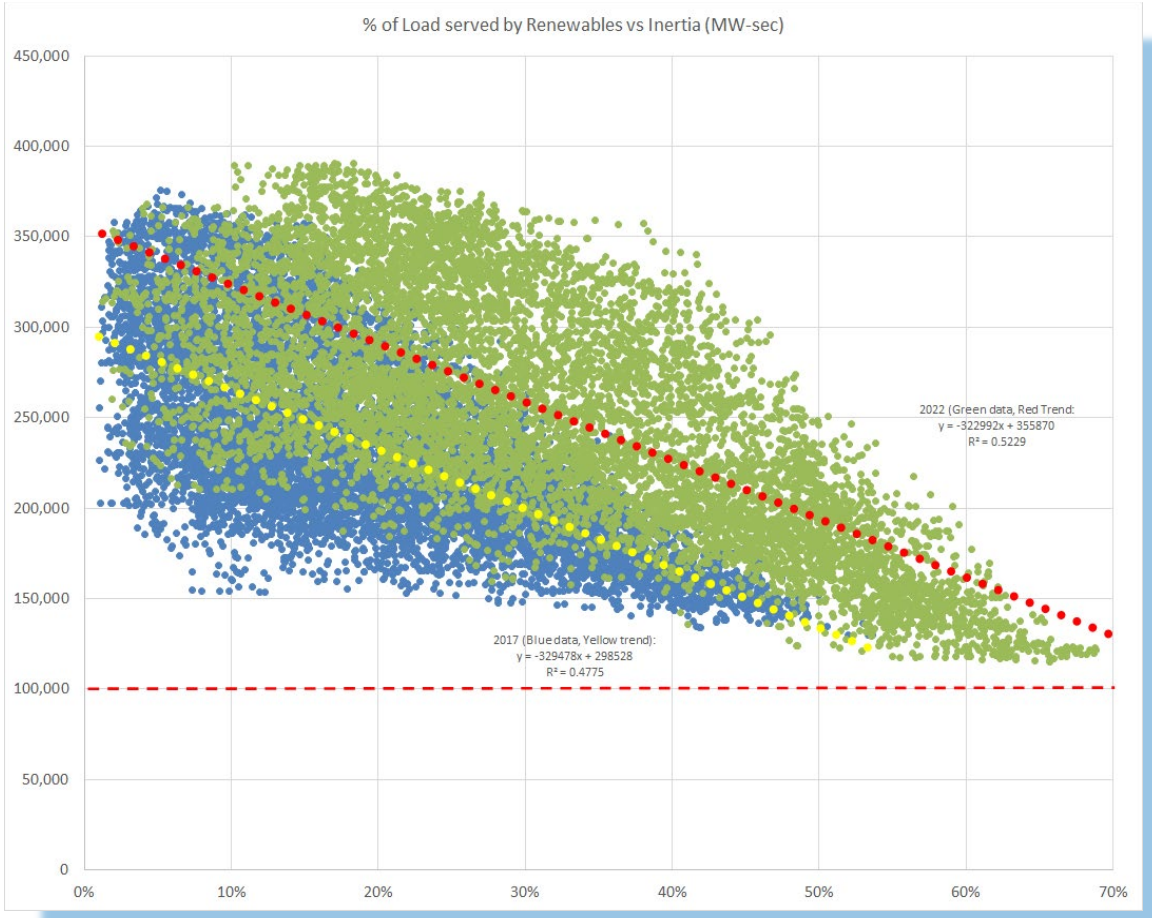
Improving	Stable or No Change	Monitoring	Actionable

