NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

NERC 101

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2019 Compliance and Standards Workshop
July 23, 2019

RELIABILITY | RESILIENCE | SECURITY




Agenda

- History of NERC
- ERO and ERO Enterprise
- Stakeholder Process
- NERC Board of Trustees
- Program Areas

History

- **November 9, 1965 – Northeast Blackout**
- **1968:** National Electric Reliability Council established by the electric industry
- **2002:** NERC operating policy and planning standards became mandatory and enforceable in Ontario, Canada
- **August 14, 2003 – Blackout**
- **2005:** U.S. Energy Policy Act of 2005 creates the Electric Reliability Organization (ERO)
- **2006:** Federal Energy Regulatory Commission (FERC) certified NERC as the ERO; Memorandum of Understanding (MOUs) with some Canadian Provinces
- **2007:** North American Electric Reliability Council became the North American Electric Reliability Corporation (NERC)

ERO

- Section 215 of the FPA (16 U.S.C. § 824(o)) defines the ERO as "the organization certified by the Commission . . . the purpose of which is to establish and enforce reliability standards for the bulk-power system, subject to Commission review"

ERO

- NERC is authorized to:
  - Coordinate efforts to improve physical and cyber security for the bulk power system;
  - Conduct detailed analyses and investigations of system disturbances and unusual events to determine root causes, uncover lessons learned, and issue relevant findings as advisories, recommendations, and essential actions to the industry; and
  - Based on lessons learned, identify the potential need for new or modified reliability standards, improved compliance, or other initiatives.

ERO

- As the international, multi-jurisdictional ERO, NERC is authorized to:
  - Propose, monitor compliance with, and enforce mandatory reliability standards for the North American BPS, subject to regulatory oversight and approvals of FERC in the U.S. and applicable authorities in Canada;
  - Conduct near-term and long-term assessments of the reliability and future adequacy of the North American BPS;
  - Certify BPS operators as having and maintaining the necessary knowledge and skills; and
  - Maintain situational awareness of events and conditions that may threaten reliability.

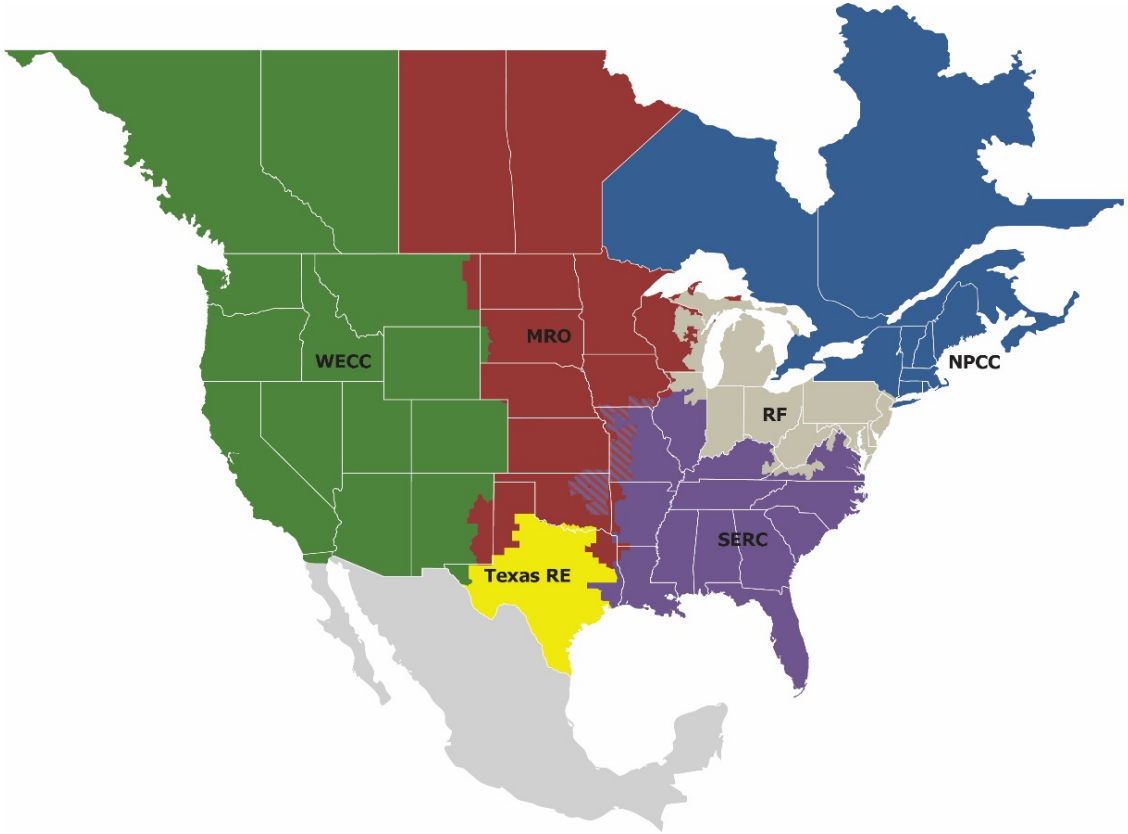
ERO Enterprise

- NERC provides delegated authority to Regional Entities (RE)
- Delegated functions:
  - Compliance Monitoring and Enforcement
  - Reliability Standards Development
  - Organization Registration
  - Reliability Assessments and Performance Analysis
  - Training and Education
  - Situation Awareness
  - Infrastructure Security
- Regional consistency is key for transparency and predictability

NERC Funding

- NERC and Regional Entities allocate operating costs to load-serving entities (LSEs):
  - LSEs are owners, operators, and users of the BPS, responsible for delivering electricity to retail customers.
- Budgets are approved by Federal Energy Regulatory Commission (FERC) each year
  - Individual Regional Entity budgets are submitted to NERC
  - NERC reviews each individual budget, and sends to FERC as a comprehensive budget for approval

ERO Enterprise



Stakeholder Process

- Through NERC's technical committees, experts from all segments of the electricity industry contribute their knowledge to promote the reliability of the North American BPS
  - Compliance and Certification Committee (CCC)
  - Critical Infrastructure Protection Committee (CIPC)
  - Operating Committee (OC)
  - Personnel Certification Governance Committee (PCGC)
  - Planning Committee (PC)
  - Reliability Issues Steering Committee (RISC)
  - Standards Committee (SC)

NERC Board of Trustees












NERC Program Areas

- Standards
- Compliance & Enforcement
- Reliability Risk Management
- Reliability Assessment and System Analysis
- System Operator Certification and Continuing Education
- Electricity Information Sharing and Analysis Center (E-ISAC)

Standards Framework

- Mandatory and enforceable to registered entities
- Reliability Standards define the reliability requirements for planning and operating the North American bulk power system
- Requirements organized by topic areas (for example, transmission operations, transmission planning, coordination, communication, system protection, cybersecurity, etc.)
- Reflect a results-based approach that focuses on performance, risk management, and entity capabilities
- Process includes opportunity for RE variances where necessary

Standards Topics

- Reliability Coordination
- Real-time Operations
- Transmission Planning
- Transmission Operations
- Generation Operations
- System Protection and Maintenance
- Training
- Infrastructure Protection
- Emergency Operations and System Restoration

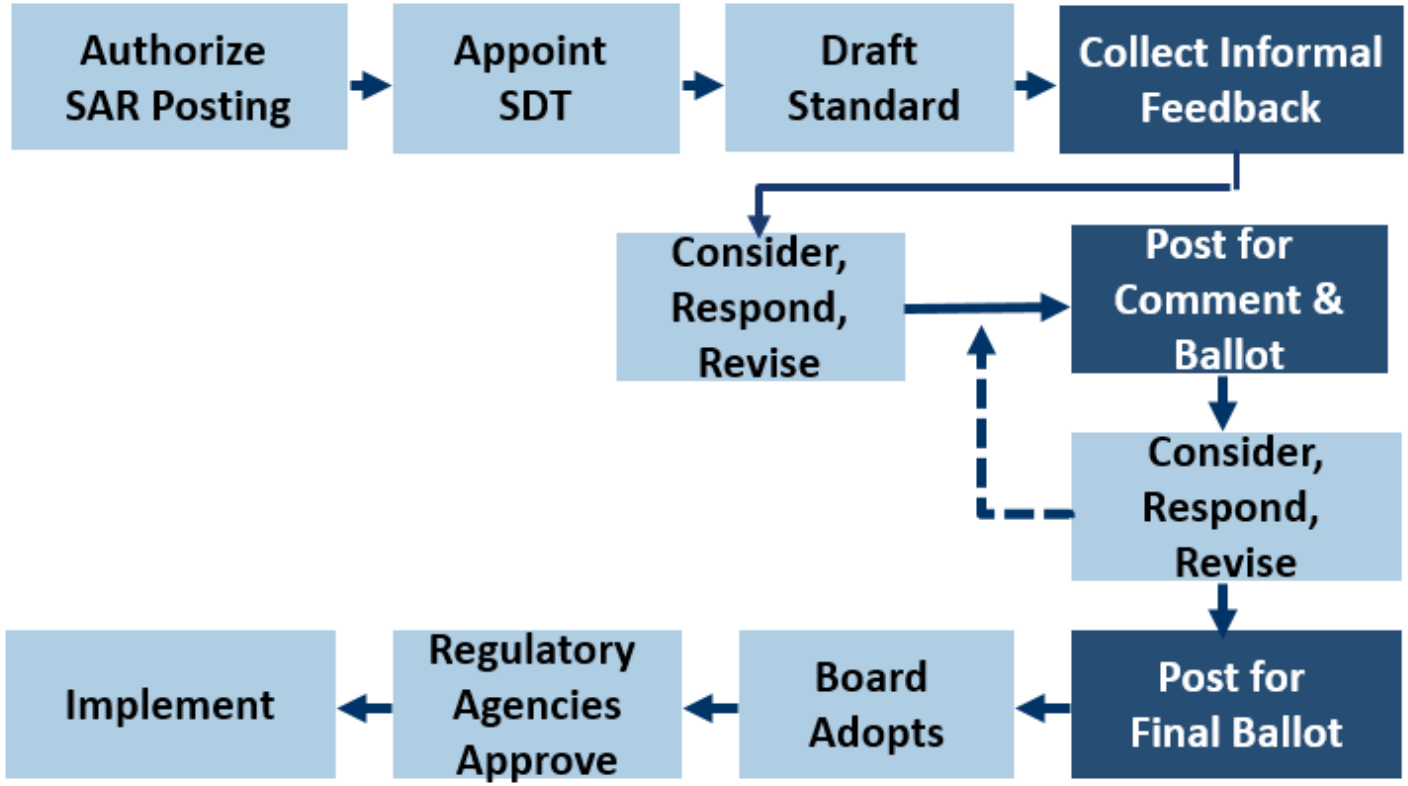
Standards Committee

- Composed of industry-elected representatives
- Prioritizes standards development activities
- Reviews and authorizes Standard Authorization Requests (SARs)
- Manages progress of SARs and standards development efforts
- Reviews and authorizes drafting new or revised standards and their supporting documents
- Makes appointments to standard drafting teams (SDTs)

Standards Development

- Fair, open, and balanced process that depends on stakeholder input and participation
- Stakeholder technical expertise is essential to standard development process
- Stakeholder drafting teams draft the standards
  - Involves comment periods with formal review and response
  - Approval achieved with two-thirds consensus vote
  - Must be approved by NERC Board of Trustees and Applicable Governmental Authorities
- Governed by Standard Processes Manual (SPM)

Standards Development Process



Standard Authorization Requests

- Required by American National Standards Institute (ANSI) to document the scope and reliability benefit of a proposed project
- Must be accompanied by technical justification
- SAR can be submitted by anyone at any time
- Postings
  - Informal
  - Formal

Roles and Responsibilities of Drafting Teams

- Develop an excellent, technically correct standard that helps provide an adequate level of reliability and achieves consensus
  - Stay within the scope of the SAR
  - Address regulatory directives and stakeholder issues
  - Consider Independent Experts' Review Panel input
  - Ensure standard meets criteria for approval
- Develop initial set of Violation Risk Factors (VRFs) and Violation Severity Levels (VSLs) and associated reasoning
- Develop Implementation Plan
- Develop supporting documents (optional)
- Outreach

Drafting Team Formation and Support

- Drafting team chair
- NERC Standards Developer
- Compliance
- Subject Matter Experts (SMEs)
- Legal
- FERC staff observers
- Industry observers

Balloting

- Typically 45-day period
  - 45-day comment period
  - 10-day ballot
  - These periods may vary due to waivers necessary to meet regulatory directives or NERC Board deadlines
- Voting
  - Must cast a vote for initial and additional ballots
- Consideration of comments
  - The drafting team must communicate changes to stakeholders

Board Adoption

- Reliability Standards or revisions to Reliability Standards approved by the ballot pool in accordance with NERC's SPM shall be submitted for adoption by the NERC Board of Trustees
- No Reliability Standard or revision to a Reliability Standard shall be effective unless adopted by the NERC Board of Trustees

FERC Submission and Approval

- NERC Submits Petition for Approval of proposed Reliability Standard to FERC for approval
- Petition must include a complete record of development for the proposed Reliability Standard
- FERC must ensure that proposed Reliability Standards are just, reasonable, not unduly discriminatory or preferential, and in the public interest
- FERC will give due weight to the technical expertise of the Electric Reliability Organization with respect to the content of a Reliability Standard

FERC Submission and Approval

- FERC "may approve, ***by rule or order***, a proposed reliability standard or modification to a reliability standard if it determines that the standard is just, reasonable, not unduly discriminatory or preferential, and in the public interest" (16 U.S.C. § 824o(d)(2) (emphasis added))
- **FERC <u>cannot</u> write Reliability Standards**
- FERC may approve or remand a Reliability Standard
  - FERC "shall remand to the Electric Reliability Organization . . . a proposed reliability standard . . . that [FERC] disapproves in whole or in part" (16 U.S.C. § 824o(d)(4))

FERC Submission and Approval

- FERC may also direct modifications to a Reliability Standard
  - FERC "may order the Electric Reliability Organization to submit to [FERC] a proposed reliability standard or a modification to a reliability standard that addresses a specific matter . . ." (16 U.S.C. § 824o(d)(5))

FERC Submission and Approval

- Section 215(d) of the Federal Power Act states that FERC may address a proposed Reliability Standard "by rule or by order"
- FERC staff will assign an "RM" prefix to rulemaking dockets (*e.g.*, RM15-11-000)
- FERC staff will assign an "RD" prefix to order dockets (*e.g.*, RD15-1-000)
- NERC petitions seeking approval of proposed Reliability Standards are docketed by FERC staff generally within one week of filing
- NERC petitions may be re-docketed (*e.g.*, changed from rulemaking to order) in rare cases

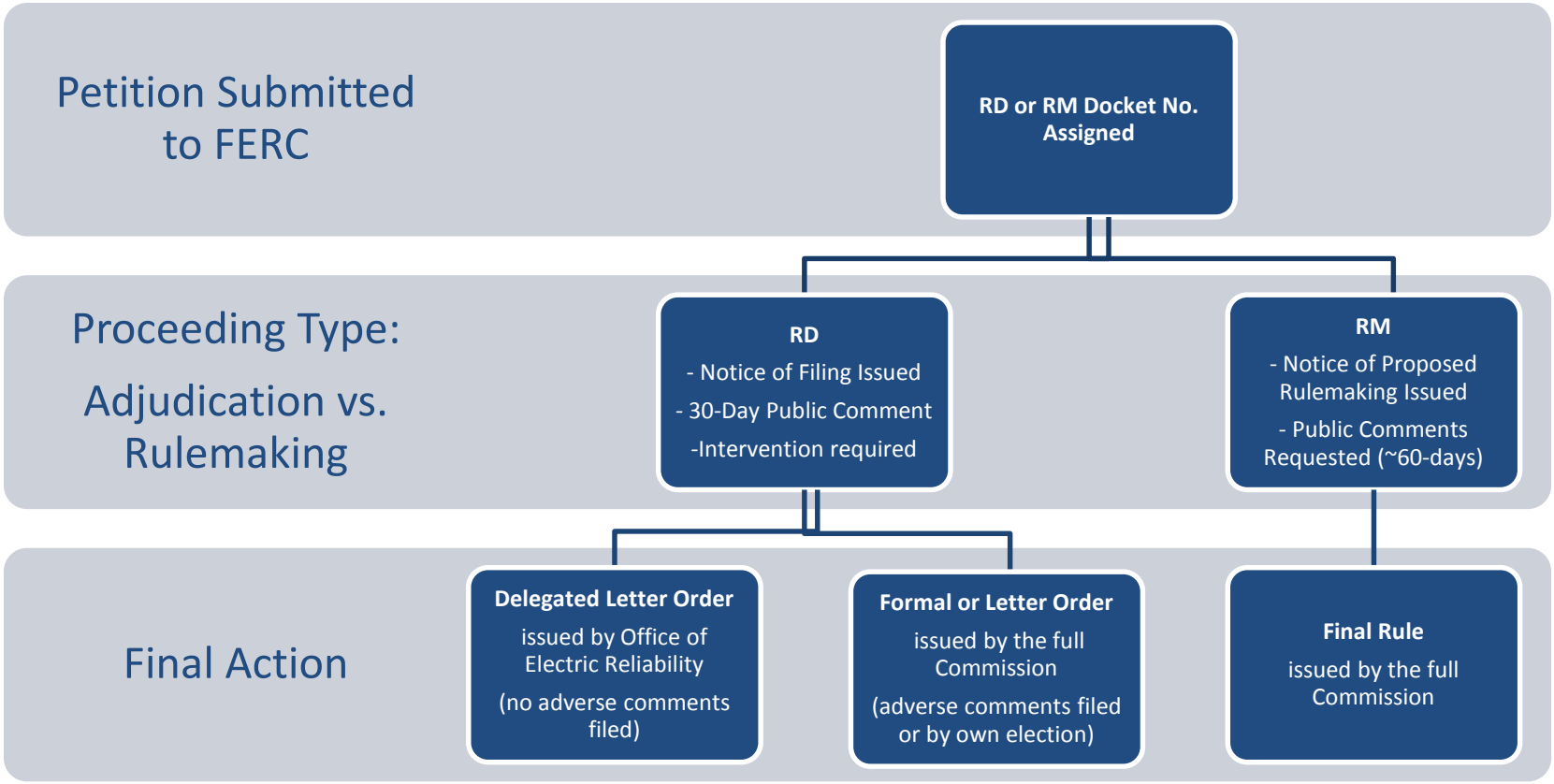
FERC Submission and Approval

- Orders (RD dockets) are generally reserved for uncontroversial NERC filings
- After docketing, FERC issues a notice setting a ~30 day deadline for filing motions to intervene and comments
- If no protests are received, FERC staff, under the authority delegated to the Director of the Office of Electric Reliability, may issue a Delegated Letter Order approving the proposed Reliability Standard
- FERC will issue a formal Commission order if protests are received, FERC does not approve the proposed Reliability Standard, or FERC otherwise determines that a Commission order is appropriate
- FERC *ex parte* rules apply in contested Order dockets

FERC Submission and Approval

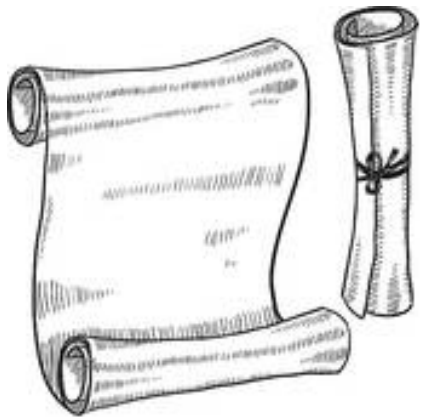
- Rulemaking dockets are typically used for proposed Reliability Standards that raise complex technical or policy issues
- Rulemakings involve issuance of a FERC Notice of Proposed Rulemaking and a FERC Final Rule
- Notice of Proposed Rulemaking (NOPR)
  - Identifies and explains FERC's intentions regarding the proposed Reliability Standards (*e.g.*, proposes to approve Reliability Standard)
  - Invites the submission of public comments on the NOPR
- Final Rule
  - Addresses comments submitted in response to NOPR
  - Makes final determinations regarding the proposed Reliability Standard
- FERC *ex parte* rules do not apply in rulemaking dockets

FERC Submission and Approval



Compliance Foundations

- Energy Policy Act of 2005 – Federal Power Act section 215
- Rules of Procedure (ROP) – Section 400
  - NERC oversight of Regional Entities
  - Compliance program attributes (audit cycles, independence, confidentiality)
  - ROP Appendix 4C, Compliance Monitoring and Enforcement Program
- Regional Delegation Agreements (RDA)
  - Regional Entities “contract” with NERC
  - Regional Entities must adhere to ROP



Compliance Foundations

- Compliance Monitoring and Enforcement Program (CMEP)
  - Outlines Compliance Monitoring processes
  - Provides guidance and requirements for each monitoring method
- CMEP also addresses:
  - Enforcement actions
  - Mitigations of violations
  - Remedial Action Directives
  - Data retention and confidentiality

Risk-based Compliance

- Registered Entity specific
  - Inherent Risk Assessment (IRA)
  - Compliance Oversight Plan (COP)
- ERO Enterprise Guidance Documents
  - Overview of the ERO Enterprise's Risk-Based CMEP
  - ERO Enterprise Guide for Compliance Monitoring

Annual Guidance Documents

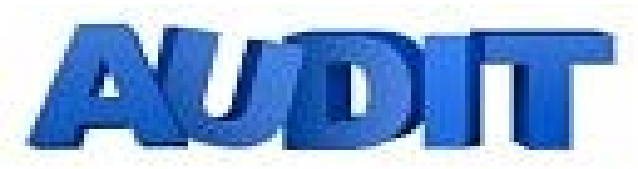
- Annual ERO Enterprise CMEP Implementation Plan
  - Key components and themes
  - Risk Elements and areas of focus for the year
  - Regional CMEP Implementation Plans
    - Region-specific Risk Elements and areas of focus for the year

Compliance Tools

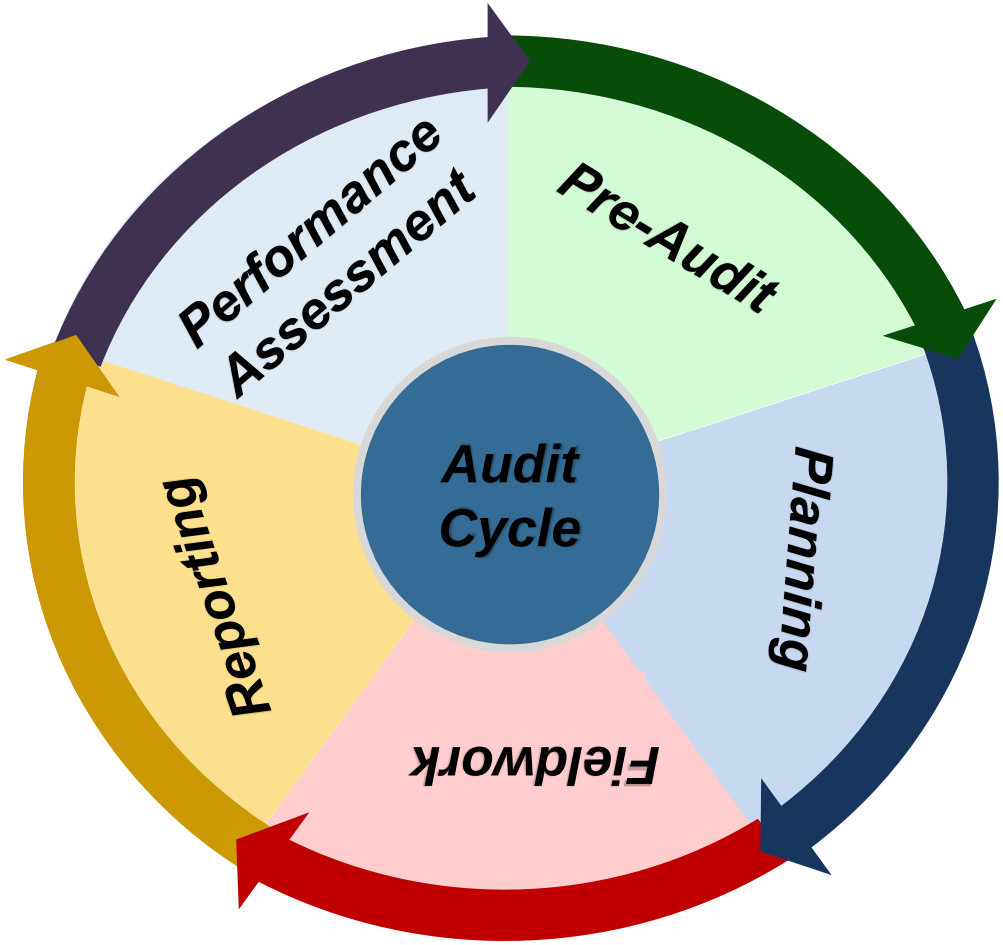
- Compliance Monitoring Methods
  - Compliance Audits
  - Self-Certifications
  - Spot Checks
  - Self-Reports
  - Periodic Data Submittals
  - Complaints
  - Compliance Investigations

Compliance Activities: Audit

- Audits occur at least once every three years for Balancing Authority (BA), Reliability Coordinator (RC), Transmission Operator (TOP)
- Audits of other entities may occur based on entity IRA and Compliance Oversight Plan (COP)
  - Level of risk informs compliance monitoring tool and interval
- Regional Entities typically lead compliance audits, NERC and FERC may observe
- Audit team composition and requirements described in CMEP
- Audits based on professional auditing standards



Compliance Audit Cycle



Compliance Audit Cycle

- Pre-audit:
  - Regional Entity performs Inherent Risk Assessment (IRA) to determine audit scope
  - Audit team assembled
- Planning:
  - 90-day notification letter delivered
  - Team develops understanding of entity and makes data requests
- Fieldwork:
  - Actual audit starts, interviewing and testing begins
- Reporting:
  - Reports include Findings, Recommendations, and Areas of Concern
- Performance Assessment:
  - Regional Entity reviews workpapers, identifies lessons learned, and process improvement

Compliance Activities: Self-Certifications

- Regional Entities will notify registered entities about self-certifying compliance to selected Reliability Standard/Requirement
  - Refer to Regional Annual CMEP Implementation Plans
  - Regional Entities also follow notification process in CMEP
- Registered entities must identify non-compliance when identified
- May request additional information

Compliance Activities: Spot Checks

- Regional Entity may conduct a spot check at any time to determine compliance with any Reliability Standard/Requirement
  - Typically narrower scope than an audit
  - May result after an event, system disturbance, compliance issue, or to ensure mitigation of previous findings
  - Regional Entities follow process in CMEP
  - May be used in lieu of an audit

Compliance Activities: Self-Reports

- Entities should make a self-report once it becomes aware it:
  - Has/may have violated a Reliability Standard or Requirement
  - The Violation Severity Level (VSL) of a previously reported violation has changed
- Regional Entities have self-reporting processes entities must follow
  - Regional Entity makes available self-report forms
  - Entity should provide relevant documentation to support filing
  - Regional Entity will review information to evaluate compliance and needed mitigation

Compliance Activities: Periodic Data Submittals

- Certain Reliability Standards contain Periodic Data Submittal (PDS) requirements
- NERC and Regional Entities may also identify PDS
- NERC and the Regional Entities notifies entities of PDS requirements
  - Refer to Annual CMEP Implementation Plan
  - Refer to NERC and Regional Entity websites
- NERC and the Regional Entities collects PDS and reviews for compliance

Compliance Activities: Complaints

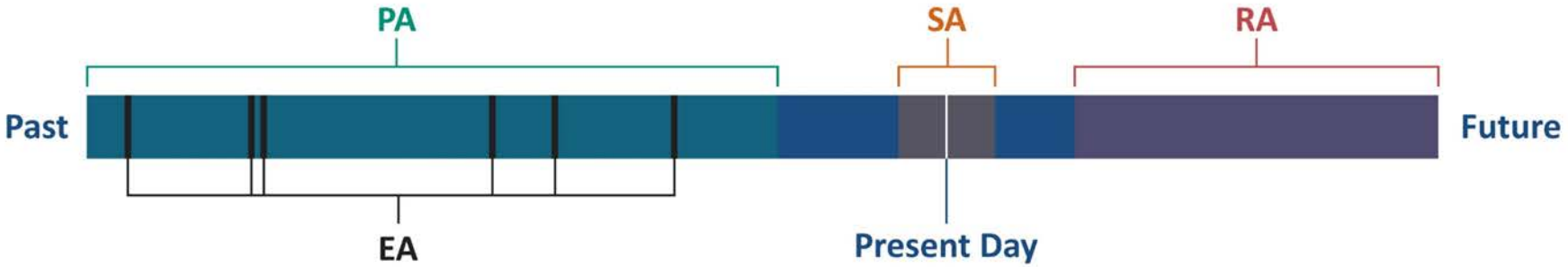
- Entities/third parties may submit complaint to NERC or a Regional Entity
- Complaints may be made through compliance hotlines, emails, or other contact methods
- Complaints may trigger spot check or investigation
- Any findings resulting from a complaint are processed similarly to an audit finding or spot check finding

Compliance Activities: Compliance Investigations

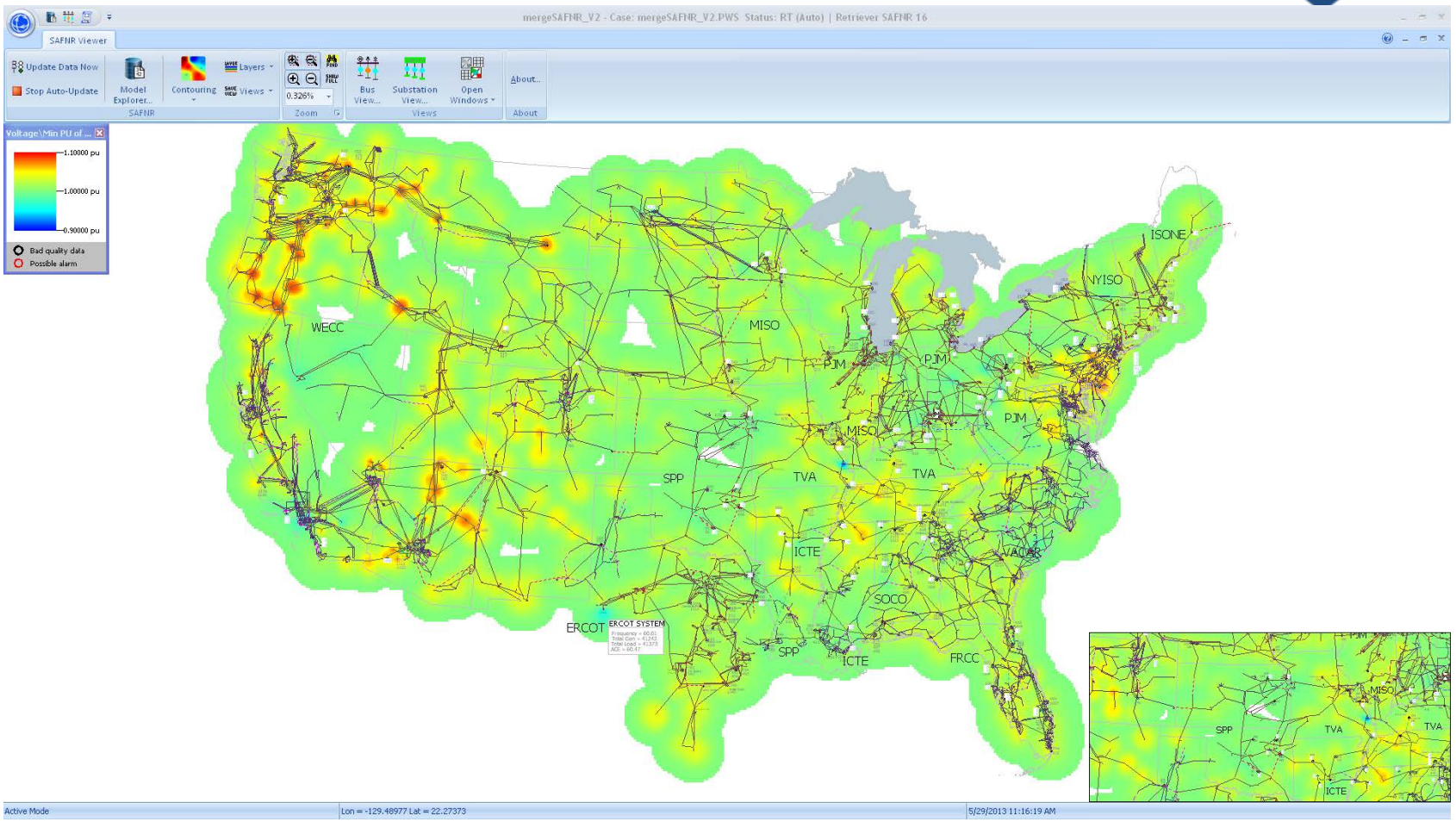
- May be triggered by events
- Confirm suspected non-compliance
- Specific scope at onset but scope can change
- Generally led by Regional Entity staff
  - Will always have NERC participation
  - Most likely will have FERC observers
- Confidential, unless conducted in response to FERC directive

Reliability Risk Management

Performance Analysis	Event Analysis	Situational Awareness	Reliability Assessments
			
Focus: past	Focus: specific events	Focus: current events	Focus: future

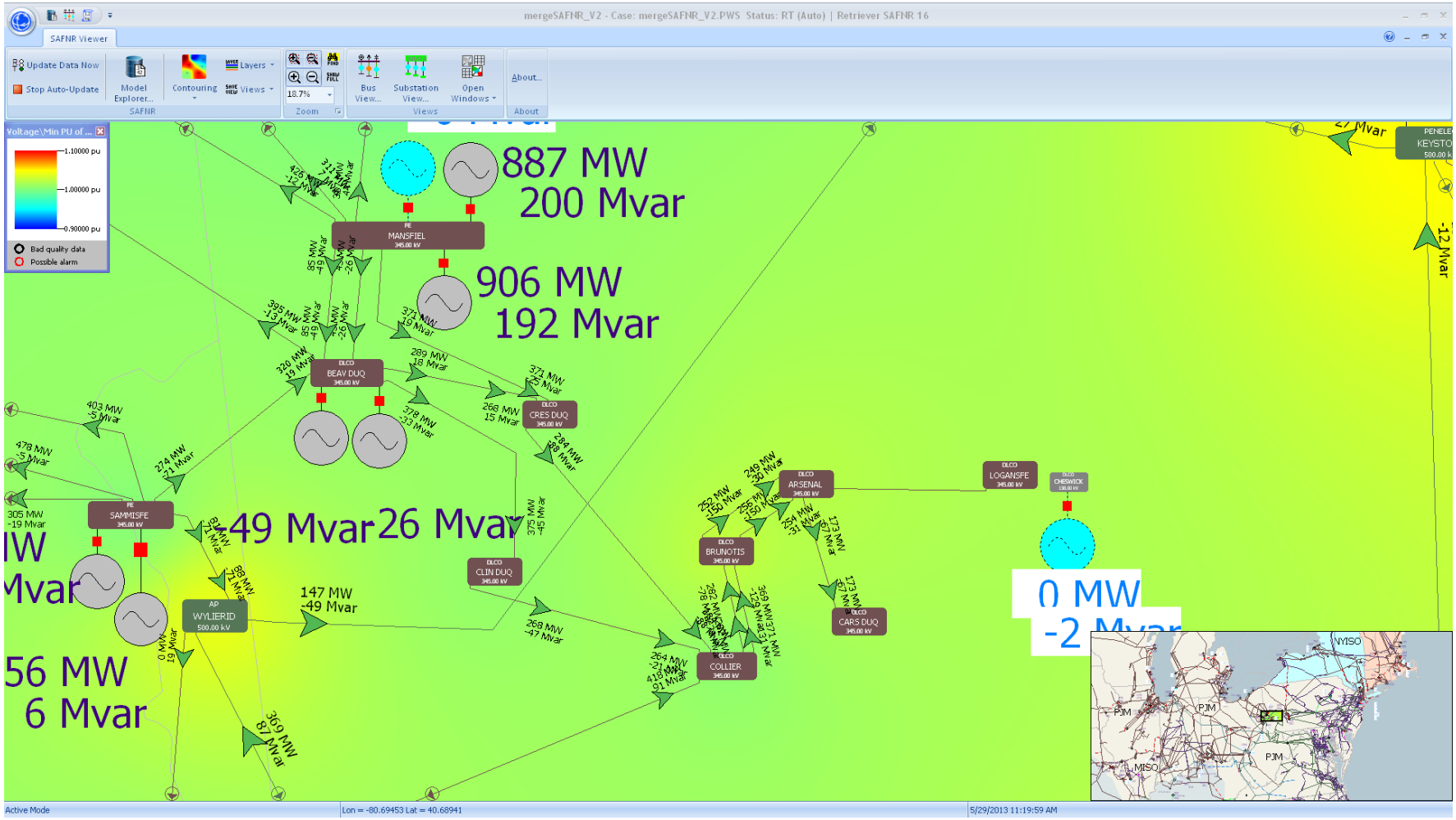


SAFNRv2: Voltage Contour



US voltage contour (200kV+), May 29, 2013, 1116 EDT

SAFNRv2: Details



Pittsburgh, PA - May 29, 2013, 1119 EDT

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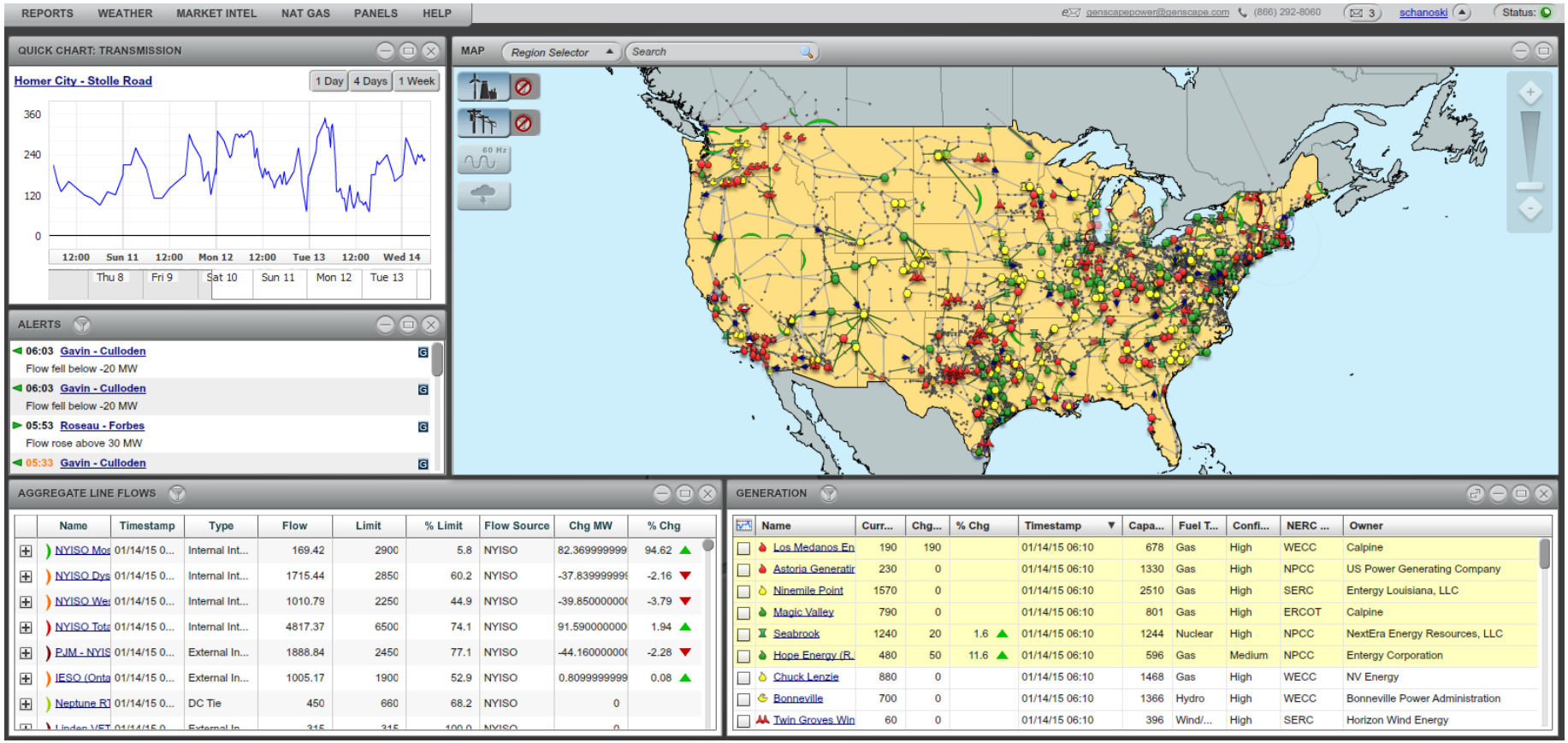
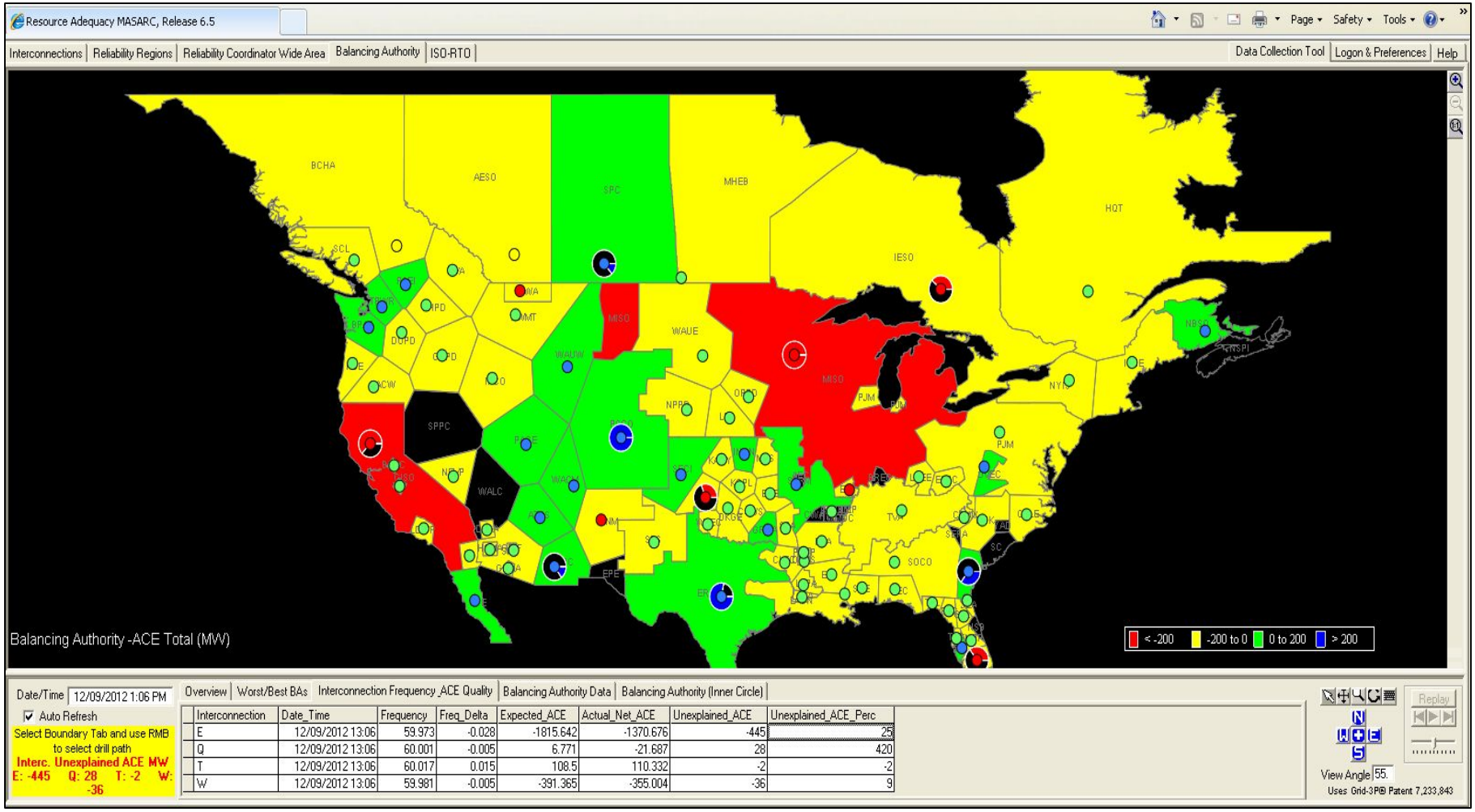
Genscape PowerRT