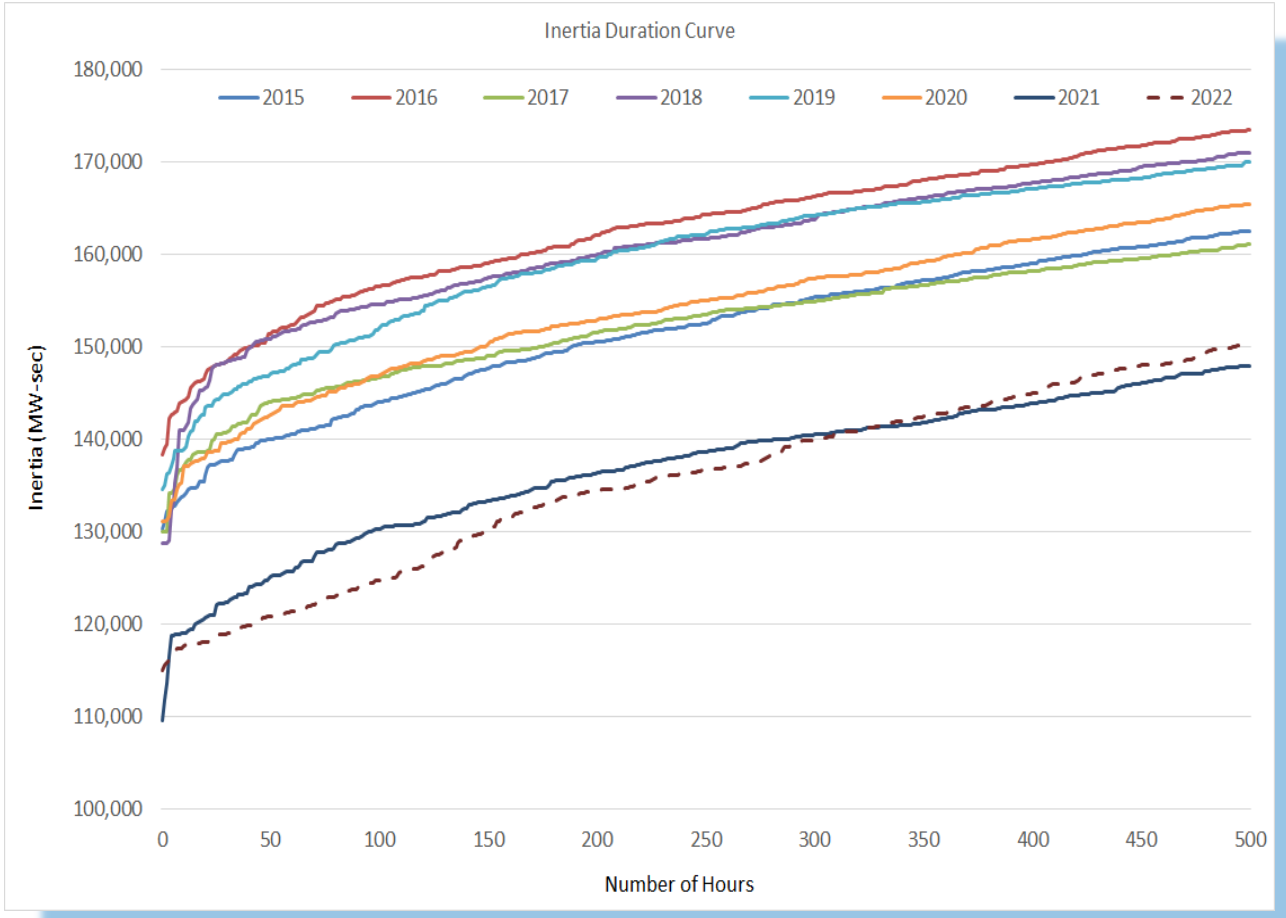
Key Performance Indicator with Description	2022 Performance & Trend Results
Resource Adequacy Measures potential resource adequacy issues by analysis of planning reserve margin and energy emergency alerts	Reserve margins show sufficient resource capacity Extreme event scenarios highlight risk areas Resource weatherization
Transmission Performance Measures transmission performance by analysis of transmission outage rates and IROL exceedances	345 kV & 138 kV transmission outage rates IROL Exceedances
Resource Performance Measures generation performance by analysis of generator outage rates, primary frequency response, and balancing contingency events	Resource outages/gas restrictions during cold weather Year-over-year continued increase in EFOR rates Primary frequency response No balancing contingency event failures
Grid Transformation Measures potential issues related to grid transformation by analysis of system inertia and ramping	Solar ramp magnitudes continue to increase Synchronous generator retirements Voltage ride through for inverter-based resources Decrease in average system inertia levels
Protection System Performance Measures Protection System performance by analysis of Protection System Misoperations	Misoperations due to incorrect settings increased in 2022 Misoperation rate increased in 2022, remains less than overall NERC Misoperation rate
Human Performance Measures transmission outages, generation outages, and Protection System Misoperations caused by human error	Reduction in transmission and generation outage rates from human error Human error primary causal factor in Misoperations and events
Situational Awareness Measures situational awareness by analysis of state estimator convergence rates, event analysis, and telemetry performance	Four loss of situational awareness events State Estimator convergence rate

Performance Metrics

- Reserve margins show sufficient resource capacity but at risk on extreme days
- Inverter-based resource issues highlighted by Odessa disturbance
- Resource weatherization and gas restrictions continue to be an issue
- Year-over-year increase in outage rates for conventional fleet
- Protection system misoperations rate increased in 2022, but remained near historical averages