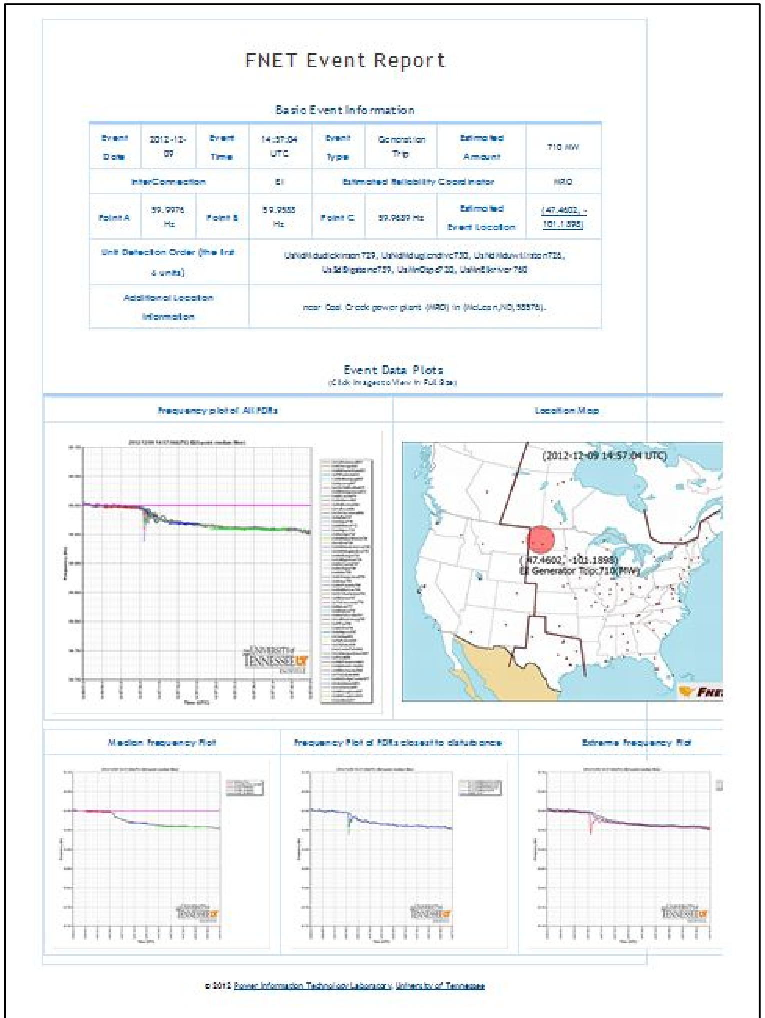


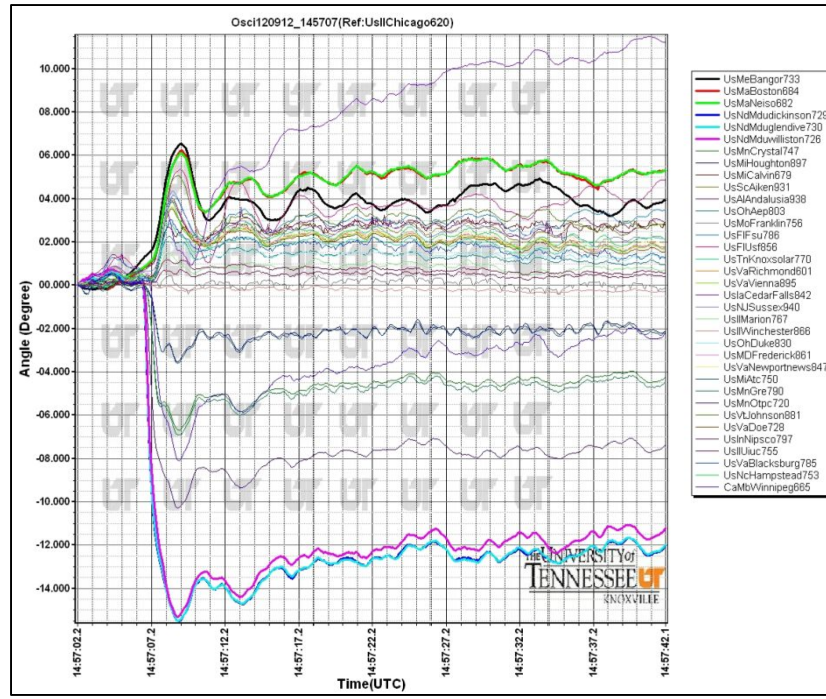
Tools: Resource Adequacy



Interconnection	Date_Time	Frequency	Freq_Delta	Expected_ACE	Actual_Net_ACE	Unexplained_ACE	Unexplained_ACE_Perc
E	12/09/2012 13:06	59.973	-0.028	-1815.642	-1370.676	-445	25
Q	12/09/2012 13:06	60.001	-0.005	6.771	-21.687	28	420
T	12/09/2012 13:06	60.017	0.015	108.5	110.332	-2	-2
W	12/09/2012 13:06	59.981	-0.005	-391.365	-355.004	-36	9

Tools: FNet


FNET Event Report
Basic Event Information
Event Date
2012-12-09
Event Time
14:57:04 UTC
Event Type
Generation Trip
Estimated Amount
710 MW
InterConnection
EI
Estimated Reliability Coordinator
MRO
Point A
Point B
Point C
Estimated Event Location
(47.4602, -101.1898)
Additional Location Information
Event Data Plots
Frequency plot of All FDRs
Location Map
(2012-12-09 14:57:04 UTC)
(47.4602, -101.1898)
EI Generator Trip:710(MW)
Median Frequency Plot
Frequency Plot of FDRs closest to disturbance
Extreme Frequency Plot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UsMaNeiso682
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UsNdMduglendive730
UsNdMduwilliston726
UsMnCrystal747
UsMiHoughton897
UsMiCalvin679
UsScAiken931
UsAlAndalusia938
UsOhAep803
UsMoFranklin756
UsFlFsu786
UsFlUsf856
UsTnKnoxsolar770
UsVaRichmond601
UsVaVienna895
UsIaCedarFalls842
UsNJSussex940
UsIlMarion767
UsIlWinchester866
UsOhDuke830
UsMDFrederick861
UsVaNewportnews847
UsMiAtc750
UsMnGre790
UsMnOtpc720
UsVtJohnson881
UsVaDoe728
UsInNipsco797
UsIlUiuc755
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THE UNIVERSITY of TENNESSEE UT
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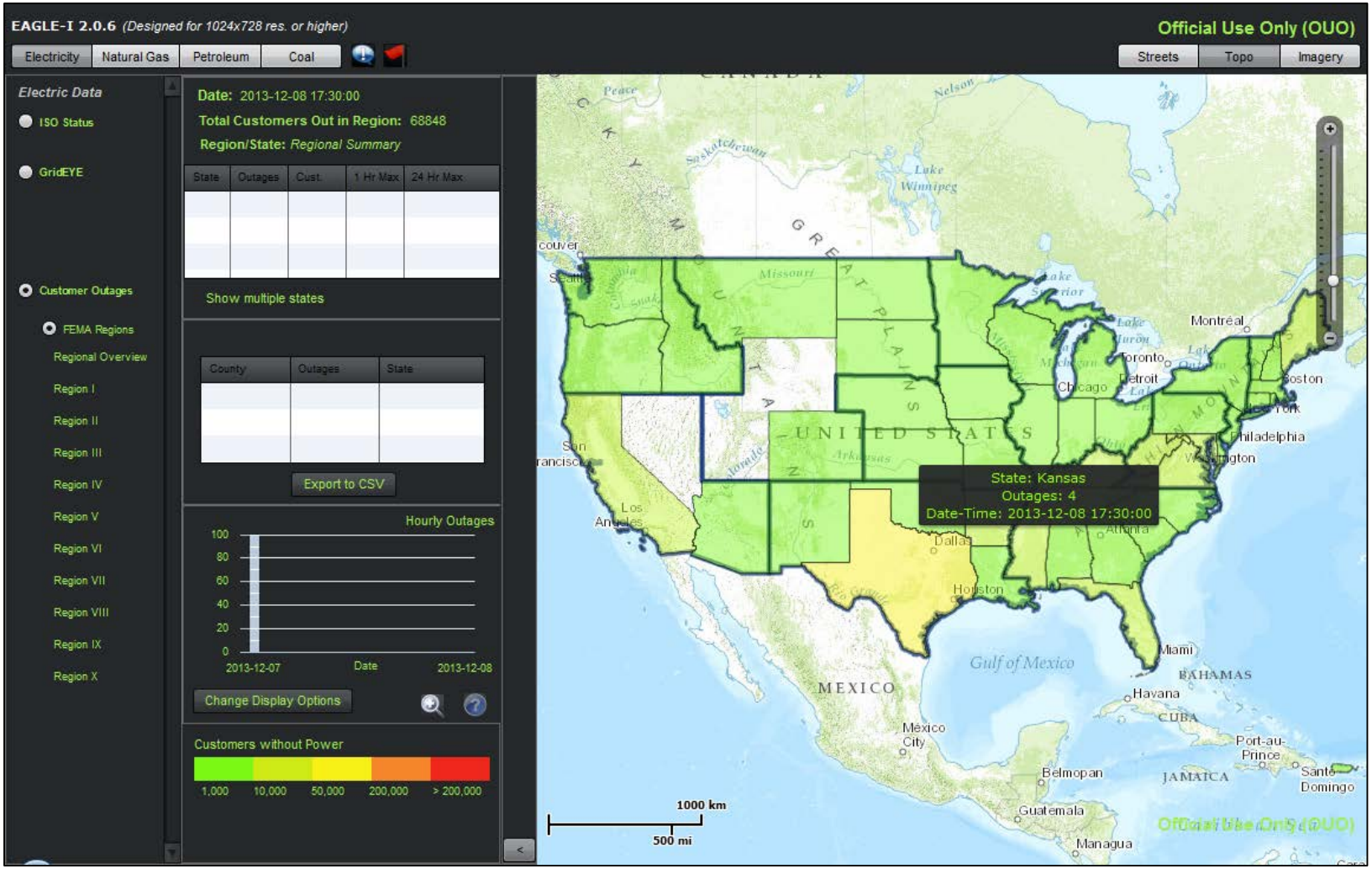
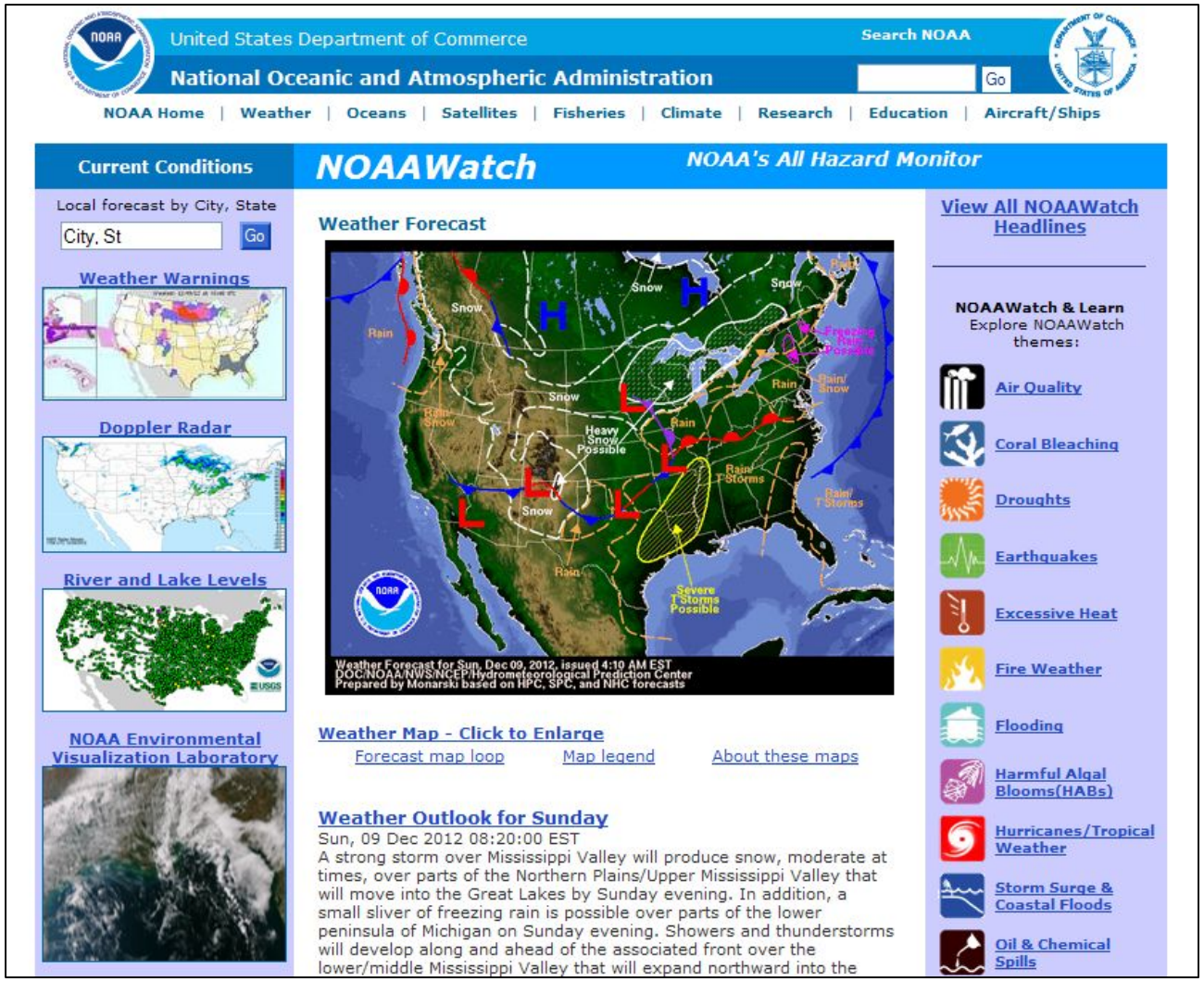
Tools: DOE EAGLE-I



Tools: Weather Forecasting



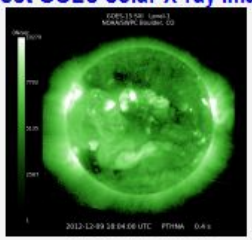
Tools: Space Weather

NOAA / Space Weather Prediction Center

Space Weather Now

2012 Dec 09 18:13 UTC (Dec 09 11:13 MST)

Latest GOES Solar X-ray Image



NOAA Scales Activity

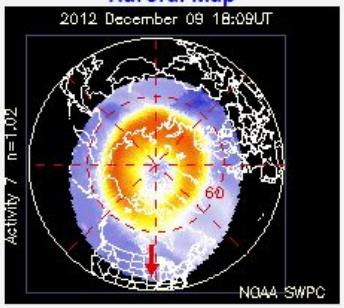
Range 1 (minor) to 5 (extreme)

NOAA Scale	Past 24 hrs	Current
Geomagnetic Storms	none	none
Solar Radiation Storms	none	none
Radio Blackouts	none	none

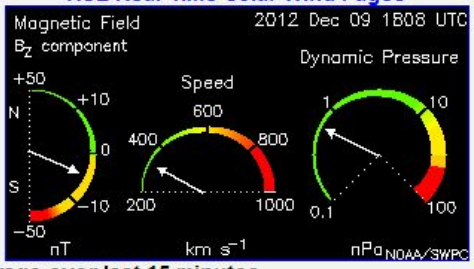
Alerts

Latest Alert: Nov 26 0511 UTC WARNING: Geomagnetic K-index of 4 expected

Auroral Map



ACE Real-Time Solar Wind Pages



Average over last 15 minutes

◁| ▷ ■ |▷ |▷▷ 10 frames/sec

Solar Cycle Progression

Space Weather User Groups

- Navigation
- Radio

Tools: Social Media

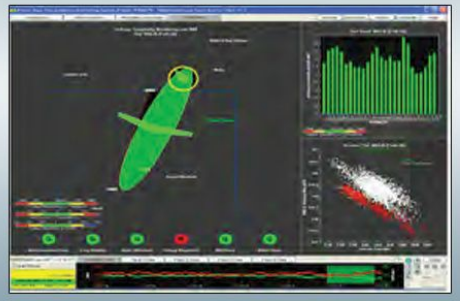
Future Tools: PMUs for SA

Intro | Small Signal Stability | Voltage Stability | Dashboard | Configurable Alarms | Detection of Grid Stress

VOLTAGE STABILITY MONITORING

Measurement based dynamics provide voltage sensitivities; monitoring of key corridors or load pockets; Scatter plots forPower-Voltage and Power-Angle monitoring.

Assess proximity to voltage collapse conditions.

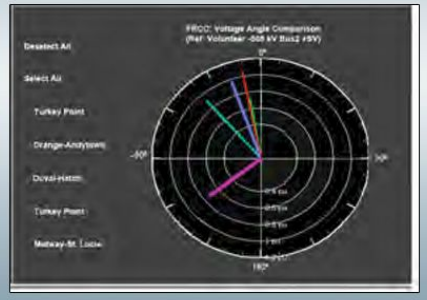


Intro | Small Signal Stability | Voltage Stability | Dashboard | Configurable Alarms | Detection of Grid Stress

DETECTION OF GRID STRESS

Real Time tracking of Angular Separations provide an accurate pulse of the stresses on the grid.

Assess high stressed conditions across major interfaces which can lead to cascading blackouts (e.g. 2003 Northeast Blackout).



Intro | Small Signal Stability | Voltage Stability | Dashboard | Configurable Alarms | Detection of Grid Stress

DASHBOARD DISPLAY

Situational Awareness — visualization of the overall grid.

Health; attention grabbing traffic lights signal alarms.

Gauges quantify the metrics and identify the problem locations.

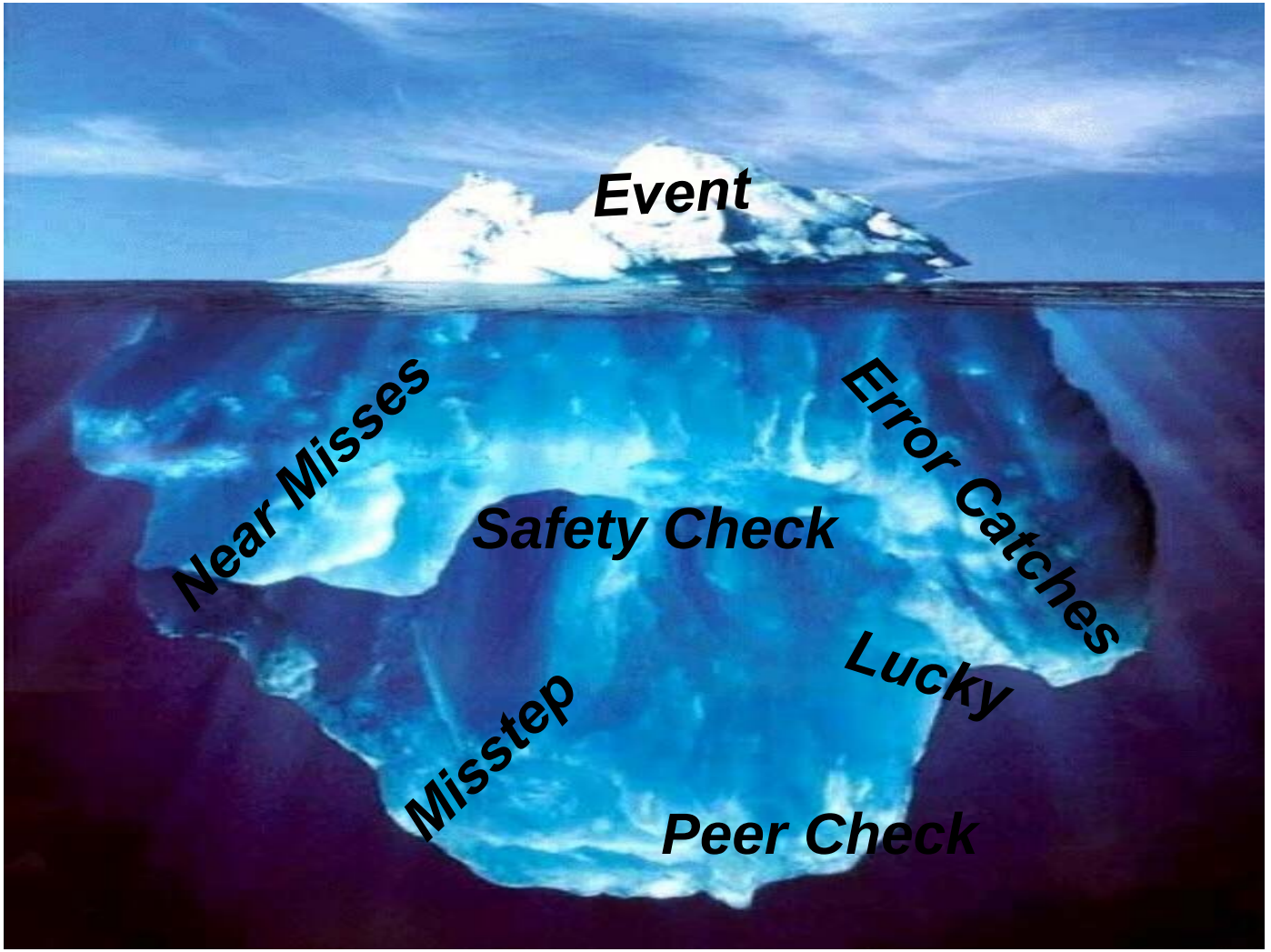
Intro | Small Signal Stability | Voltage Stability | Dashboard | Configurable Alarms | Detection of Grid Stress

SMALL SIGNAL STABILITY MONITORING

For low frequency oscillatory modes, tracking damping and oscillatory behavior.

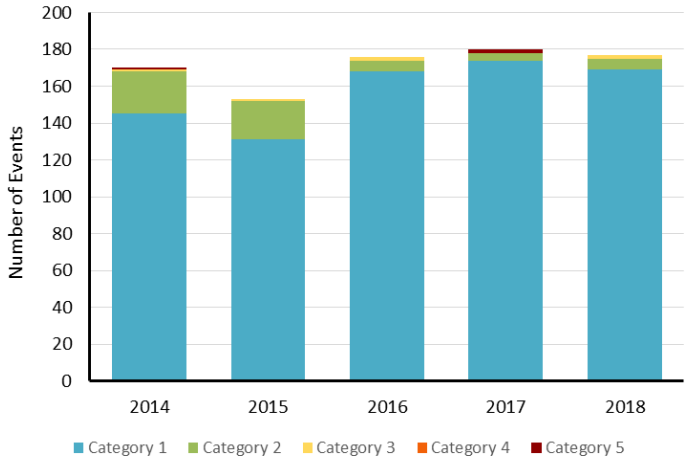
Detect dangerous oscillations which could result in grid separation (e.g. 1996 WECC breakup).

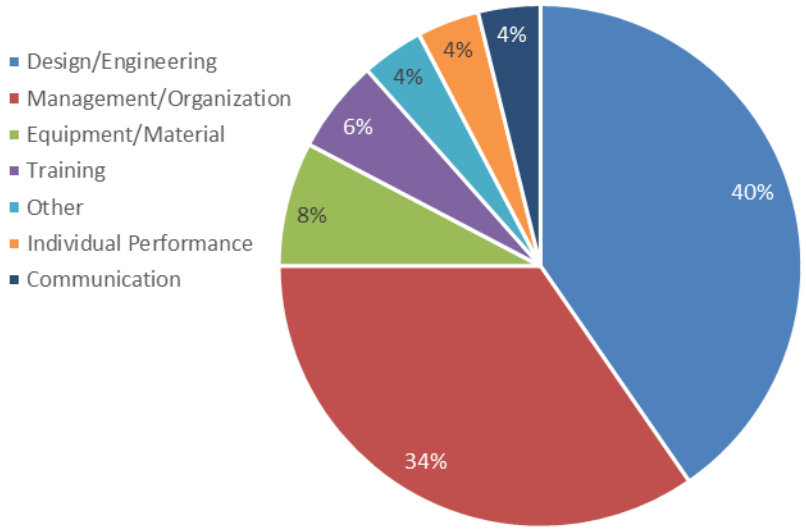
Event Analysis



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	





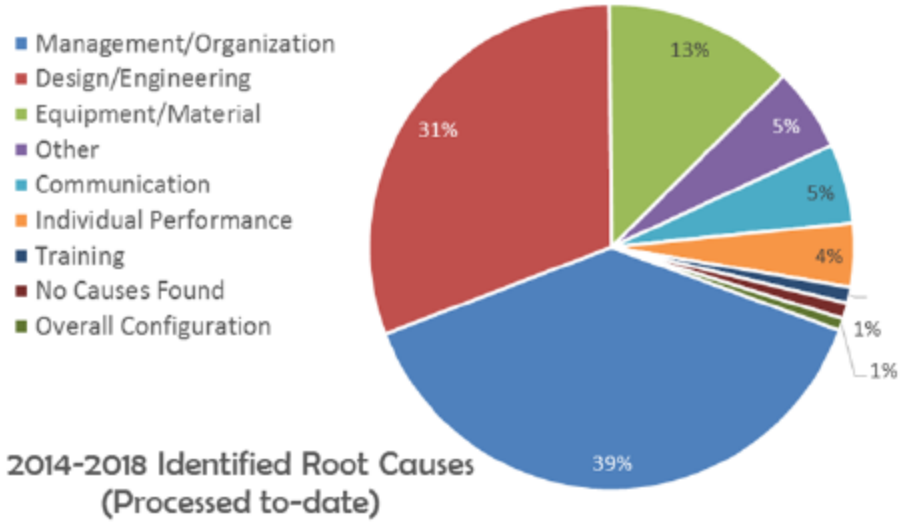
2014-2018 Event Analysis Trends

856 Event Reports

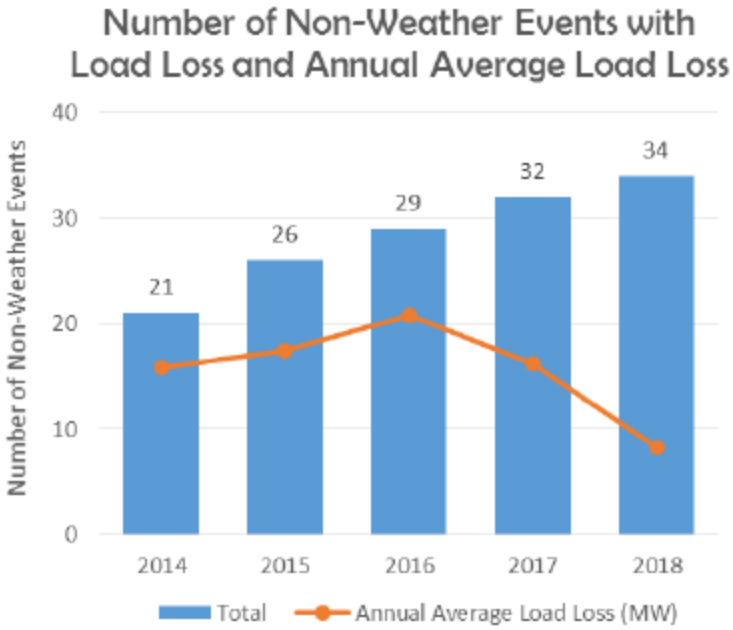
378 Identified Root Causes

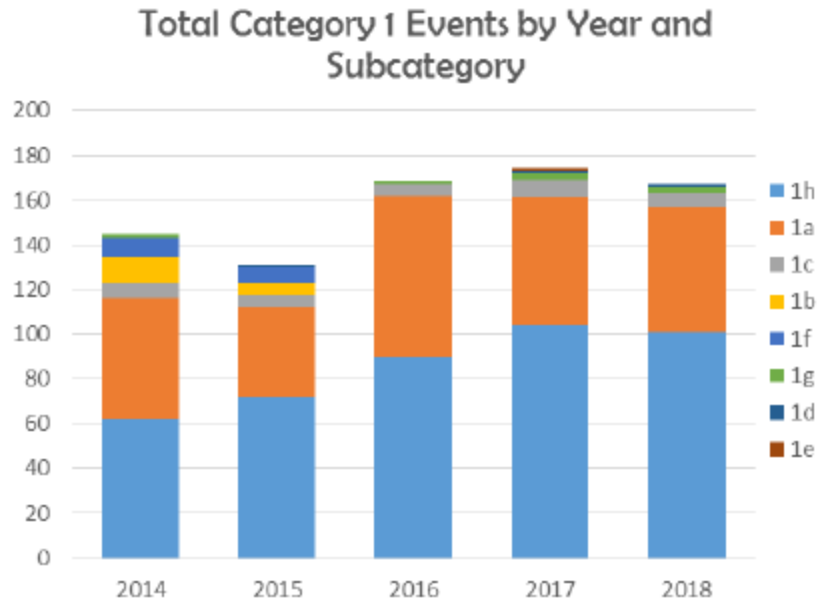
116 MW

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



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





Primary Data Sources

Transmission Availability Data System (TADS)

TADS inventory and outage data are used to study the initiating cause codes (ICCs) and sustained cause codes (SCCs) of transmission outages. Metrics are developed that analyze outage frequency, duration, causes, and many other factors related to transmission outages. This analysis can shed light on prominent and underlying causes affecting the overall performance of the BPS.

Transmission
100kV and greater

Generation Availability Data System (GADS)

GADS contains information that can be used to compute generation-related reliability measures, such as Weighted-Equivalent Forced Outage Rate (WEFOR). WEFOR is a metric measuring the probability that a unit will not be available to deliver its full capacity at any given time due to forced outages and derates. NERC's GADS maintains operating histories on more than 5,000 generating units in the North America.

Conventional Generators
20 MW and larger

Misoperation Info Data Analysis System (MIDAS)

MIDAS collects protection system relay operations and misoperations. Metrics are developed to assess protection system performance. Trends are evaluated and can be used to identify remediation techniques to reduce the rate of occurrence and severity of misoperations. Misoperations exacerbate event impacts on the BPS. The data collection is granular and allows NERC to identify specific trends associated with certain geographies, technologies, human performance, and management.

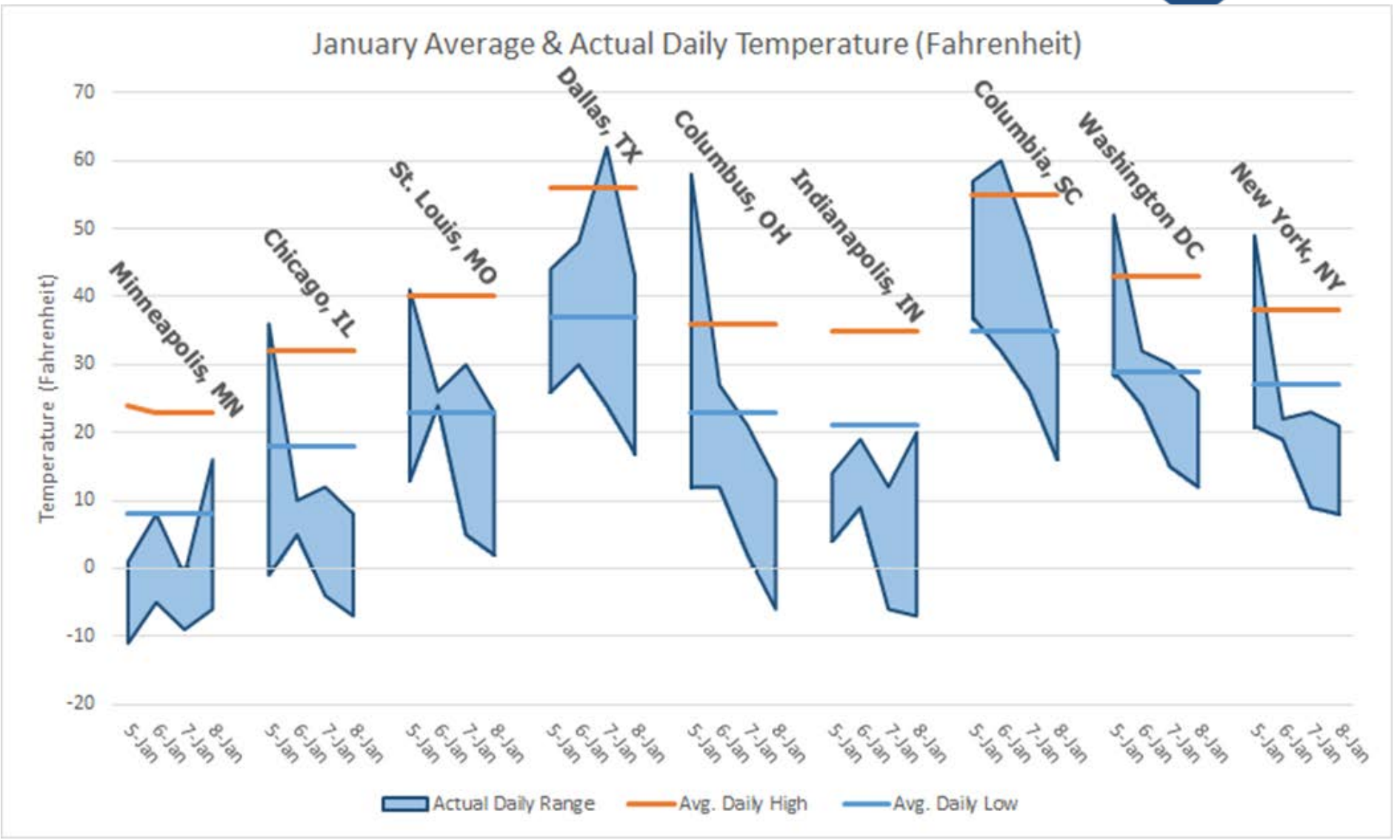
Transmission Owners,
Generator Owners,
Distribution Providers

The Event Analysis Management System (TEAMS)

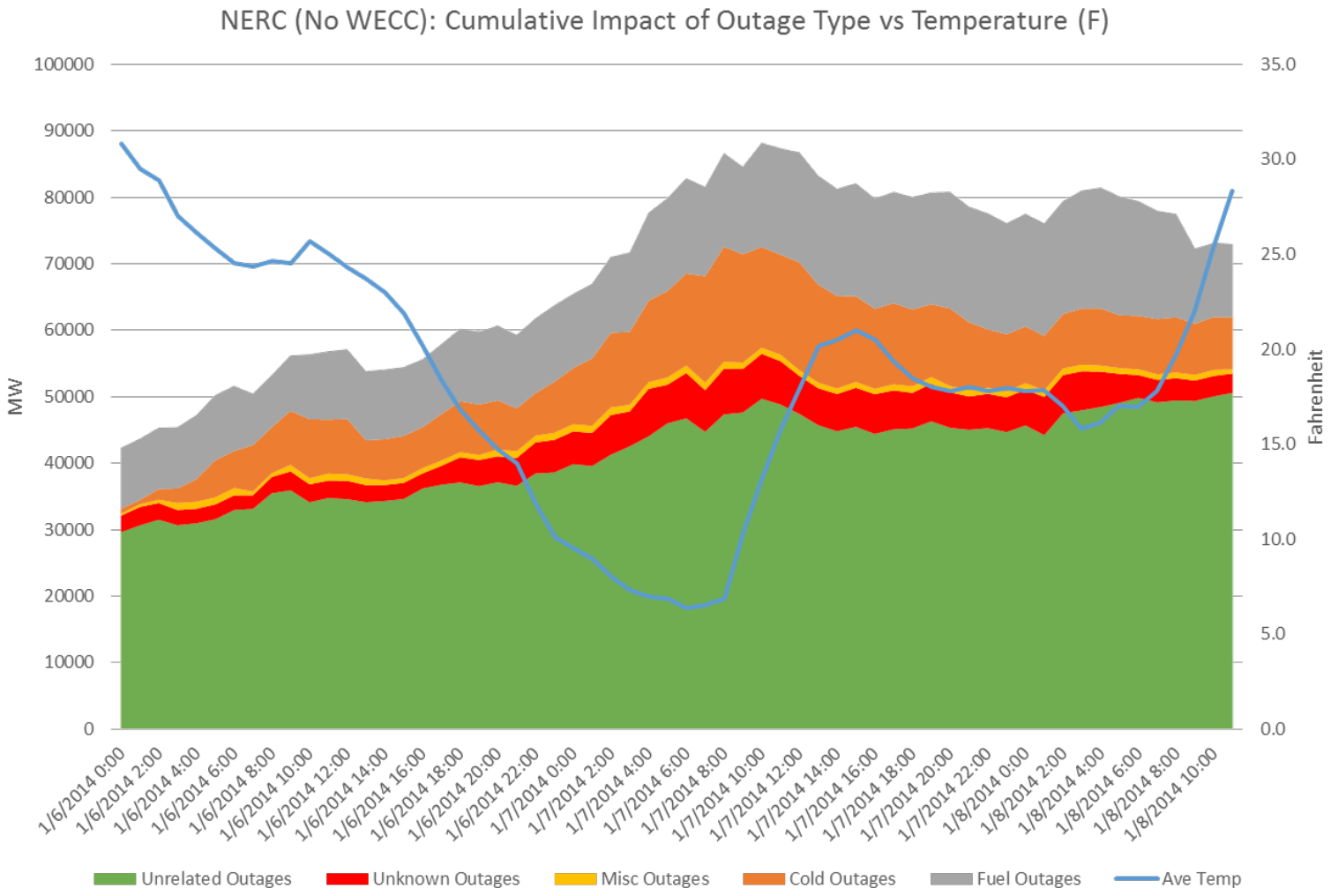
TEAMS is used to track and process records originating from the EOP-004 reporting, OE-417 reporting, Event Analysis Process and the ERO Cause Code Assignment Process. Relevant reports are recorded, uploaded and tied together into a single event. The data in TEAMS is used to support event cause coding, general system performance analysis and key performance indicators for the bulk power system.

Balancing Authorities,
Reliability Coordinators,
Transmission
Owner/Operators,
Generation
Owner/Operators,
Distribution Providers

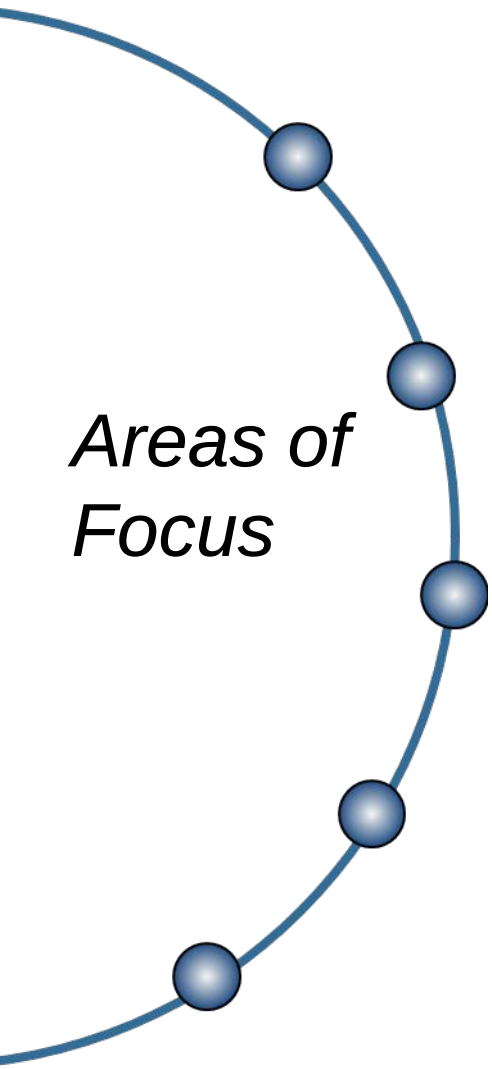
Deviation from Normal 2015 1st quarter



NERC: Outages vs Temperature



Performance Analysis



Areas of Focus

- Application Management
- Data Management
- Application Support
- Stakeholder Engagement
- Analysis and Reporting

Application Management: Data Collection Applications

- Five active data collection applications
  - OATI-developed and hosted
    - TADS: 2008
    - DADS: 2011
    - GADS: 2012
  - NERC-developed and hosted
    - MIDAS July 2016 -> MIDAS Portal October 2017
    - GADS Wind February 2017 -> GADS Wind Portal TBD
- Data Request Development – New data collection efforts
  - Geomagnetic Disturbance
  - GADS Solar
  - Energy Storage

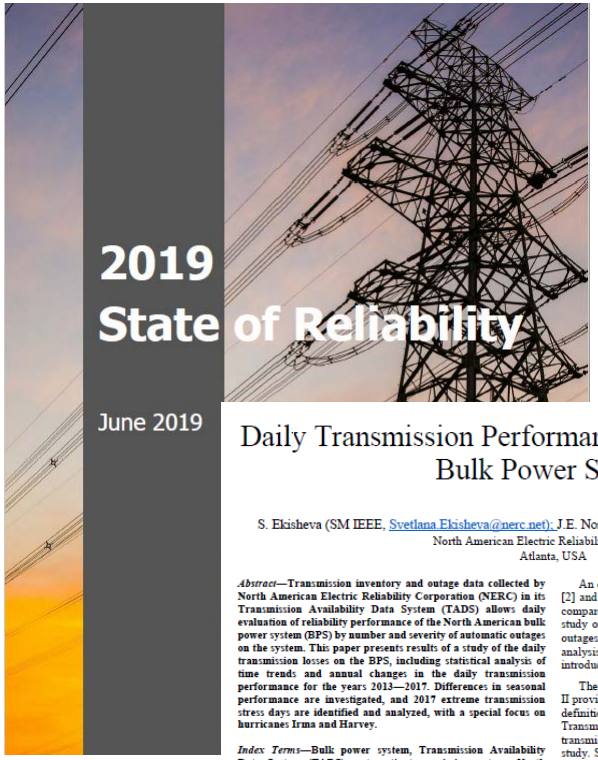
Application Support

- Support
  - Over 5,000 users across six applications
- Training
  - Annual in-person training sessions
- Documentation
  - Data Reporting Instructions updated annually
- Application web pages
  - Regional Contacts
  - Frequently Asked Questions
  - Dashboards, Analysis, and Summary Data

Stakeholder Engagement

- **Liaisons for Planning Committee groups with performance analysis functions**
  - Performance Analysis Subcommittee (PAS)
  - Working Groups/Task Forces
    - DADS Working Group
    - GADS Working Group
      - Conventional and Wind Generation
    - MIDAS Working Group
    - TADS Working Group
    - GMD Task Force
- **ERO Enterprise**
  - Regional entity application group
  - Data warehouse and analytics
- **FERC Staff**
- **Industry Outreach**
  - Third-party GADS vendors
  - IEEE
  - American Wind Energy Association (AWEA)
  - Energy Systems Integration Group (ESIG)
    - Formerly UVIG: Utility Variable-Generation Integration Group
  - Forums such as NATF and NAGF
  - Carnegie Mellon University

Analysis and Reporting



Daily Transmission Performance of North American Bulk Power System

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***Abstract*—Transmission inventory and outage data collected by North American Electric Reliability Corporation (NERC) in its Transmission Availability Data System (TADS) allows daily evaluation of reliability performance of the North American bulk power system (BPS) by number and severity of automatic outages on the system. This paper presents results of a study of the daily transmission losses on the BPS, including statistical analysis of time trends and annual changes in the daily transmission performance for the years 2013—2017. Differences in seasonal performance are investigated, and 2017 extreme transmission stress days are identified and analyzed, with a special focus on hurricanes Irma and Harvey.**

***Index Terms*—Bulk power system, Transmission Availability Data System (TADS), automatic transmission outage, North American Electric Reliability Corporation (NERC)**

I. Introduction

NERC uses transmission equipment inventory and outage data collected in TADS to analyze outages and performance trends and assist in identifying significant reliability risks to the bulk power system (BPS) [1]. Since 2008 until July 1, 2018, these data have been collected in TADS from eight NERC regions, shown in Fig. 1. (In 2018, the regions reformulated into only seven, but that is beyond the scope of the study discussed herein.)