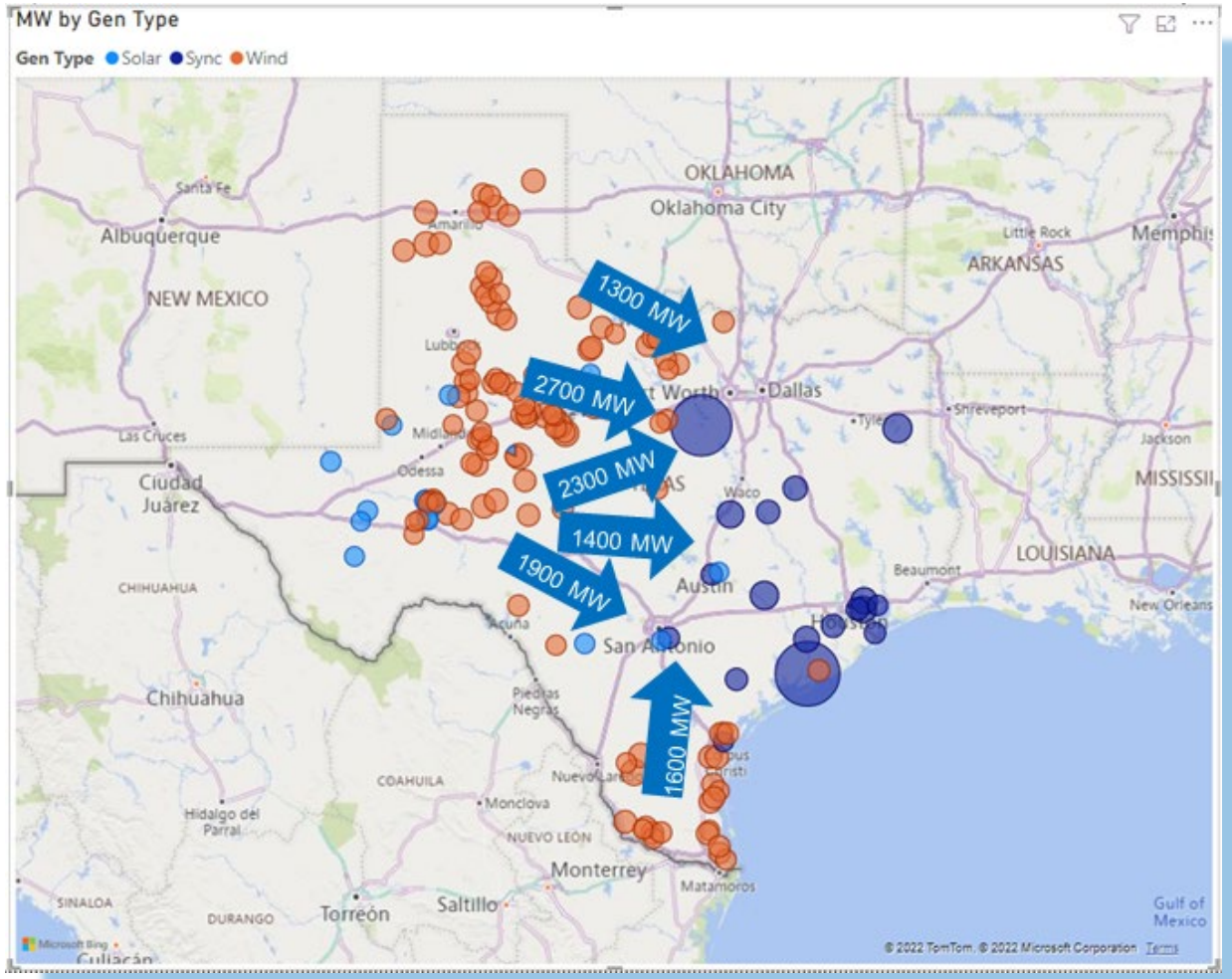
Inertia Trend





Long term trends in inertia show shift due to resource mix changes

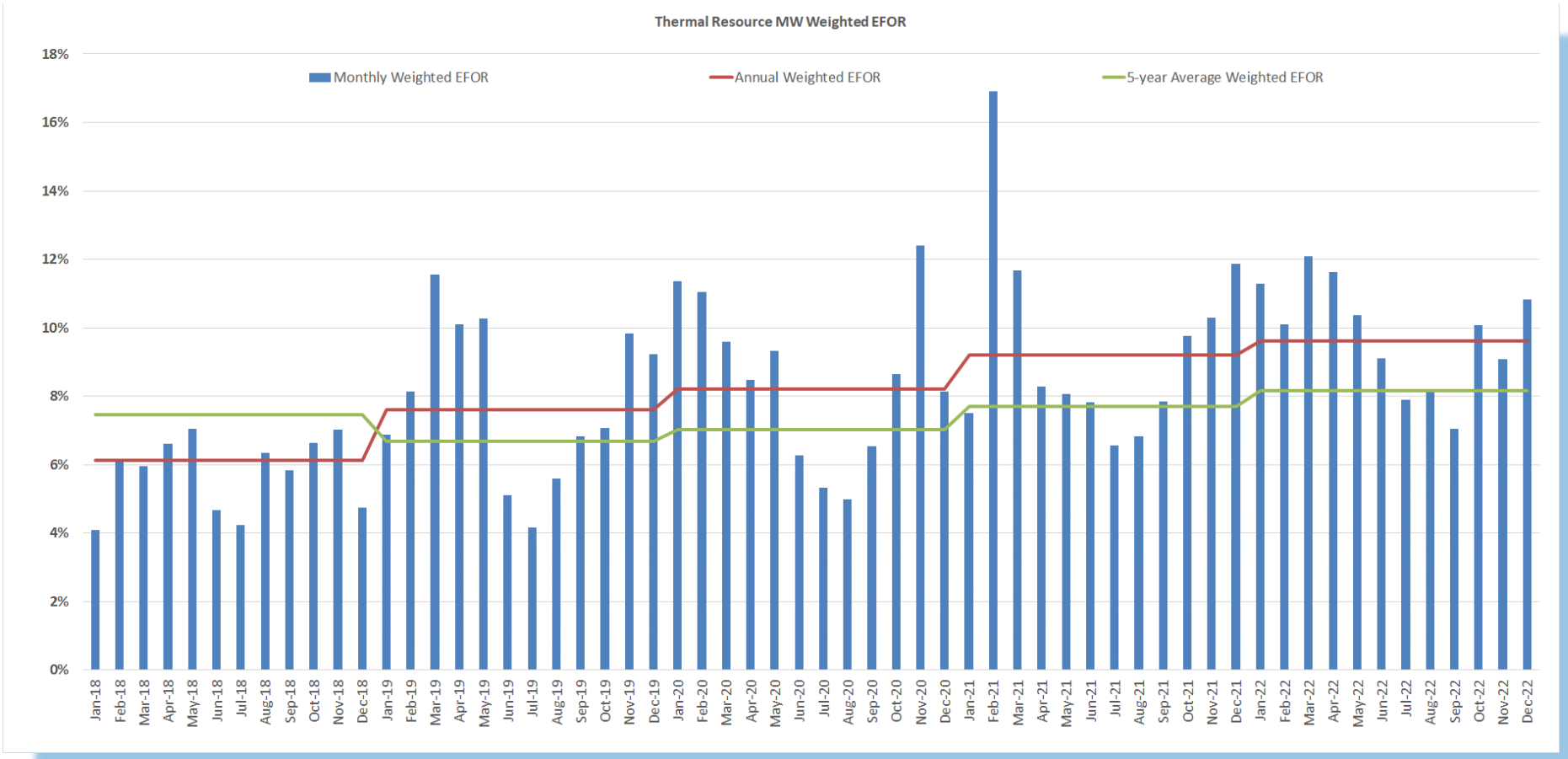
Renewables and Powerflow



Highest Renewable Penetration Period: 4/10/2022 HE09

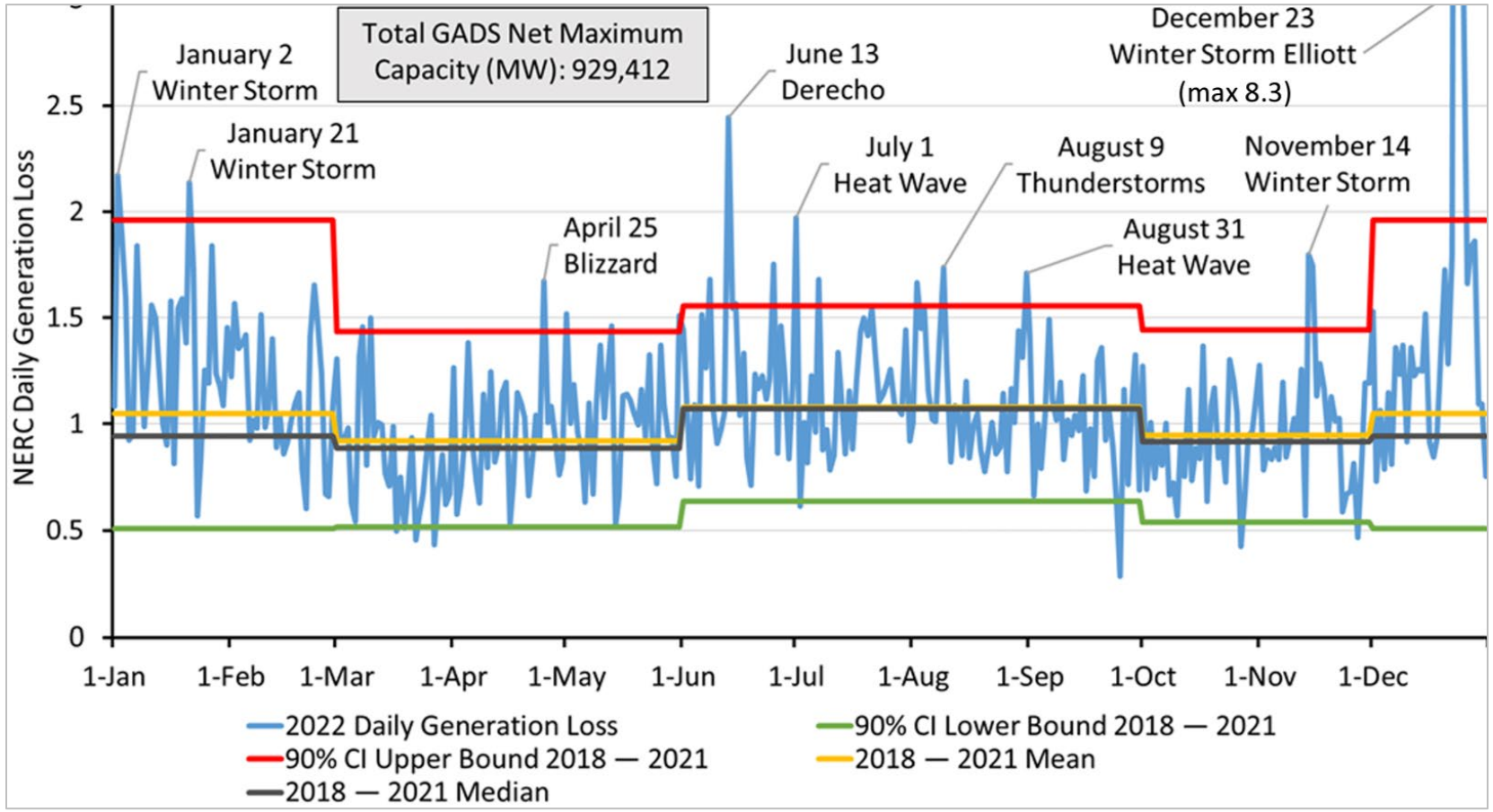
- No synchronous generation online in West Texas, Panhandle, or Lower Rio Grande Valley
- ERCOT load: 35,867 MW (net load of 10,565 MW)
- Inertia level: 120.8 GW-sec
- Wind gen: 23,008 MW
- Solar gen: 2,294 MW
- Renewable penetration: 70.5%
- Approx. 2,300 MW of wind and solar curtailments