Figure 1. The North American Bulk Electric System divided into eight Regional Entities

An overview of TADS data and analysis was introduced i [2] and updated in [3]. A series of papers [4-7] analyzed an compared reliability of TADS elements while [8] presented study on leading causes that initiate and sustain transmissio outages on the system. This paper develops and extend analysis of daily performance of the transmission BPS, firs introduced in [1].

The body of the paper is divided into six sections. Section II provides a brief TADS overview and several relevant TADS definitions. Section III presents a definition of Daily Transmission Loss (DTL) as an indicator of the performance of transmission BPS and describes the TADS data used for the study. Section IV summarizes results of the statistical analysis of the DTL for years 2013-2017 and introduces a methodology to identify transmission stress days. Section V focuses on two NERC category 5 events that hit the North American BPS in 2017, (Saffir-Simpson category 4) hurricanes Irma and Harvey. Conclusions are presented in the final Section VI.

II. Transmission Availability Data System (TADS)

A. TADS Overview

NERC has been collecting North American automatic outage data for transmission elements of 200 kV and above since January 1, 2008. Transmission elements of BPS reportable in TADS include (1) ac circuits (overhead and underground), (2) transformers (no generator step-up units), and (3) dc circuits (a dc circuit element is a complete line, not just a single pole). Automatic outage data collection started with TADS inception, and non-automatic (i.e. planned and operational) outage data collection began on January 1, 2010.

In 2015, TADS reporting changed to align with the implementation of the FERC approved BES definition [9]. Two additional voltage classes were added; namely, less than 100 kV and 100–199 kV. Sustained automatic outages are the only outages collected at voltage classes below 200 kV. Also in 2015 the planned outage reporting was discontinued, and since then, for voltages at or above 200 kV, only operational and automatic (momentary and sustained) outage data have been collected.

B. TADS Definitions [10]

- Automatic Outage: An outage that results from the automatic operation of a switching device, causing an

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PA Oversight Plan Metrics
GADS and TADS Reporting

Updated – 03/29/18

Report date:	27-Mar-18							
	Percentage of Complete Data Submissions*							
Reporting Quarter	2017-Q1		2017-Q2		2017-Q3		2017-Q4	
	GADS	TADS	GADS	TADS	GADS	TADS	GADS	TADS
FRCC	100%	100%	100%	100%	100%	100%	100%	100%
MRO	90%	100%	90%	100%	90%	100%	90%	100%
NPCC	98%	100%	98%	100%	98%	100%	98%	100%
RF								
SERC								
SPP								
TRE								
WECC								

*Adjustmer

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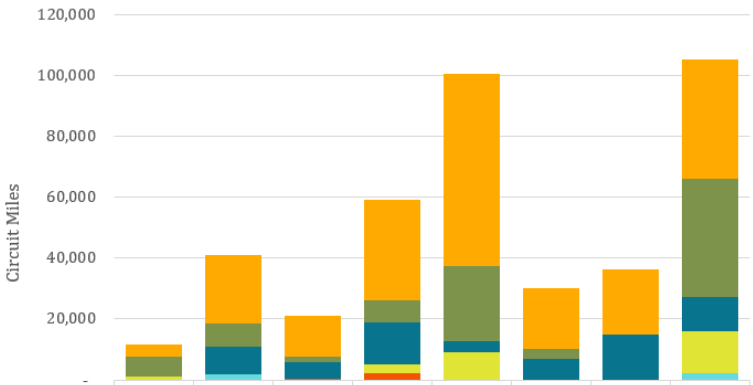

	FRCC	MRO	NPCC	RFC	SERC	SPP	TRE	WECC
100-199 kV	4,050	22,517	13,598	33,156	63,264	19,819	21,329	39,242
200-299 kV	6,468	7,631	1,638	7,195	24,408	3,218	-	38,781
300-399 kV	-	9,087	5,642	13,923	3,627	6,938	14,986	11,200
400-599 kV	1,201	139	-	2,723	9,223	94	-	13,843
600 kV - 799 kV	-	-	190	2,233	-	-	-	-
Total DC	-	1,802	48	66	-	-	-	2,190
Inventory Count	*1,002*	*2,078*	*1,791*	*4,142*	*5,841*	*1,648*	*2,260*	*4,591*
Entity Count	*15*	*33*	*19*	*27*	*30*	*20*	*25*	*62*

Figure 2-2. Existing U.S. transmission (circuit miles) as of last day of 2017

Note: Inventory Count includes the number of elements reported by voltage class for each year; Entity Count includes the number of reporting entities for each year

Source: Developed by DOE from NERC TADS Inventory (personal communication from NERC received on July 2, 2018)

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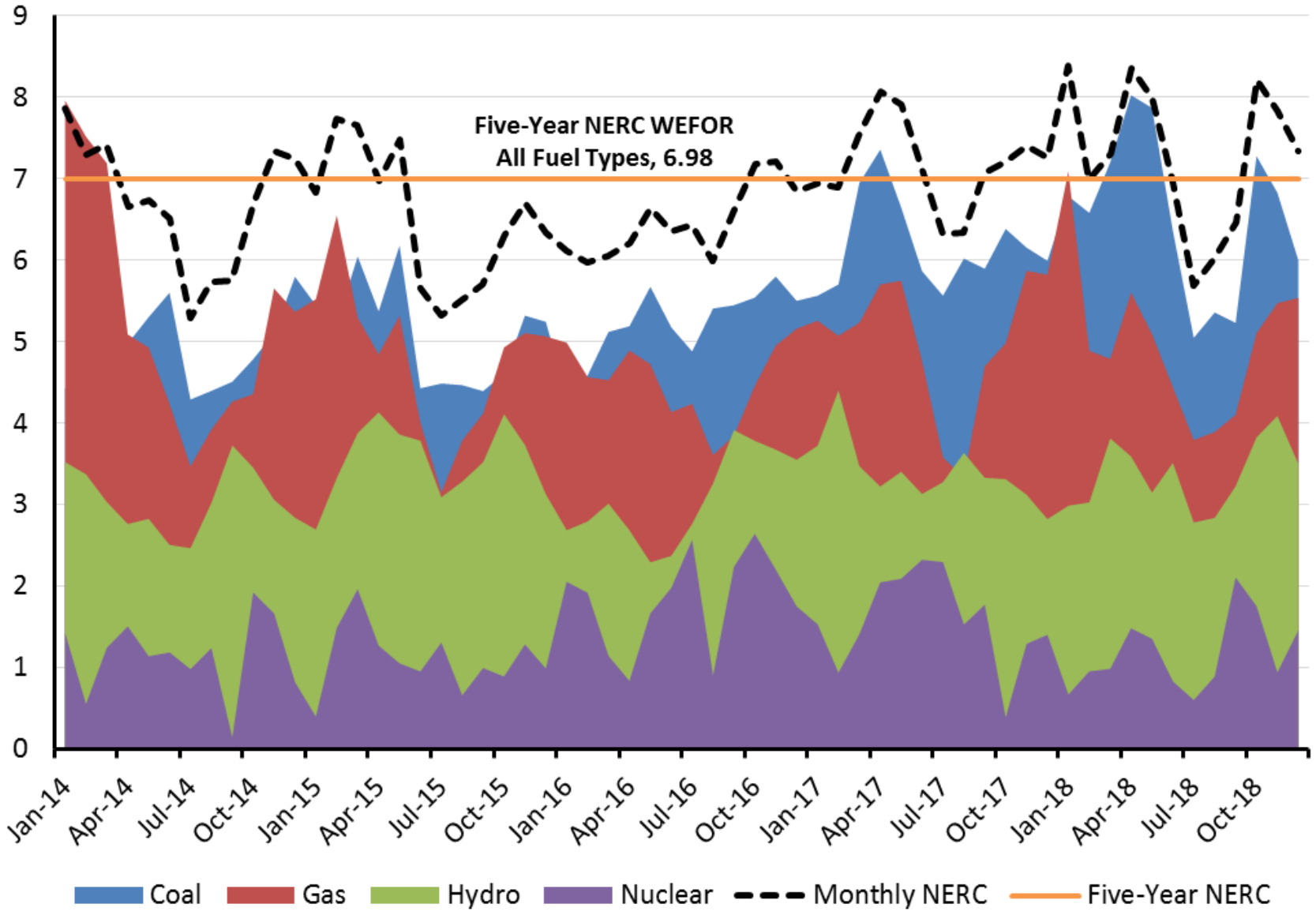
Reliability Indicator – Weighted Effective Forced Outage Rate, Conventional



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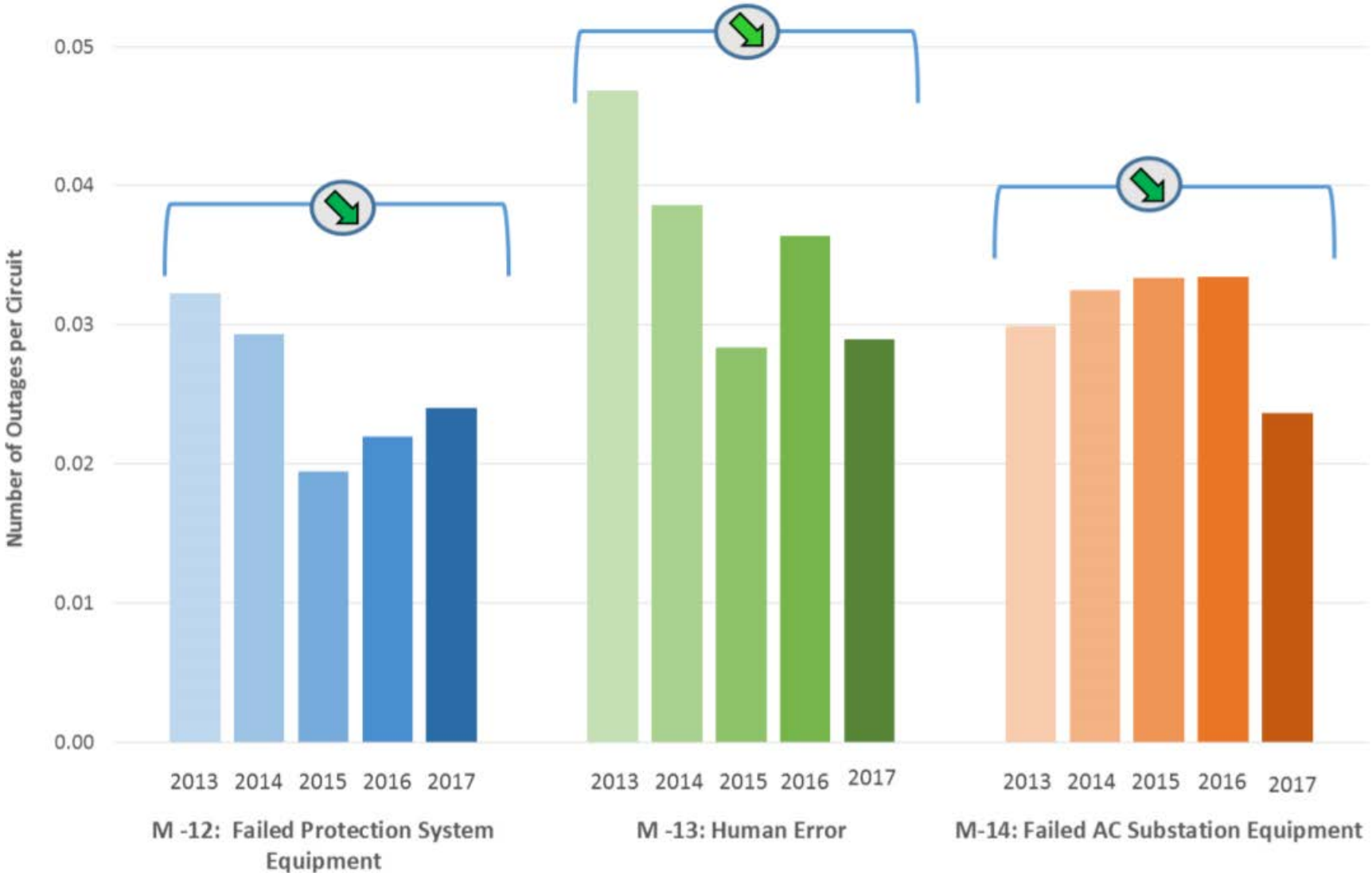
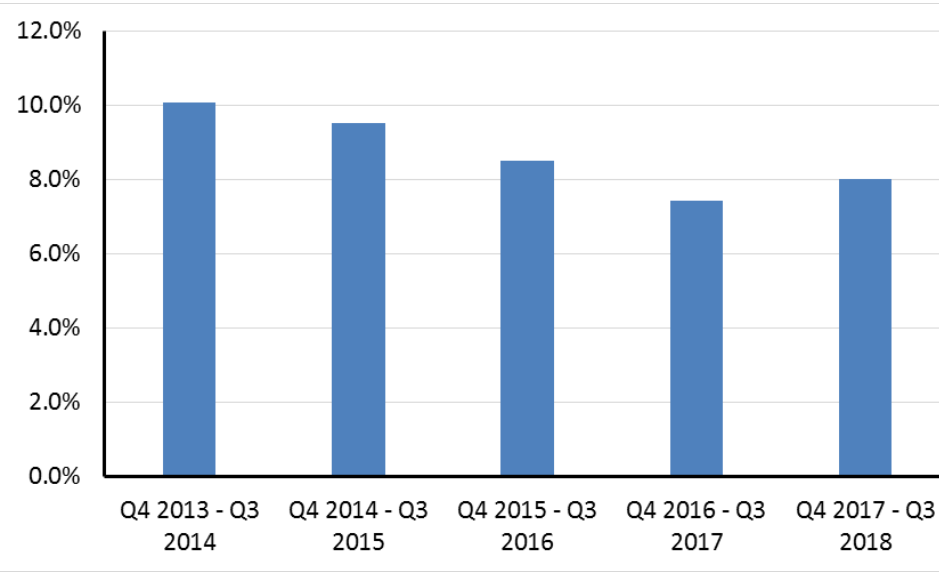
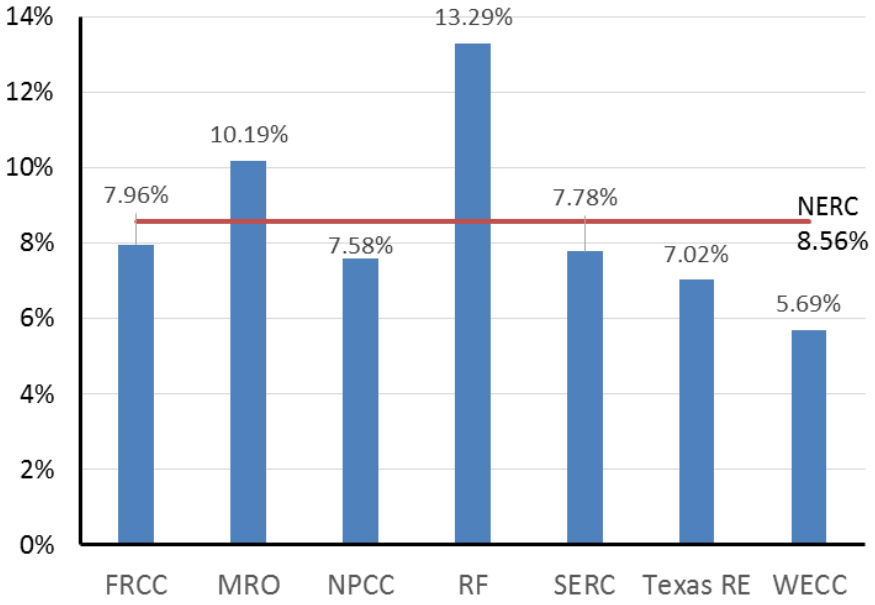
200 kV+ Outages by Cause Code



Reliability Indicator – Protection System Misoperation Rate



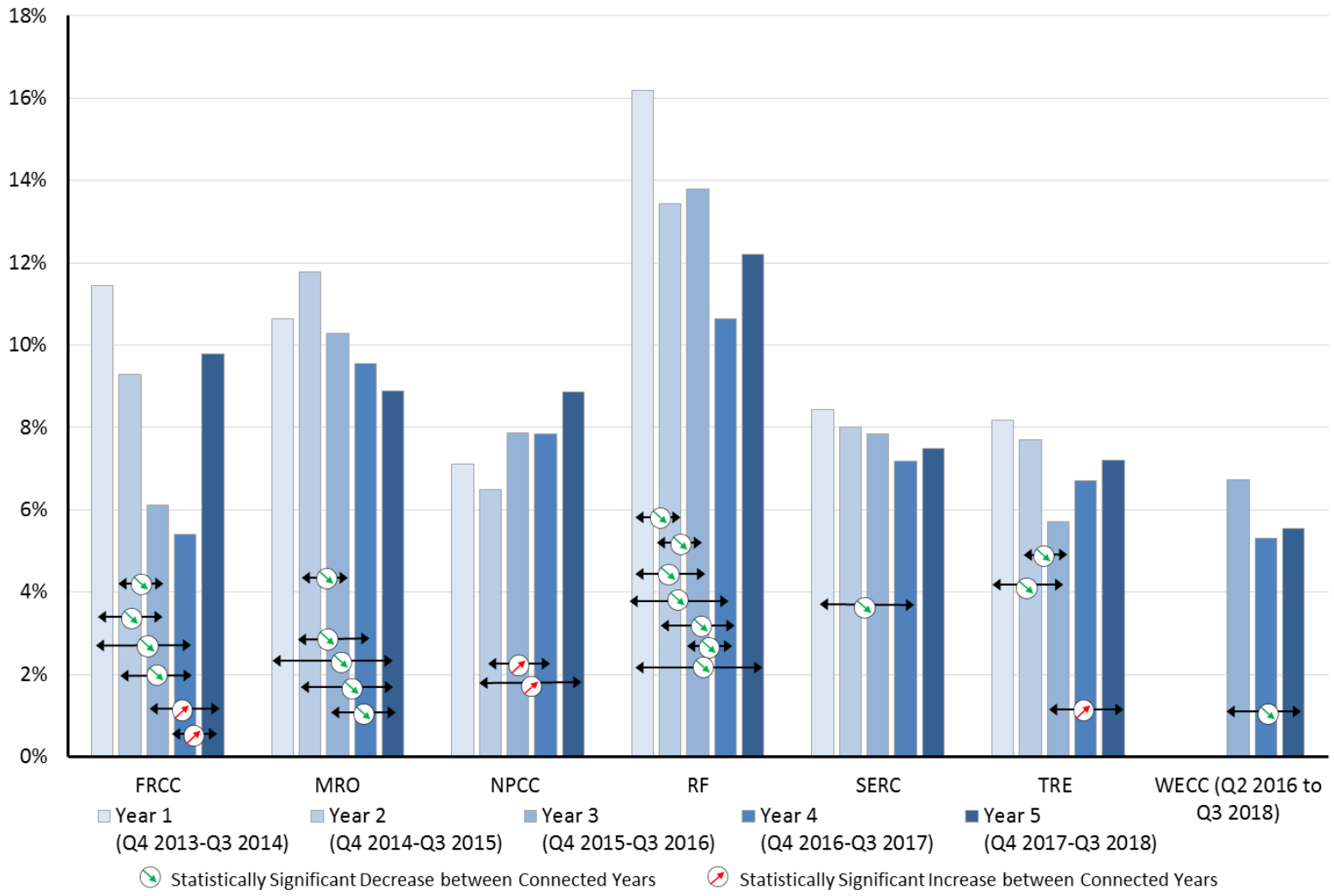
Annual Protection System Misoperation Rate