Conventional Unit Outage Rates in Texas RE



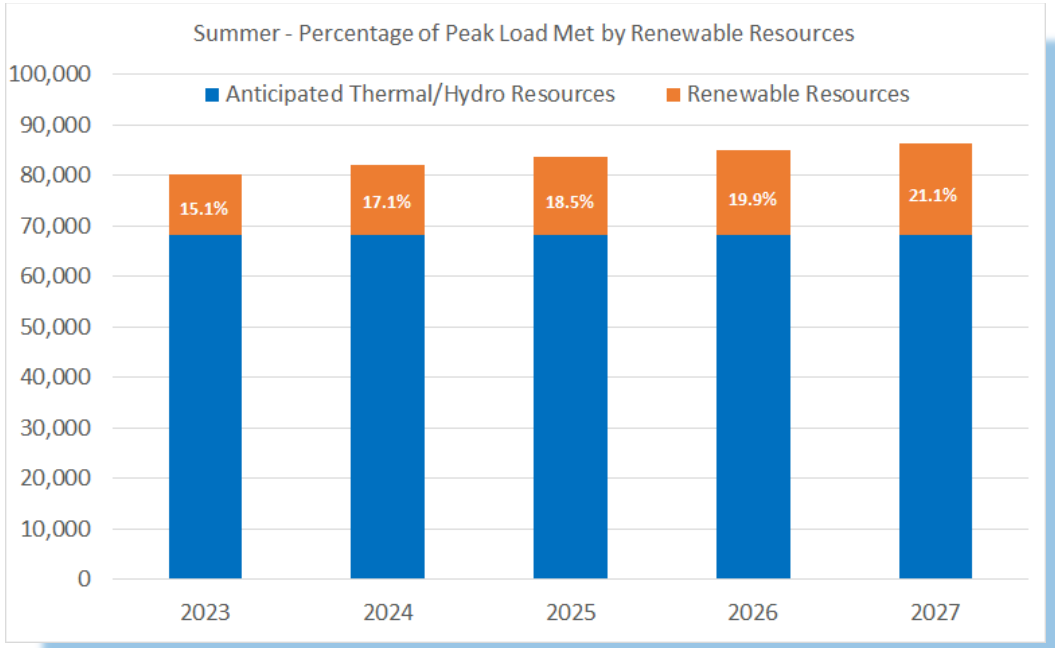
Conventional unit outage rates continue to increase

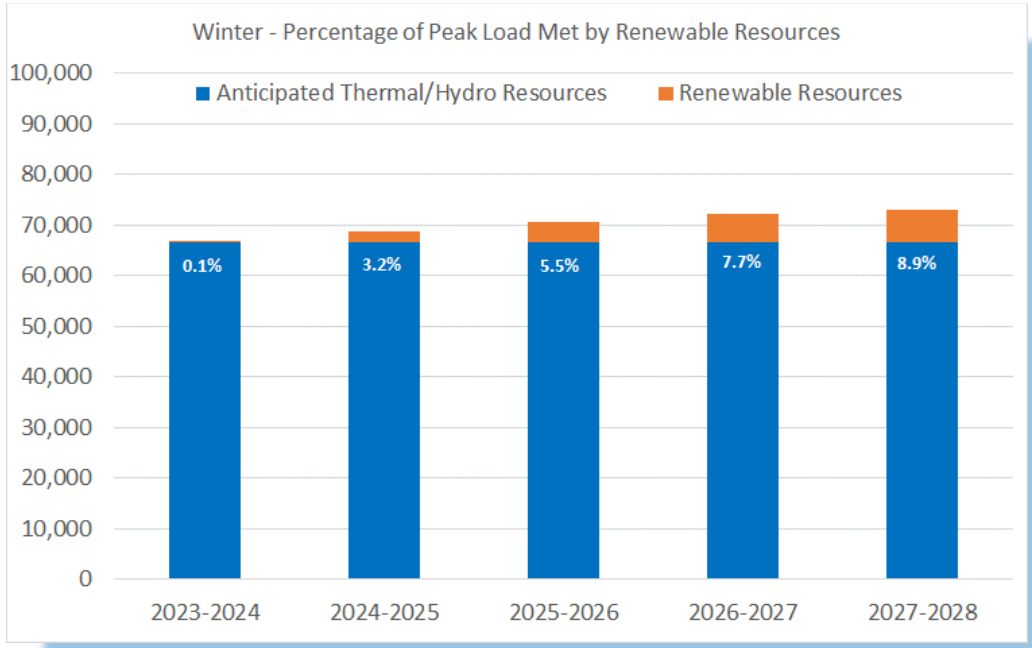
ERO-Wide Conventional Generation Outages



NERC-wide conventional unit outage rates on extreme days

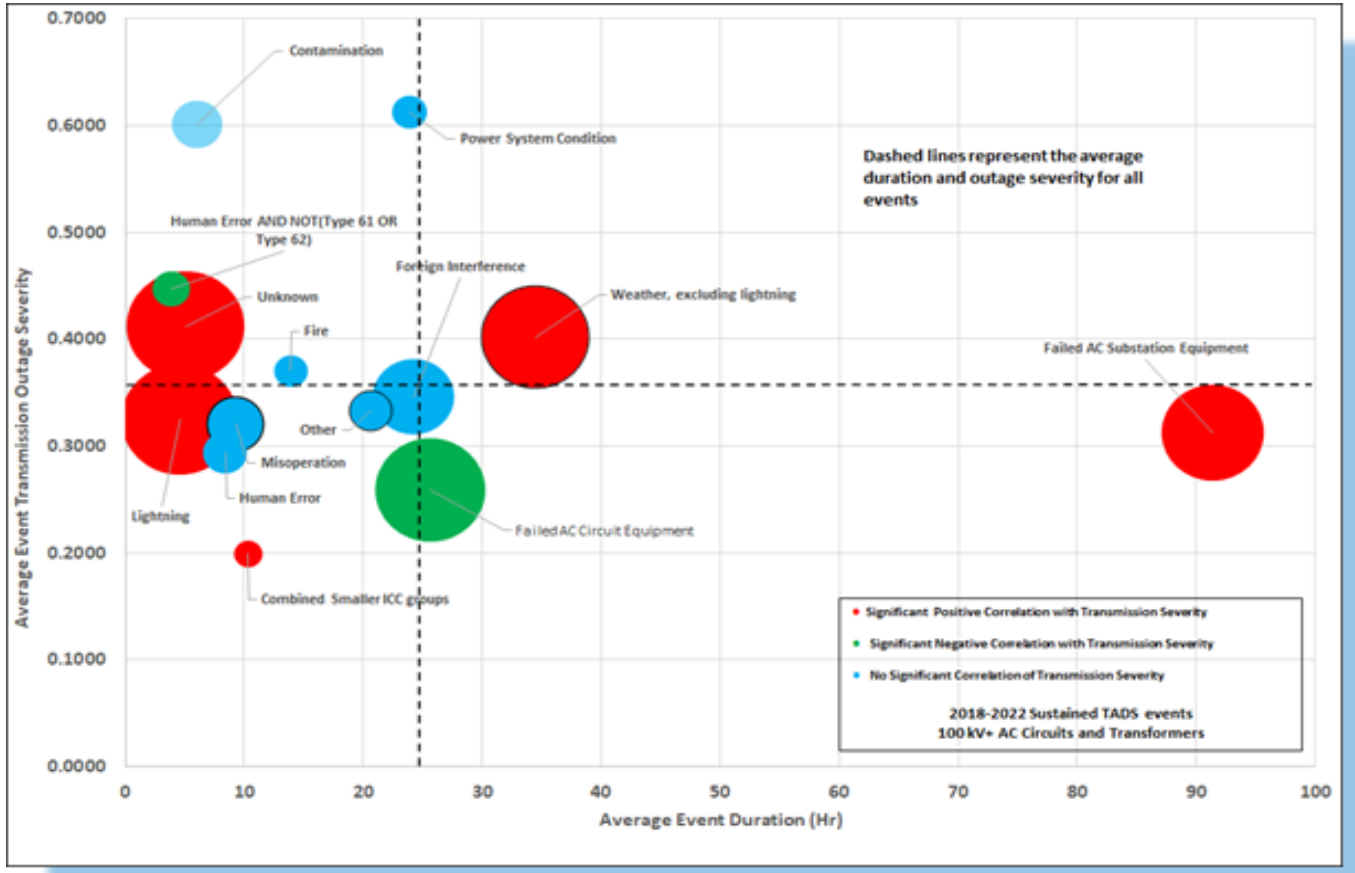
Dispatchable and Renewable Share of Peak Demand