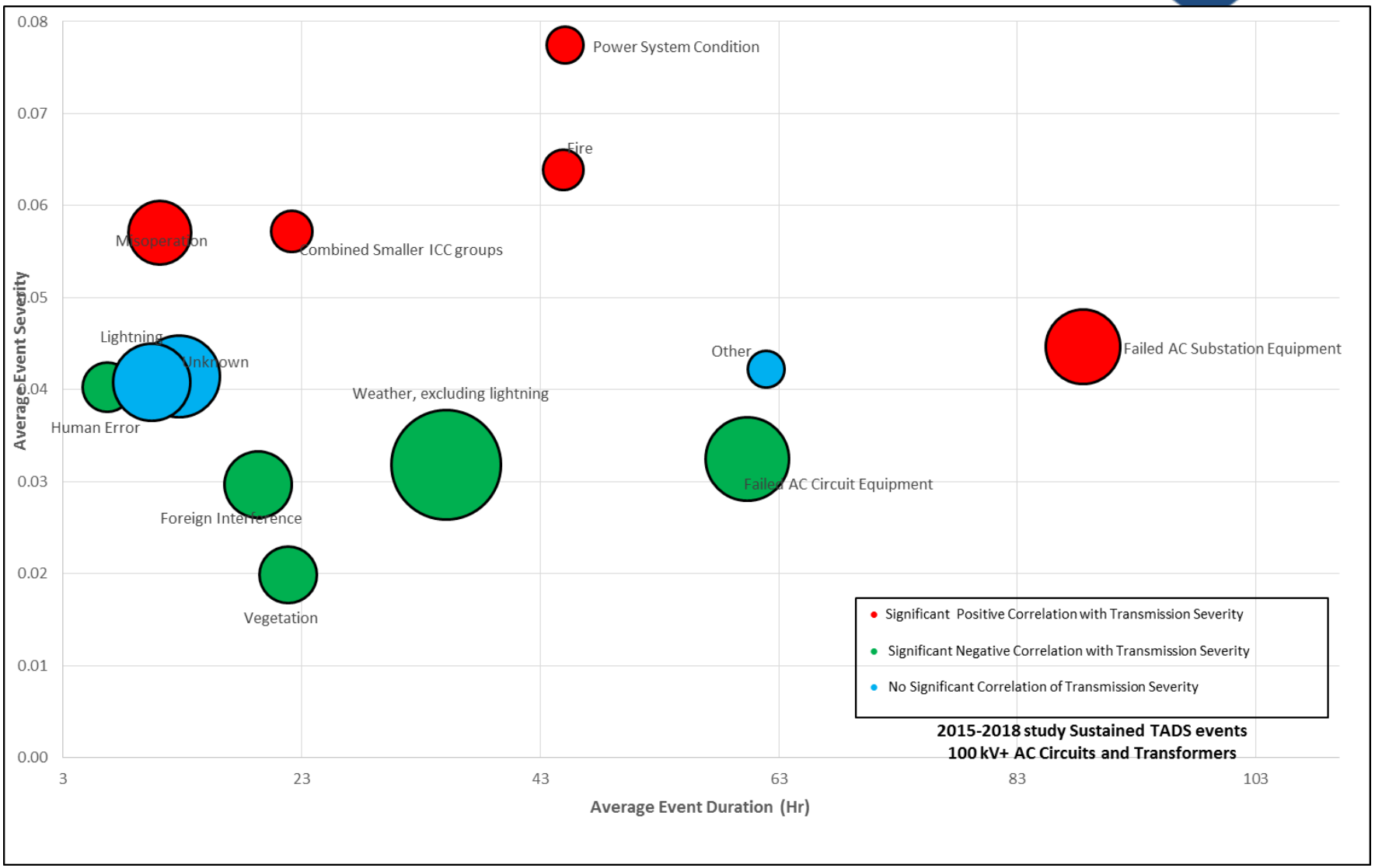
Five-Year Protection System Misoperation Rate by Region

Q4 2013 through Q3 2018

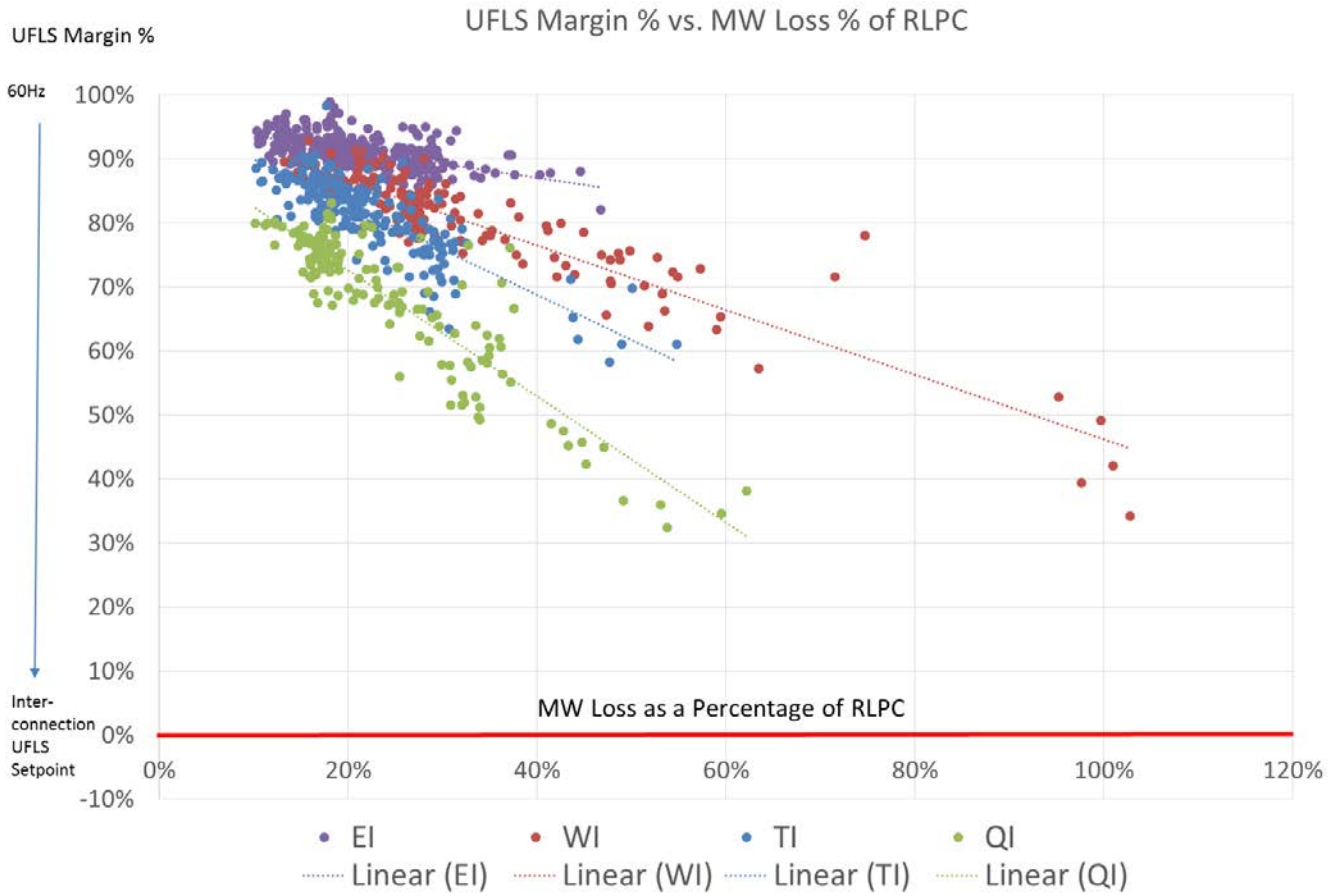
Misoperation Rates Continuing to Decline



Continued Decline in Average Transmission Outage Severity

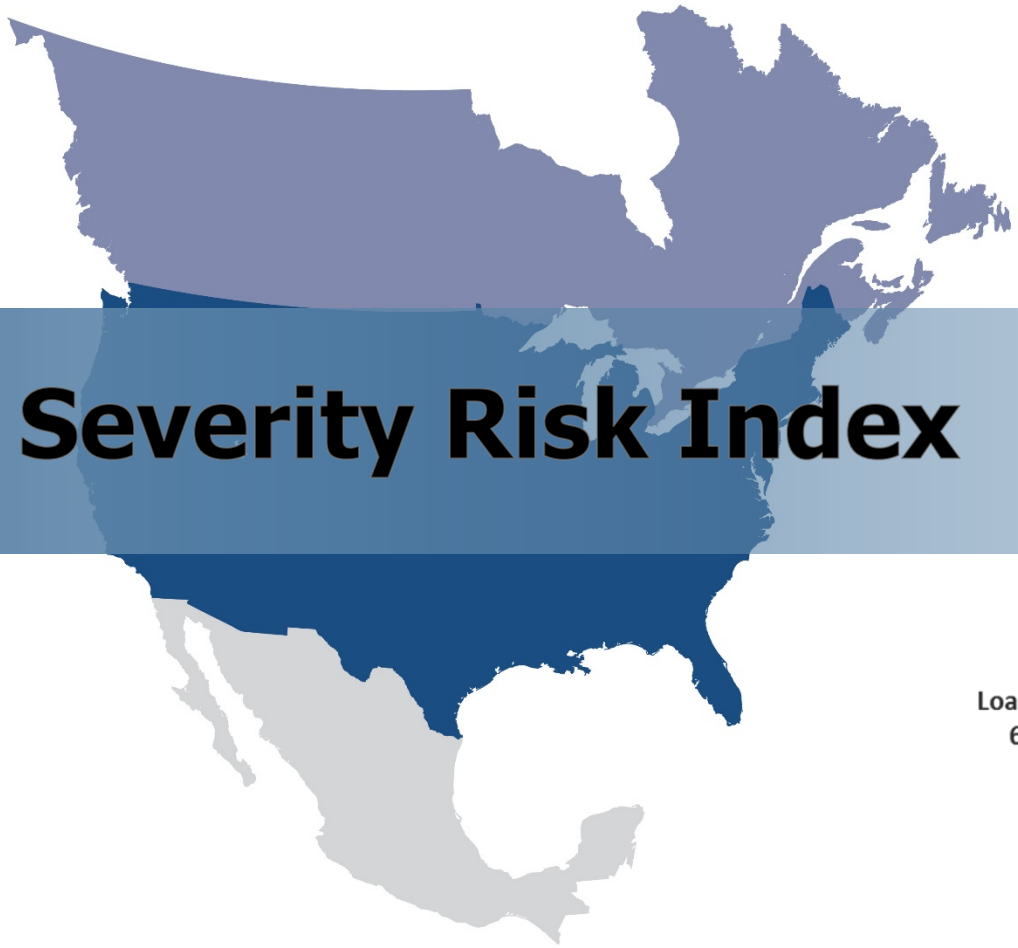


Reliability Indicator – Frequency Response

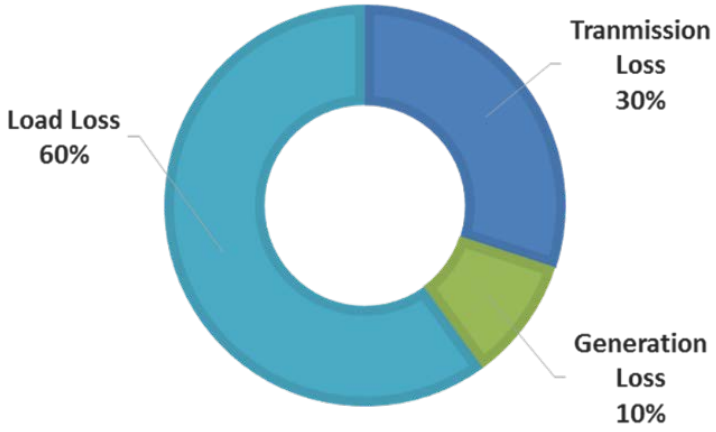


2018 Frequency Response Performance Statistics and Trend Assessment

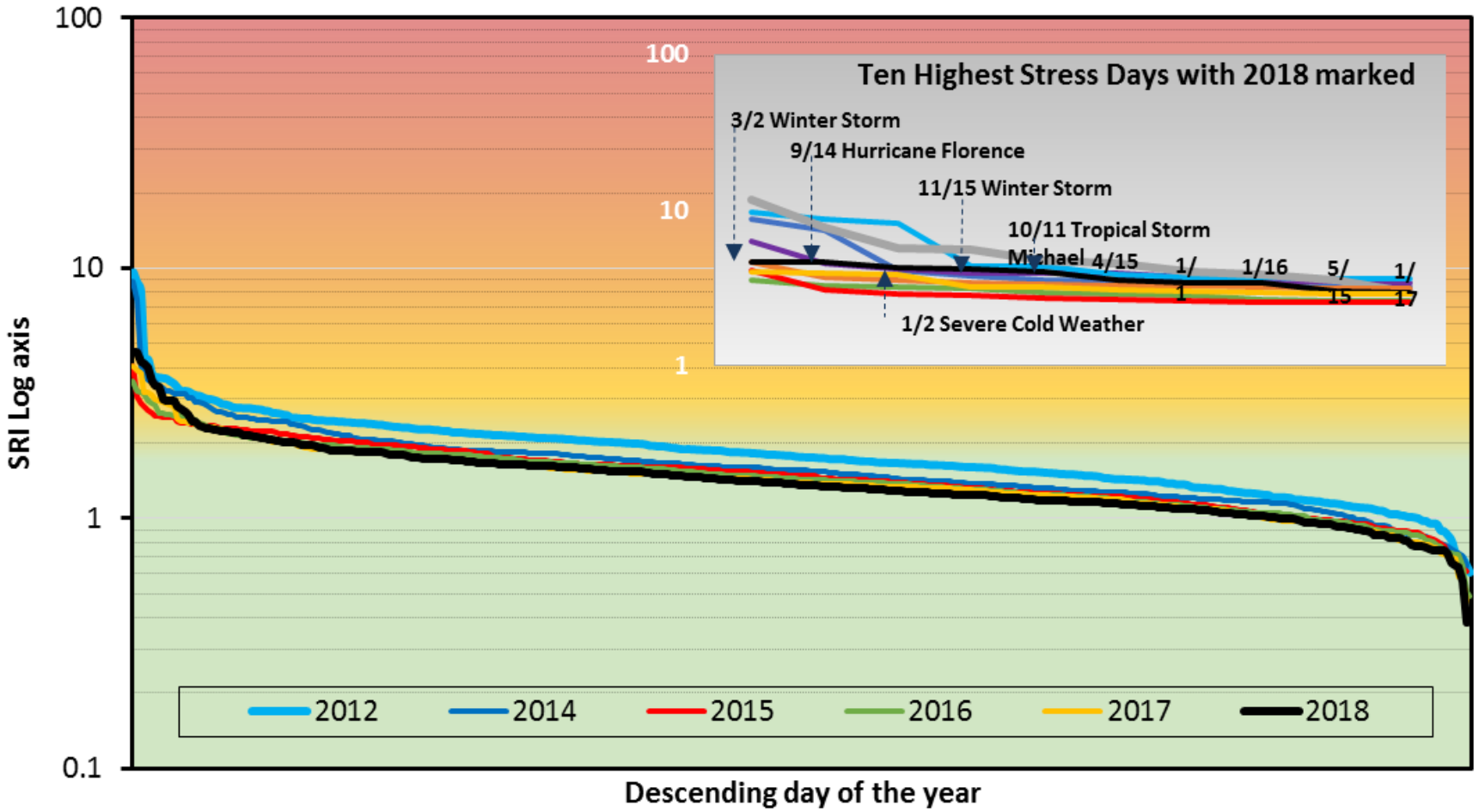
Interconnection	2018 OY Arresting Period Performance			2018 OY Stabilizing Period Performance		
	Mean UFLS Margin (Hz)	Lowest UFLS Margin (Hz)	2014–18 OY Trend	Mean $IFRM_{A-B}$ (MW/0.1 Hz)	Lowest $IFRM_{A-B}$ (MW/0.1 Hz)	2014–18 OY Trend
Eastern	0.458	0.404	Improving	2,411	1,141	Stable
Texas	0.594	0.498	Improving	940	562	Improving
Quebec	1.075	0.678	Improving	862	364	Improving
Western	0.405	0.246	Stable	1,789	890	Improving



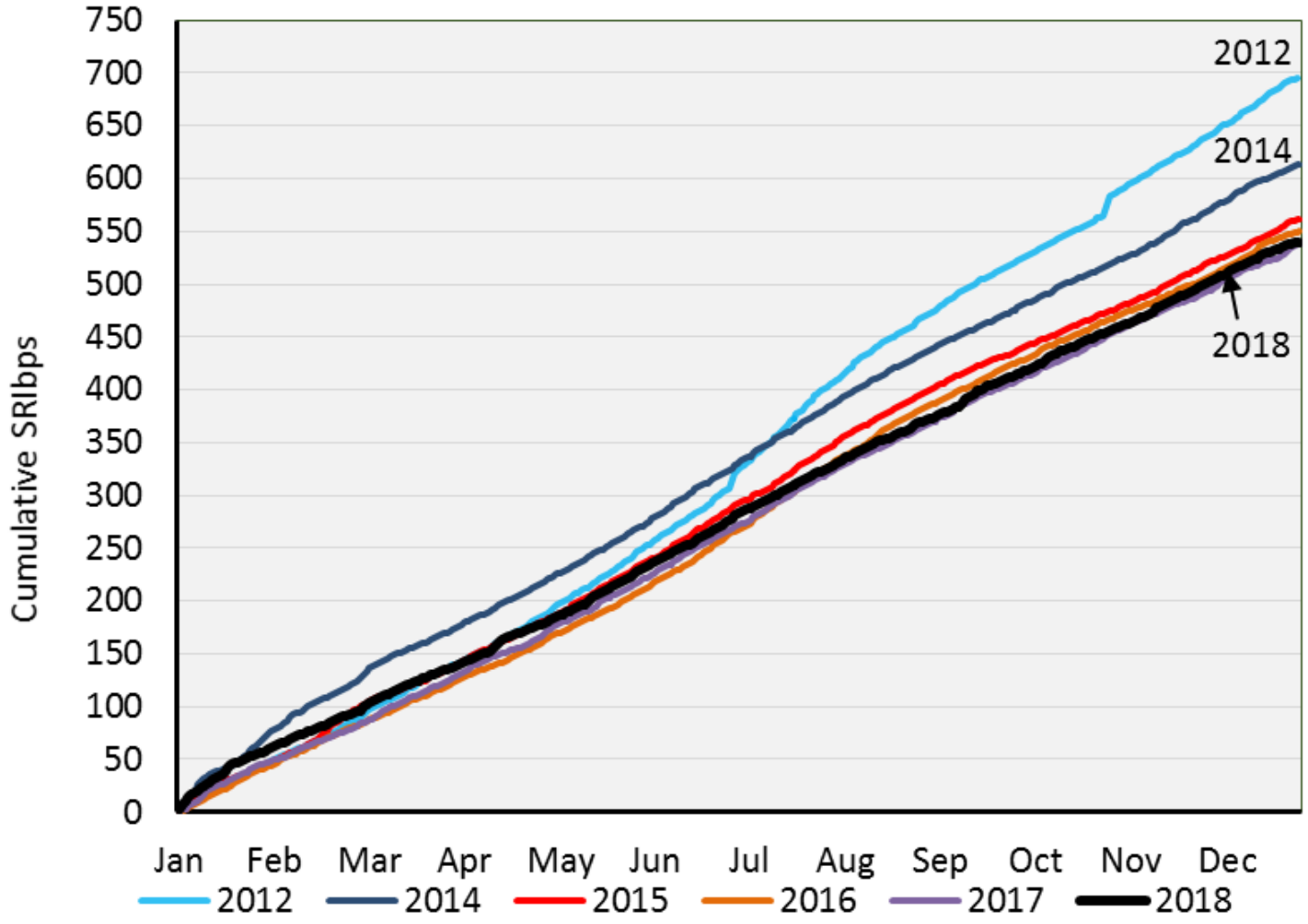
Severity Risk Index



Severity Risk Index (SRI) - Sorted



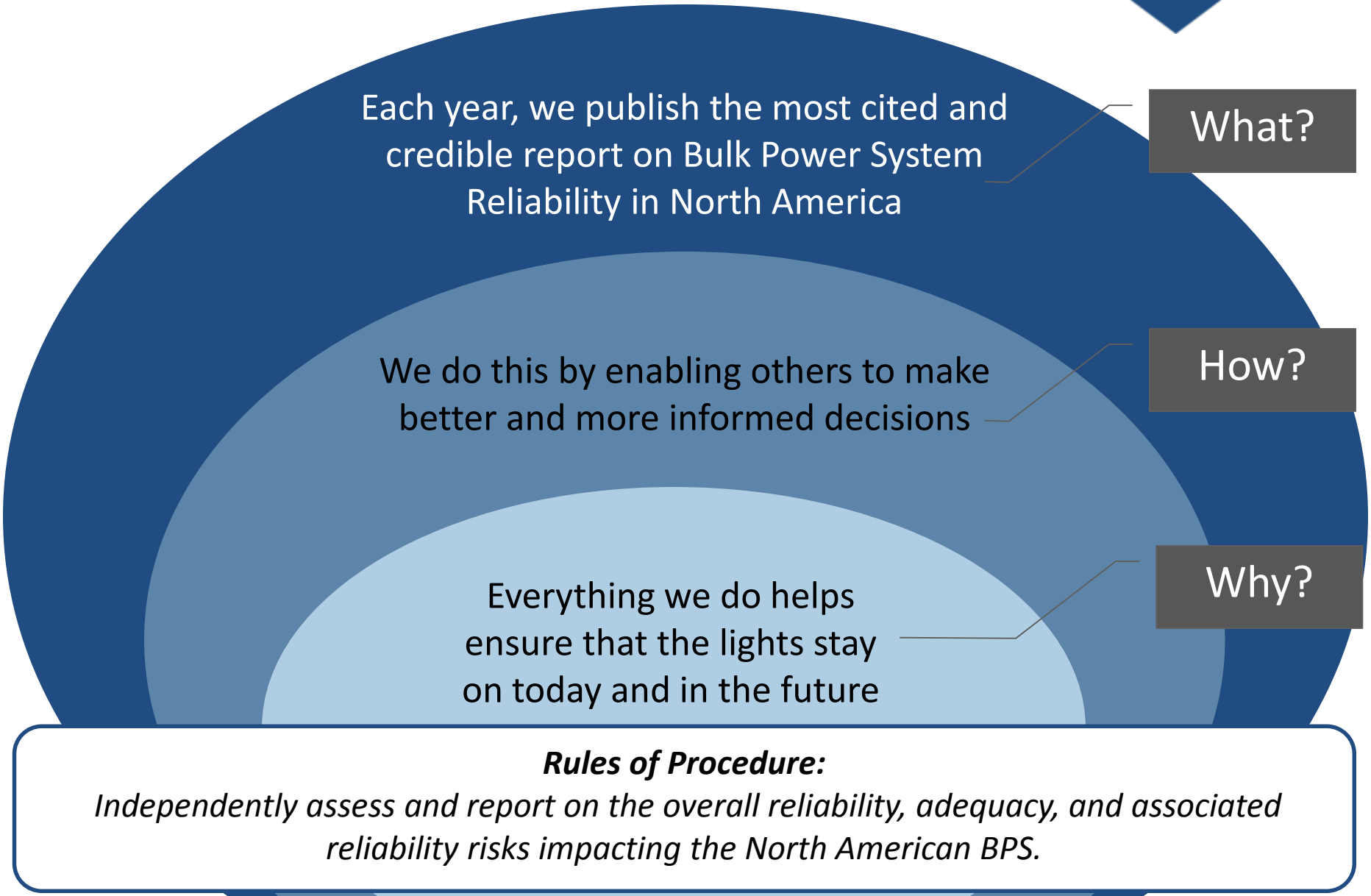
Severity Risk Index (SRI) – Cumulative



Reliability Assessment and System Analysis – RASA Key Objectives

- **Independently assess and report** on the overall reliability, adequacy, and associated reliability risks
- **Identify emerging reliability risks** and other reliability issues garnering an in-depth analysis
- **Evaluate system models** and case development practices
- **Conduct and coordinate interconnection-wide analysis** for steady-state power flow, frequency response, transient and voltage stability, oscillatory behavior, and event forensics
- **Establishment of reliability leadership** and sound guidance through effective outreach and communications that influence industry and policy maker decisions

Why Reliability Assessments?