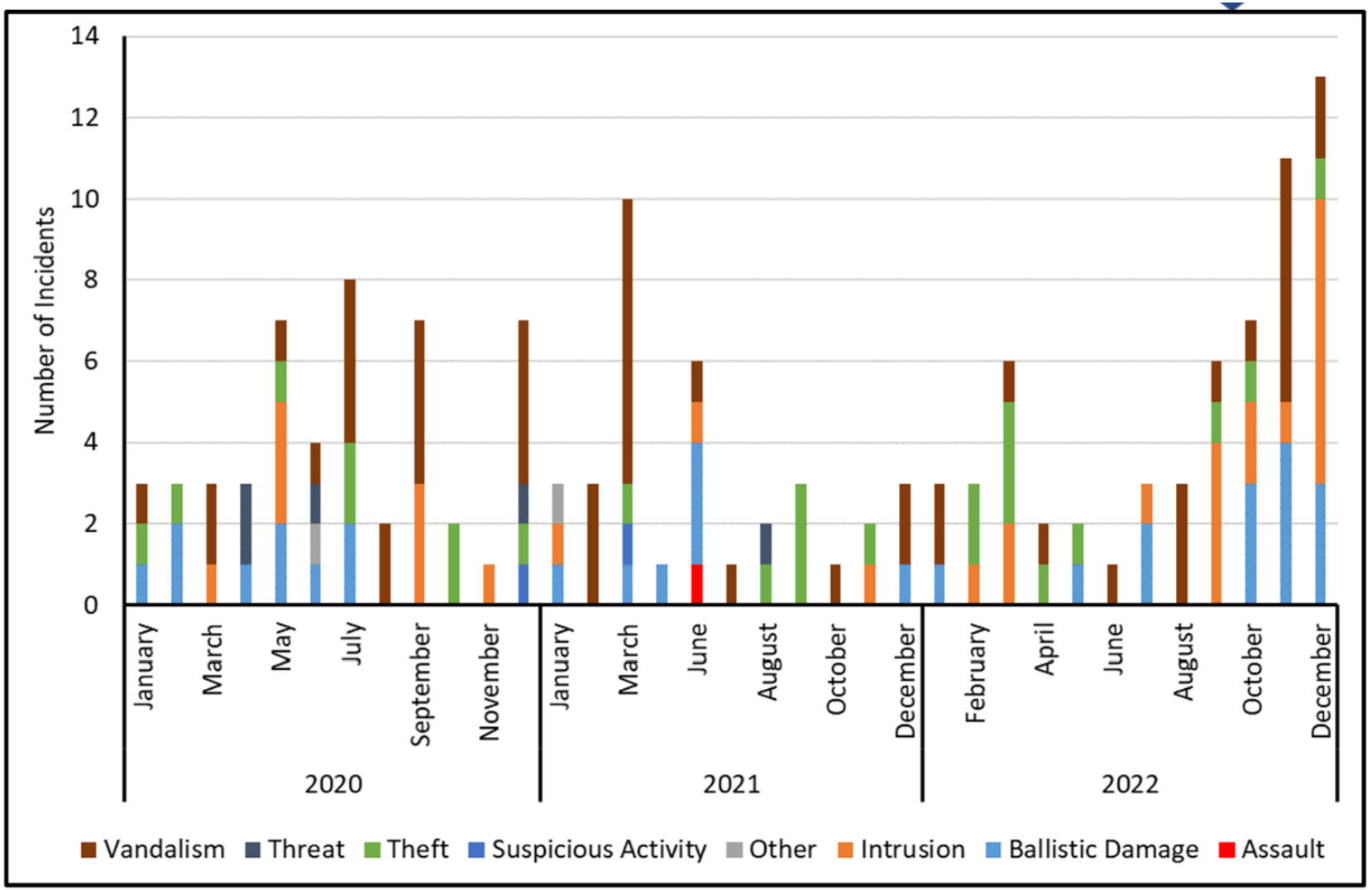
- Dispatchable resources can no longer meet peak demand
- Increasing dependence on renewable resources to meet high load periods
- Energy adequacy rather than resource adequacy will be the primary focus