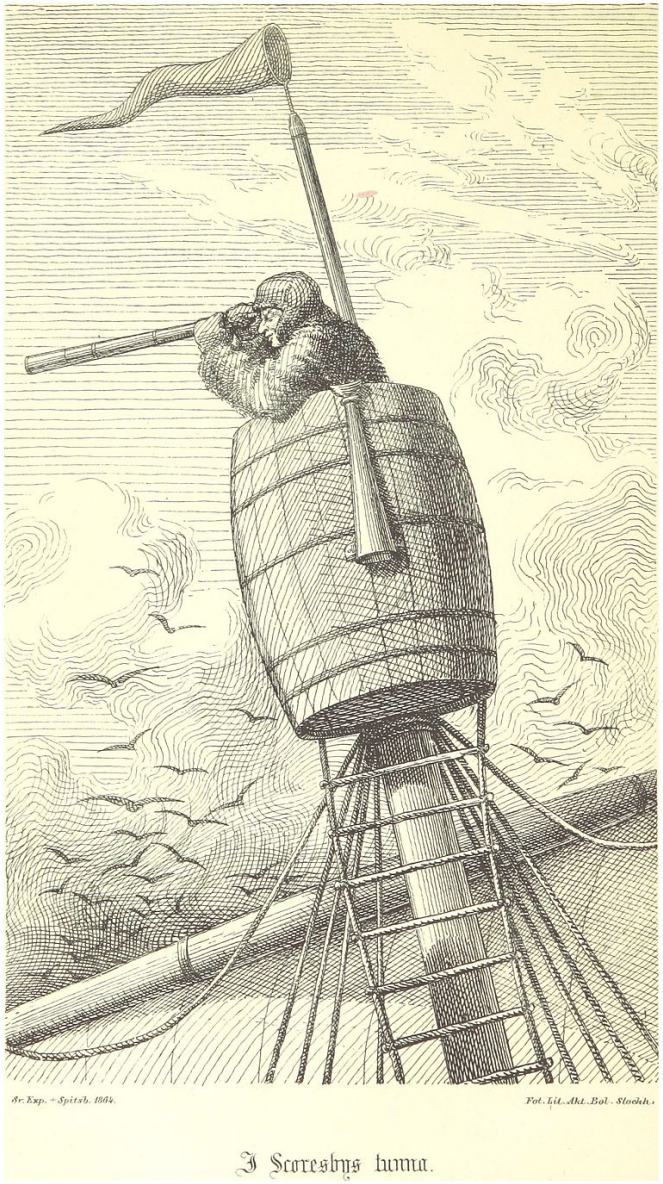


Rules of Procedure:

Independently assess and report on the overall reliability, adequacy, and associated reliability risks impacting the North American BPS.

Assessments Serve as Early Warning Indicator

- *Is there sufficient supply of resources?*
- *Is transmission being expanded to support new system resources?*
- *How does DER impact reliability?*
- *Do state regulators need to step in to mitigate a potential risk?*
- *Will there be enough natural gas to power the transitioning resource mix?*
- *Do the markets have the tools needed to preserve reliability?*
- *How will a federal policy impact reliability?*



RAPA: Everything We Do

We work with industry's best experts in reliability to fulfill our statutory obligations of independently assessing the BPS through effective and efficient processes with our Regional partners.

	Technical Committee Material	Reliability Assessment Reports	ERO Management and Oversight
Program Activities	• Technical Leadership/Strategy • Work-plan development • Group coordination • Supporting analysis	• Independent evaluation • Policymaker outreach • Data analytics and trending • Coordination with technical teams	• Ensuring Regional representation • Implementing Oversight Plan • Coordination through ERO groups
Deliverables	• Technical Reference Documents • Reliability Guidelines • Whitepapers	• LTRA • Seasonal Assessments • Special Reliability Assessments	• Oversight Plan, Annual Metrics • Reliability Assessment Process

Independent Reliability Assessments

Three key reports produced annually:

Long-Term Assessment	Provide a technical platform for important policy discussions on technical challenges facing the interconnected North American bulk power system
Seasonal Assessments	Identify and report on the electric industry's preparations to manage potential seasonal issues for both the winter and the summer
Special and Scenario Assessments	As emerging risks and potential impacts to reliability are identified, special assessments are performed to provide additional insights about the range and specific aspects of these challenges and make recommendations

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Reliability Assessment Program

Assessment	Scope	Periodicity	Technical Committee Review/ Endorsement	MRC/BOT Review/ Acceptance
Long-Term	• 10-Year resource assessment • Emerging reliability issues • 5-Year probabilistic assessment	Annual *(Probabilistic assessment conducted biennially)*	Sept-Oct	Nov-Dec
Summer	• Seasonal resource assessment • Seasonal concerns/issues	Annual	May	N/A
Winter	• Seasonal resource assessment • Seasonal concerns/issues	Annual	Nov	N/A
Special (short-term and long-term)	• Topic-focused report requiring a comprehensive evaluation • Assessment generally focused on issues identified in the LTRA that require more analysis • Short-term special assessments can be developed for issues impacting the next 18-24 months	As Needed	2-4 weeks for comment and review; 1 week for endorsement	2 weeks for comment, review, and acceptance

Reliability Assessment Focus Areas

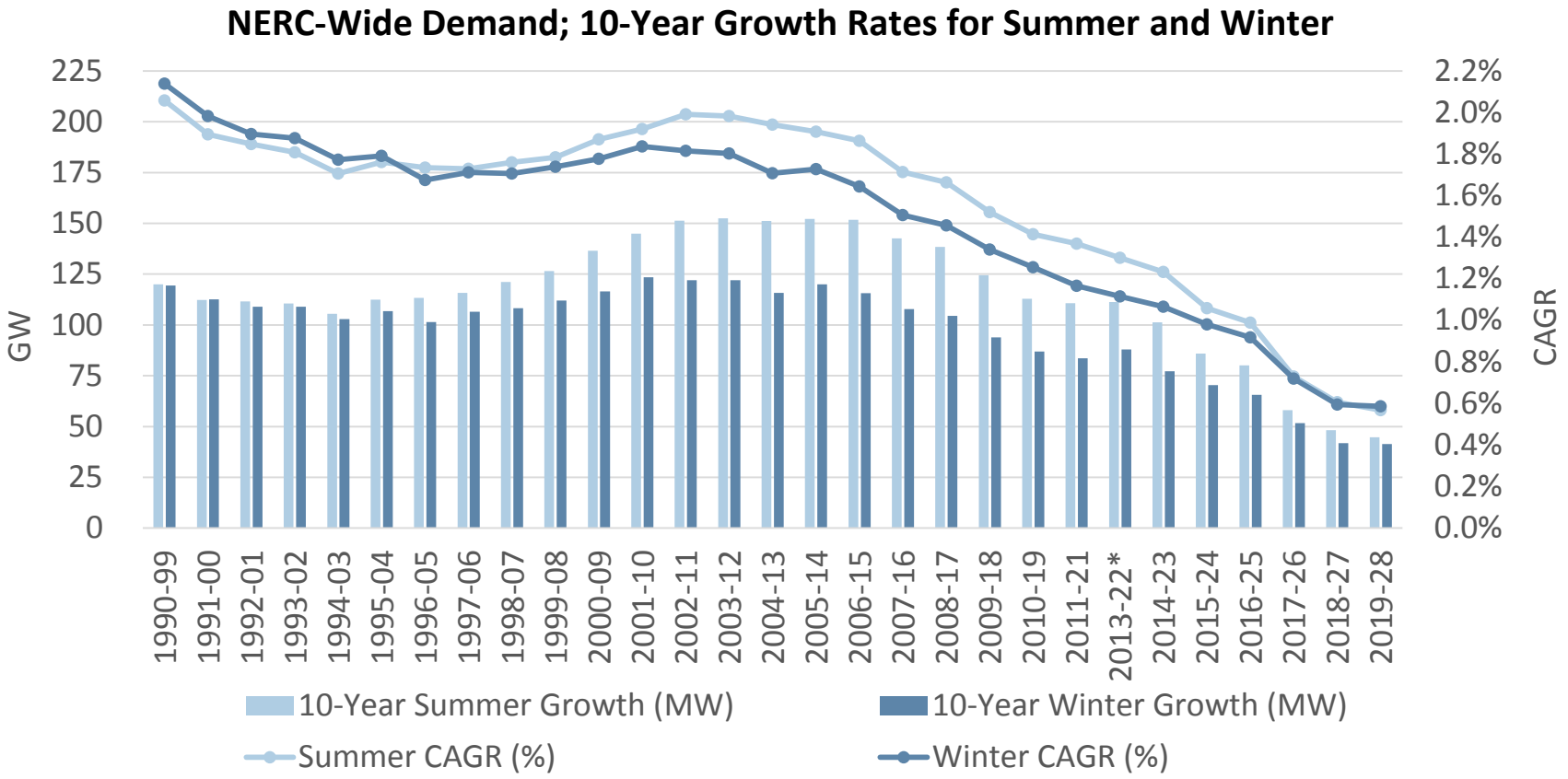
- Changing Resource Mix
  - Retirement of synchronous generation
  - Increasing dependency on natural gas, wind, and solar
  - Maintaining fast-acting controllable resources to support more variability
- Resource Adequacy Challenges:
  - 2018 Findings: Tight conditions in ERCOT and CAISO
- Accommodating large amounts of Distributed Energy Resources
- Advance NERC's Analytic Capability
  - Probabilistic Assessment
  - Evaluation of Essential Reliability Services

What's Changing?

- Higher penetration of renewables – variable resources
  - Most are inverter-connected
  - Ramping needs increase for load following
  - Capacity value
- Retirement of large fossil-fired generation plants
- Changing System Inertia
  - Trade-offs between inertia and Fast Frequency Response
- Emergence of distributed energy
- Loss of dynamic reactive support for voltage control
  - Lower levels of synchronizing torque
  - Increasing use of power electronics
- Increasing energy constraints from the generation fleet

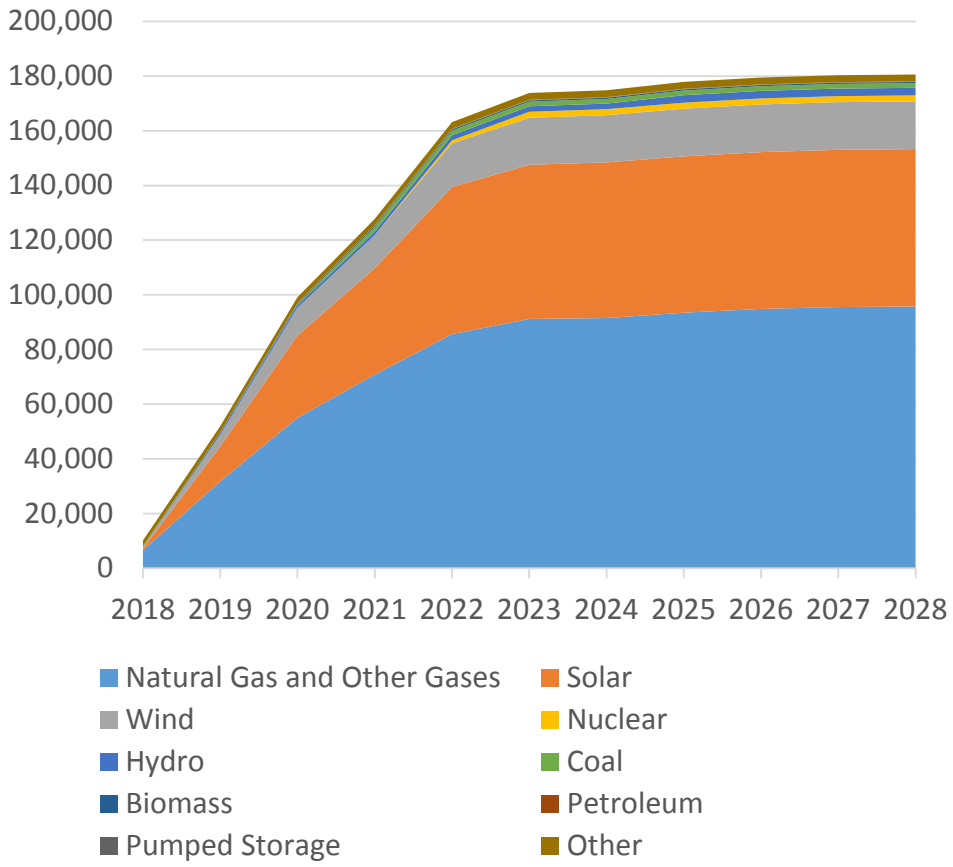
Peak Demand Growth Continues to Decline

- Energy efficiency and conservation programs increase
- Continued growth in distributed photovoltaic solar and other behind-the-meter resources



2018 Long-Term Reliability Assessment Key Finding

Tier 1 and 2 New Peak Capacity Additions – 10 Year



Assessment Areas with More Than 50% Natural Gas as a Percent of Total Capacity		
Assessment Area	**2022 (MW)**	**2022 (%)**
FRCC	42,003	**78.1%**
WECC-CAMX	42,536	**68.2%**
Texas RE-ERCOT	51,867	**63.3%**
NPCC-New England	16,308	**52.3%**
WECC-SRSG	16,774	**51.8%**
WECC-AB	8,514	**51.8%**

- 96 GW of natural gas in next 5 years, NERC-Wide

System Analysis Strategic Goals

1. Improve power system models and modeling cases
2. Understand changing grid characteristics, behaviors and performance through advanced analysis
3. Provide superior technical analysis and engineering support for ERO initiatives
4. Advance industry and technology through leadership in technical communities (e.g., IEEE, CIGRE)

Vision: *Be the leader in enhancing NERC's analytical capabilities across broad range of engineering topics and act as the go-to 'brain trust' for advanced system studies or modeling*

System Analysis

- Synchrophasor technology
- Inverter-based resource performance
- Power plant model verification
- Oscillation analysis
- Power plant modeling and performance
- Load and distributed resource modeling
- Transmission planning expertise
- Frequency and control analytics
- Case quality metrics and model validation
- Event analysis and forensics – simulation of events
- Industry technical leadership – drive initiatives
- Standards support – engineering

1-Model Improvement

- Assess and improve power system models and practices
  - PMU-based power plant and system model verification
  - Dynamic load modeling
  - Power plant model verification
  - Hybrid planning-operations models
- Provide feedback loop to ensure high model quality and fidelity
  - Review industry practices, available analysis
  - Leverage on available studies to identify benefits
  - Develop notifications for model use

2-Power System Analysis

- Perform advanced engineering analysis to understand changing grid characteristics, behaviors and performance
  - **Frequency Response and Inertia**—trends for critical contingencies in each interconnection under future resource mixes
  - **Inter-Area Oscillation**—Mode shape, frequency, and damping margin needed for the largest damping change in each interconnection
  - **Voltage and reactive support**—Minimum dynamic reactive support needed for voltage excursions
  - **Short circuit strength**—Grid strength indicators

3-Technical Support and Outreach

- Provide technical expertise, research, and insights
  - Technical References, Reliability Guidelines, whitepapers
  - Technical support for Reliability Standards
  - Transition insights from engineering analysis to actionable industry guidance
  - Partner with research and academic institutions

4-Advance Industry and Technology

- Advance industry and technology through leadership in technical communities, such as:
  - North American Synchrophasor Initiative (NASPI)
  - IEEE & CIGRE
  - WECC JSIS
  - WECC MVWG/PPMVDTF/REMTF/LMTF
  - Eastern Interconnection Reliability Assessment Group (ERAG)
  - Multi-Regional Working Group (MMWG)
  - NPCC SS-38 & LMTF
  - ERCOT Dynamics Working Group (DWG)
  - Academics & National Labs
  - Department of Energy (DOE)
  - North American Transmission Forum (NATF)
  - North American Generator Forum (NAGF)

Blue Cut Fire Disturbance Report & Alert

NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

1,200 MW Fault Induced Solar Photovoltaic Resource Interruption Disturbance Report

Southern California 8/16/2016 Event

June 2017

RELIABILITY | ACCOUNTABILITY

3353 Peachtree Road NE
Suite 600, North Tower
Atlanta, GA 30326
404-446-2560 | www.nerc.com

NERC
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Industry Recommendation

Loss of Solar Resources during Transmission Disturbances due to Inverter Settings

Initial Distribution: June 20, 2017

NERC identified a potential characteristic exhibited by some inverter-based resources, particularly utility-scale solar photovoltaic (PV) generation, which reduces power output during fault conditions on the transmission system. An example of this behavior has been observed during recent BPS disturbances, highlighting potential risks to BPS reliability. With the recent and expected increases of utility-scale solar resources, the causes of this reduction in power output from utility-scale power inverters needs to be widely communicated and addressed by the industry. The industry should identify reliability preserving actions in the areas of power system planning and operations to reduce the system reliability impact in the event of widespread loss of solar-resources during faults on the power system.

For more information, see the 1,200 MW Fault Induced Solar Photovoltaic Resource Interruption Disturbance Report

About NERC Alerts >>

Status:	**Acknowledgement Required by Midnight Eastern on June 27, 2017** **Reporting Required by Midnight Eastern on August 31, 2017**
	PUBLIC: No Restrictions More on handling >>
Instructions:	This recommendation provides specific actions NERC registered entities should consider taking to respond to a particular issue. Pursuant to Rule 810 of NERC's Rules of Procedure, NERC registered entities shall 1) acknowledge receipt of this advisory within the NERC Alert System, and 2) report to NERC on the status of their activities in relation to this recommendation as provided below. For U.S. entities, NERC will compile the responses and report the results to the Federal Energy Regulatory Commission.

RELIABILITY | ACCOUNTABILITY

Canyon 2 Fire Disturbance Report & Alert

NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

900 MW Fault Induced Solar Photovoltaic Resource Interruption Disturbance Report

Southern California Event: October 9, 2017
Joint NERC and WECC Staff Report

February 2018

RELIABILITY | ACCOUNTABILITY

3353 Peachtree Road NE
Suite 600, North Tower
Atlanta, GA 30326
404-446-2560 | www.nerc.com

NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Industry Recommendation

Loss of Solar Resources during Transmission Disturbances due to Inverter Settings - II

Initial Distribution: May 1, 2018

NERC has identified adverse characteristics of inverter-based resource performance during grid faults that could present potential risks to reliability of the BPS. As the penetration of inverter-based resources (particularly solar PV resources) continues to increase in North America, these adverse characteristics need to be widely communicated. This Level 2 Industry Recommendation alerts industry to these adverse characteristics observed with BPS-connected solar PV resources, and provides recommended actions to address fault ride-through and timely restoration of current injection by all inverter-based resources connected to the BPS. (See Background section for more information.)

Although this NERC Alert pertains specifically to BES solar PV resources, the same characteristics may exist for non-BES[1] solar PV resources connected to the BPS regardless of installed generating capacity or interconnection voltage. Owners and operators of those facilities are encouraged to consult their inverter manufacturers, review inverter settings, and implement the recommendations described herein.

For more information, see the October 9, 2017 Canyon 2 Fire Disturbance Report.

About NERC Alerts >>

Status: **Acknowledgement Required[2] by Midnight Eastern on XXXX XX, 2018**
Reporting Required by Midnight Eastern on XXXX XX, 2018

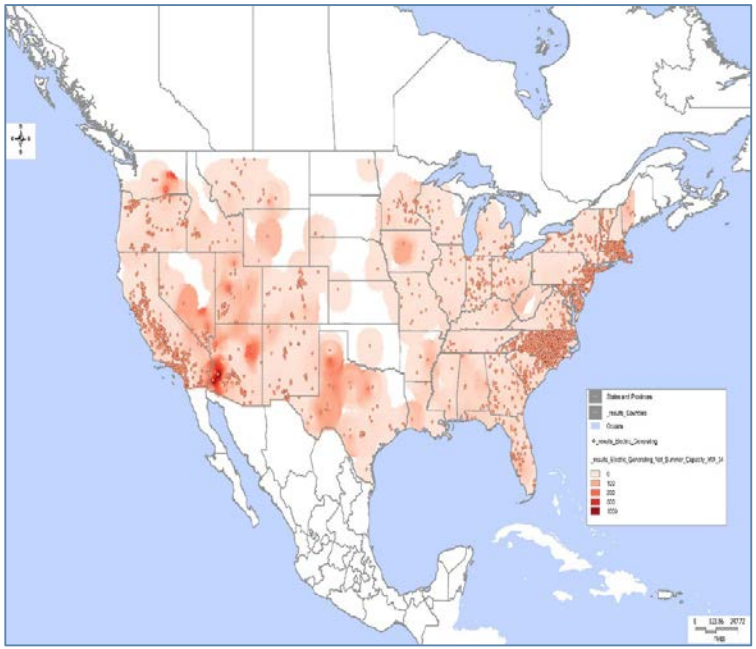
PUBLIC: No Restrictions
More on handling >>

[1] These resources do not meet the Bulk Electric System definition, and are generally less than 75 MVA yet connected to transmission-level voltage.
[2] To the extent that Canadian jurisdictions have implemented laws or requirements that vary from Section 810 of the ROP, NERC requests entities in such jurisdictions voluntarily participate in response to this Alert.