Transmission Outage Causes

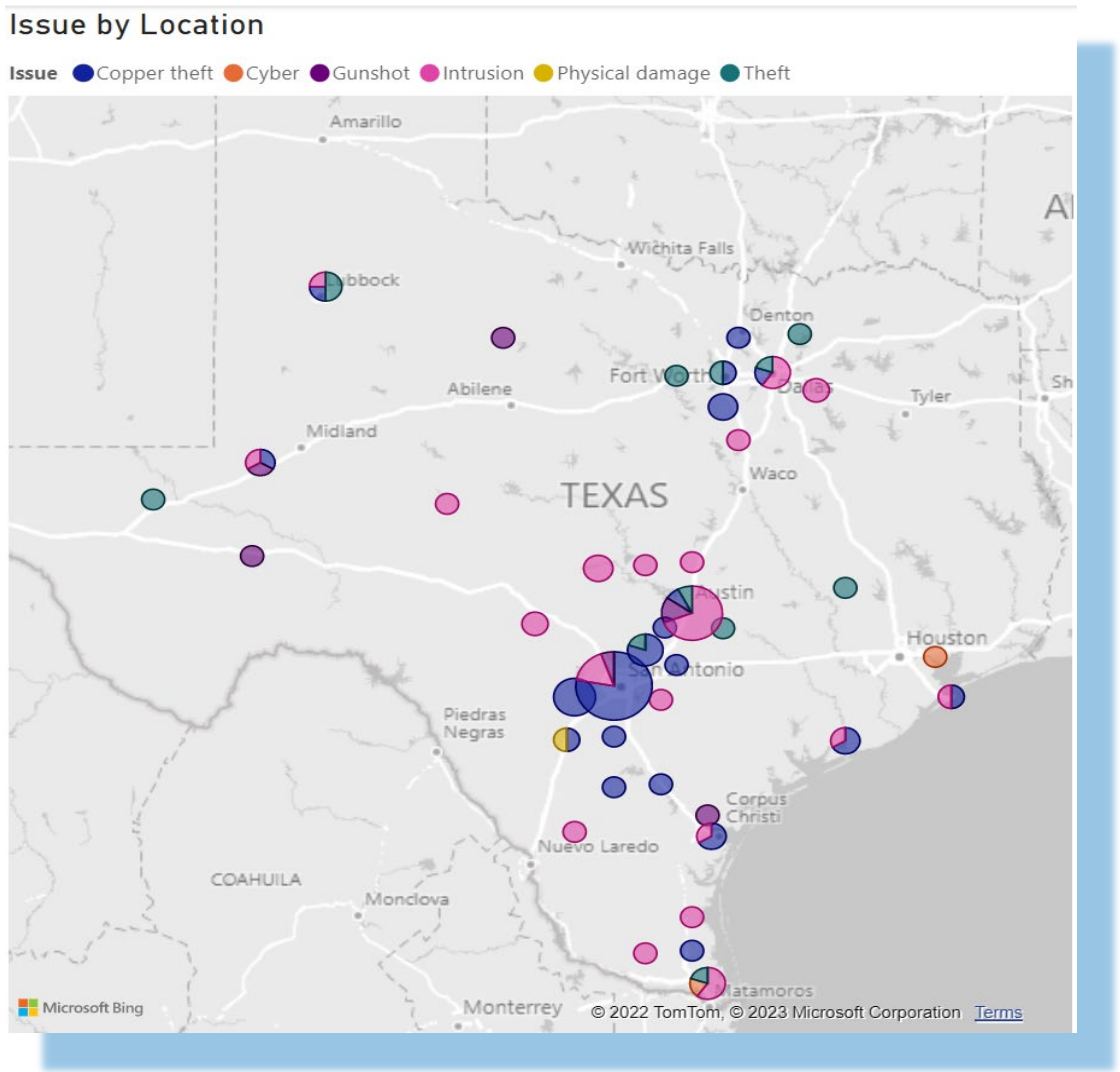


Transmission outage severity and duration driven by failed equipment and weather

Physical Security Threat Trends across NERC



Security Issue Reports in Texas RE



Nationwide trend of increasing ballistic damage to electric facilities also observed in ERCOT

2022 Assessment of Reliability Performance Risk Mapping

		Likelihood	Consequence
1	Extreme weather & Resource Weatherization	Possible	Major
2	IBR ride-through	Likely	Moderate
3	Malware	Possible	Moderate
4	Remote Access	Possible	Moderate
5	Supply Chain	Possible	Major
6	Provision of Essential Reliability Services from a Changing Resource Mix	Unlikely	Moderate
7	Energy Adequacy Planning	Possible	Major
8	Gas Supply Restrictions during Cold Weather	Possible	Major
9	Inaccurate Resource Modeling	Unlikely	Moderate
10	Physical Security	Possible	Moderate
11	Equipment Failures/Misoperations	Unlikely	Minor
12	Loss of Situational Awareness	Unlikely	Minor

Risk Focus Areas for 2023

- Continuous evaluation of emerging risks
- Priorities based on likelihood and impact
- Major areas include
  - Inverter-based resource ride-through
  - Remote access threats and vulnerabilities
  - Gas-electric interdependence and supply chain
  - Resource modeling

TEXAS RE
Ensuring electric reliability for Texans