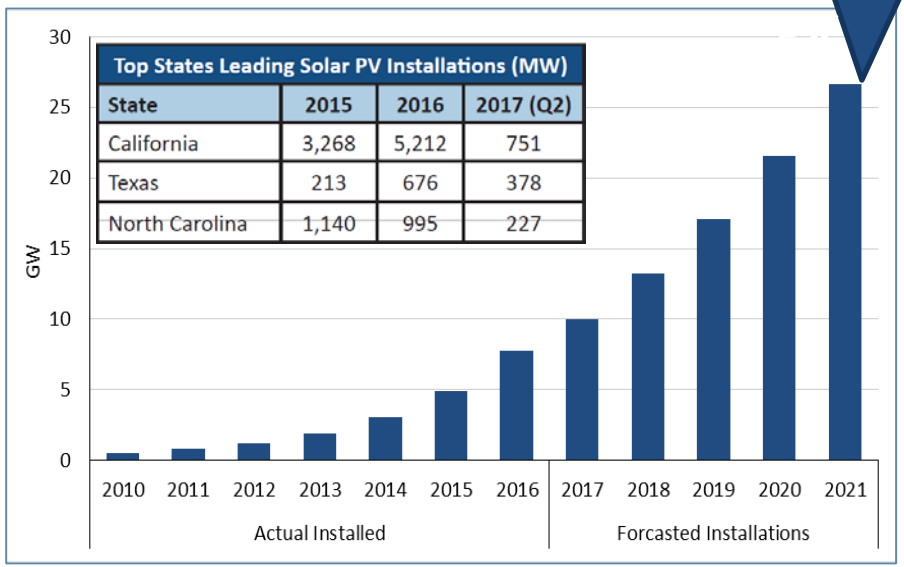
RELIABILITY | ACCOUNTABILITY

2017 Long-Term Reliability Assessment: Significant DER Expected in Near Future

- *Solar PV continues to expand at a rapid pace*
- *Visibility is needed to plan and operate the bulk power system*

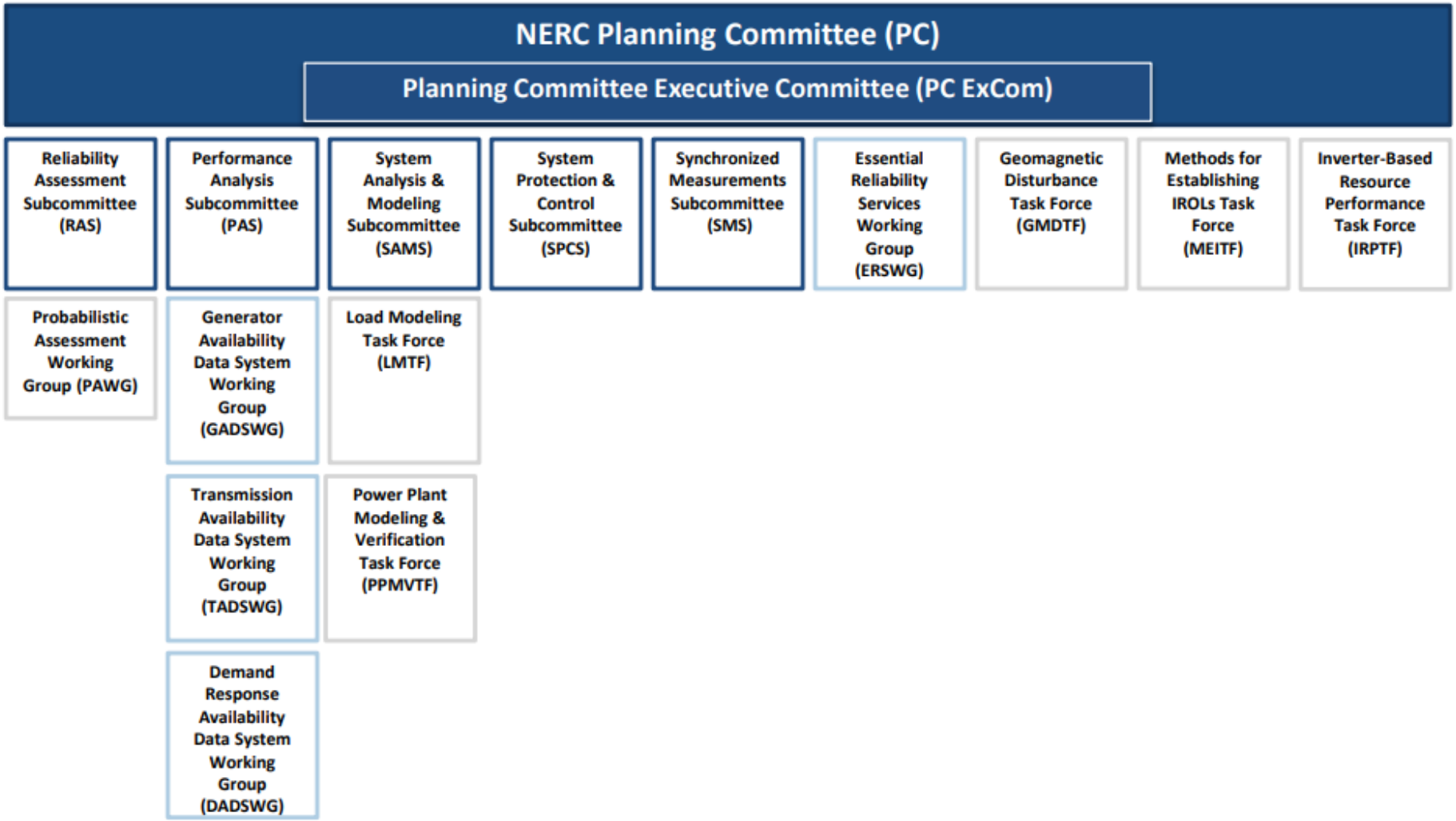


Top States Leading Solar PV Installations (MW)			
State	2015	2016	2017 (Q2)
California	3,268	5,212	751
Texas	213	676	378
North Carolina	1,140	995	227



GW by 2022 when considering utility-scale

NERC Planning Committee



Reliability Guidelines

- **What are Reliability Guidelines?**
  - **Suggested** approaches or behavior in a given technical area for the purpose of **improving** reliability
  - **Not** standards, binding norms, or mandatory requirements
  - **May** be adopted by industry entities
- **How are they developed?**
  - OC/PC/CIPC sponsored, technical groups author
  - Approval needed for 45-day public comment period
  - Comments and responses posted
  - Approval by the sponsoring committee
  - Comments may be submitted at any time

Personnel Certification Program

Personnel Certification

- *"Maintaining the reliability of the Bulk Electric System through implementation of Reliability Standards requires skilled, trained and qualified system operators." (Section 601 Scope of Personnel Certification)*
  - *International in scope*
  - *Provides a mechanism*
  - *Awards Certification Credentials*

NERC Personnel Certification Governance Committee (PCGC)

- Provides oversight to the policies and processes used to implement and maintain the integrity and independence of NERC's System Operator Certification Program
- Structure of the PCGC shall be implemented and maintained so that policies and procedures are established to protect against undue influence that could compromise the integrity of the System Operator Certification process

https://www.nerc.com/comm/PCGC/Pages/Charter.pdf

PCGC Membership Representation

- 10 voting members from the U. S. and Canada:

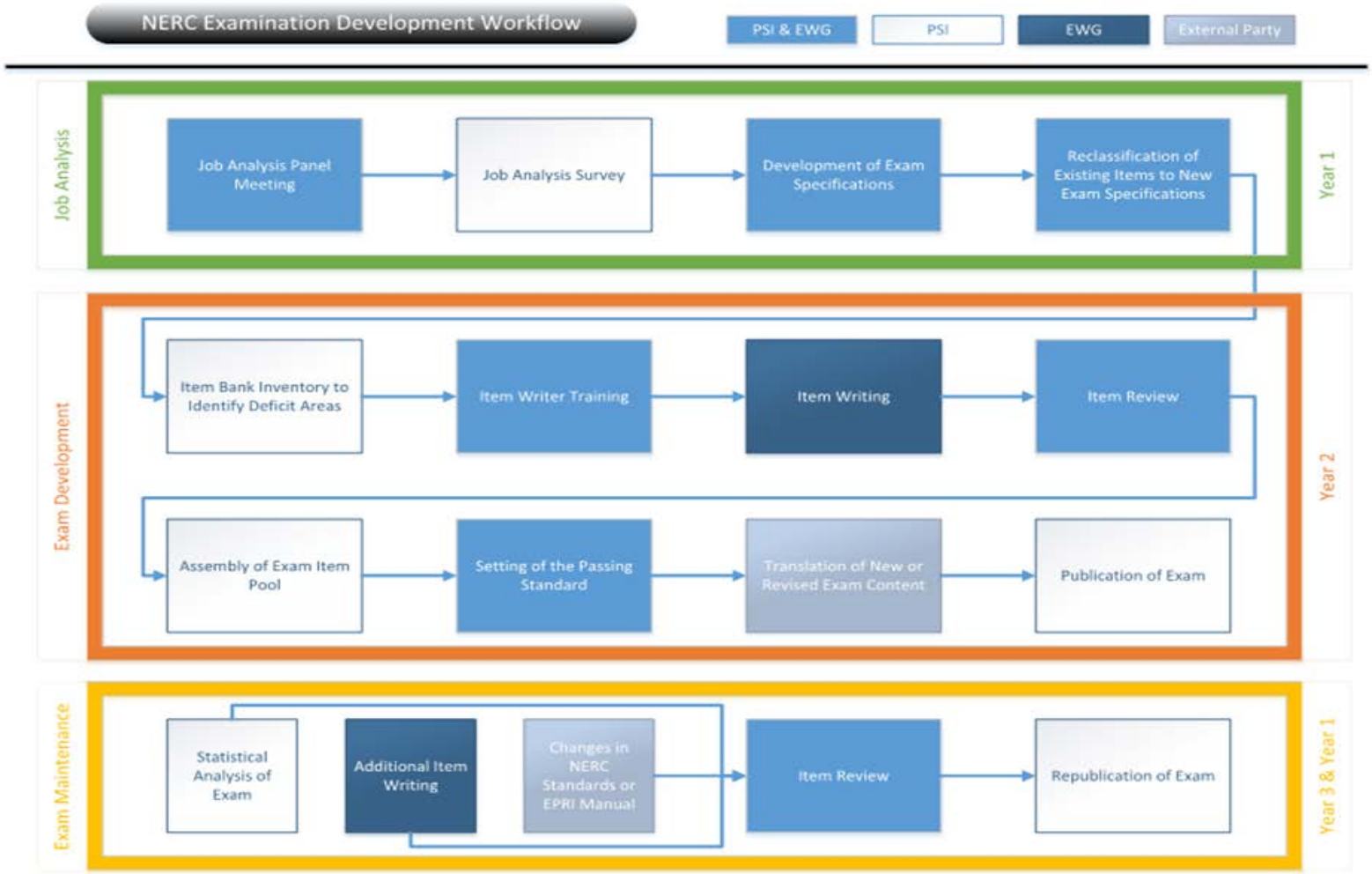
- Each member maintains a current NERC System Operator Credential
- The Federal Energy Regulatory Commission (FERC) and other governmental authorities in Canada have the option of having a non-voting member.

PCGC: Exam Working Group

- Exam Working Group (EWG)
  - Responsible for development and maintenance of the System Operator Certification exams under the general guidelines set by the PCGC
  - Recommend Exam Cut Scores
- Membership:
  - Minimum of 12 Members
  - All members hold a current NERC System Operator credential
  - Subject matter experts in real time control centers or operational support personnel

https://www.nerc.com/comm/PCGC/EWG%20DL/EWG%20Scope%20Final_Revised_Nov_2017.pdf

Exam Development and Maintenance Cycle



Recent PCGC Projects

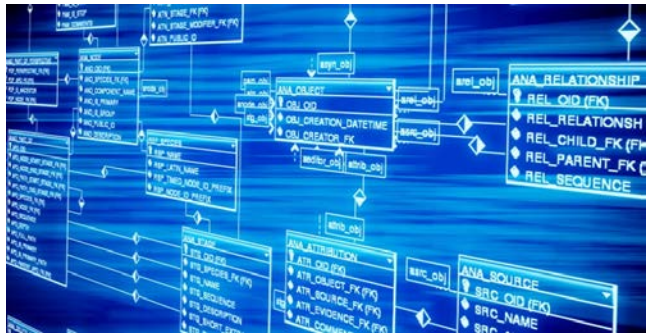
- Linear On-The-Fly Testing (LOFT) – 2016
- System Operator Certification Continuing Education Database (SOCCED) Transition – 2017
- System Operator Certification Program Survey – 2017

Linear on the Fly Testing (LOFT)

- Benefits of LOFT:
  - Reduced the exam development cycle from three year to real time
  - Elimination of fixed forms has increased the integrity of the exams
  - Item Bank currently maintained at a minimum of 3 items per task
  - Ability to update exams as Standards are created or deactivated
  - Implemented Q1_2017
    - New Content Outlines
    - New Cut Scores

Fixed Form Exams

Real Time Exam Creation



SOCCED

- Previous Platform
  - Multiple Tables of Same Data
  - Old Technology
  - System was not user-friendly
  - Support from existing vendor was inadequate
  - Improvements to system were costly
- Credential Maintenance Database – New Platform
  - Deployed December 2017
  - Current Technology
  - One Source for Data
  - Improved Accuracy

System Operator Certification Program Survey

- Purpose was to gather information from industry stakeholders related to the evolving NERC System Operator Certification program
  - Use of one credential was launched in 1998 with a 5-year expiration
  - This credential was expanded to four credentials in 2001
  - Credential maintenance was implemented in 2005 in lieu of testing
- The collected information was used to determine potential future development and improvement of the program

Current State

Four System Operator Exams/Credentials:

- Reliability Coordinator (RC)
  - 200 Continuing Education Hours (CEHs)
- Transmission Operator (TO)
  - 140 CEHs
- Balancing, Interchange and Transmission Operator (BT)
  - 160 CEHs
- Balancing and Interchange Operator (BI)
  - 140 CEHs

Future State

At this time, the only proposed changes to the program are one credential and the required CEHs to maintain this credential.

- One Credential:
  - NERC Certified System Operator (NCSO)
  - 140 CEHs

SOC Program Highlights

- 1998: System Operator Certification Program established
- 2001: 4 Credentials with 3 year expiration
- 2005: Credential maintenance in lieu of retesting
- 2006-2014: Focused on Exam Development
- 2015-2017: Strategic Plan
- 2017- Q1_2018: System Operator Certification Program Survey
- 2018: Survey Analysis and Develop One Credential Whitepaper
- 2019: Whitepaper/Credential Maintenance Analysis
- 2021-2021: Update program

Mission and Vision

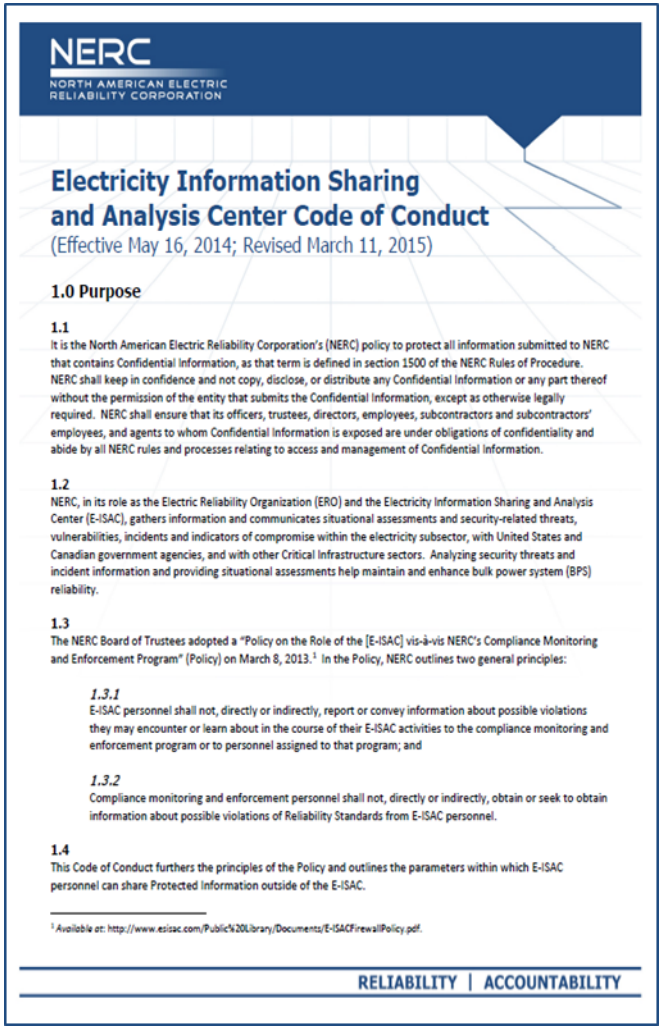
Mission

The E-ISAC reduces cyber and physical security risk to the electricity industry across North America by providing unique insights, leadership, and collaboration

Vision

To be a world-class, trusted source for quality analysis and rapid sharing of security information for the electricity industry

- Established in 2014; revised in 2015
- Covers all NERC personnel
- Technical and administrative controls
- Analogous to FERC Standards of Conduct for Transmission Providers
- Full document available here



NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Electricity Information Sharing and Analysis Center Code of Conduct
(Effective May 16, 2014; Revised March 11, 2015)

1.0 Purpose

1.1
It is the North American Electric Reliability Corporation's (NERC) policy to protect all information submitted to NERC that contains Confidential Information, as that term is defined in section 1500 of the NERC Rules of Procedure. NERC shall keep in confidence and not copy, disclose, or distribute any Confidential Information or any part thereof without the permission of the entity that submits the Confidential Information, except as otherwise legally required. NERC shall ensure that its officers, trustees, directors, employees, subcontractors and subcontractors' employees, and agents to whom Confidential Information is exposed are under obligations of confidentiality and abide by all NERC rules and processes relating to access and management of Confidential Information.

1.2
NERC, in its role as the Electric Reliability Organization (ERO) and the Electricity Information Sharing and Analysis Center (E-ISAC), gathers information and communicates situational assessments and security-related threats, vulnerabilities, incidents and indicators of compromise within the electricity subsector, with United States and Canadian government agencies, and with other Critical Infrastructure sectors. Analyzing security threats and incident information and providing situational assessments help maintain and enhance bulk power system (BPS) reliability.

1.3
The NERC Board of Trustees adopted a "Policy on the Role of the [E-ISAC] vis-à-vis NERC's Compliance Monitoring and Enforcement Program" (Policy) on March 8, 2013.[1] In the Policy, NERC outlines two general principles:

1.3.1
E-ISAC personnel shall not, directly or indirectly, report or convey information about possible violations they may encounter or learn about in the course of their E-ISAC activities to the compliance monitoring and enforcement program or to personnel assigned to that program; and

1.3.2
Compliance monitoring and enforcement personnel shall not, directly or indirectly, obtain or seek to obtain information about possible violations of Reliability Standards from E-ISAC personnel.

1.4
This Code of Conduct furthers the principles of the Policy and outlines the parameters within which E-ISAC personnel can share Protected Information outside of the E-ISAC.

[1] Available at: http://www.esisac.com/Public%20Library/Documents/E-ISACFirewallPolicy.pdf.

RELIABILITY | ACCOUNTABILITY

Traffic Light Protocol (TLP)

Color	When should it be used?	How may it be shared?
TLP:RED  Not for disclosure, restricted to participants only.	Sources may use TLP:RED when information cannot be effectively acted upon by additional parties, and could lead to impacts on a party's privacy, reputation, or operations if misused.	Recipients may not share TLP:RED information with any parties outside of the specific exchange, meeting, or conversation in which it was originally disclosed. In the context of a meeting, for example, TLP:RED information is limited to those present at the meeting. In most circumstances, TLP:RED should be exchanged verbally or in person.
TLP:AMBER  Limited disclosure, restricted to participants' organizations.	Sources may use TLP:AMBER when information requires support to be effectively acted upon, yet carries risks to privacy, reputation, or operations if shared outside of the organizations involved.	Recipients may only share TLP:AMBER information with members of their own organization, and with clients or customers who need to know the information to protect themselves or prevent further harm. **Sources are at liberty to specify additional intended limits of the sharing: these must be adhered to.**
TLP:GREEN  Limited disclosure, restricted to the community.	Sources may use TLP:GREEN when information is useful for the awareness of all participating organizations as well as with peers within the broader community or sector.	Recipients may share TLP:GREEN information with peers and partner organizations within their sector or community, but not via publicly accessible channels. Information in this category can be circulated widely within a particular community. TLP:GREEN information may not be released outside of the community.
TLP:WHITE  Disclosure is not limited.	Sources may use TLP:WHITE when information carries minimal or no foreseeable risk of misuse, in accordance with applicable rules and procedures for public release.	Subject to standard copyright rules, TLP:WHITE information may be distributed without restriction.

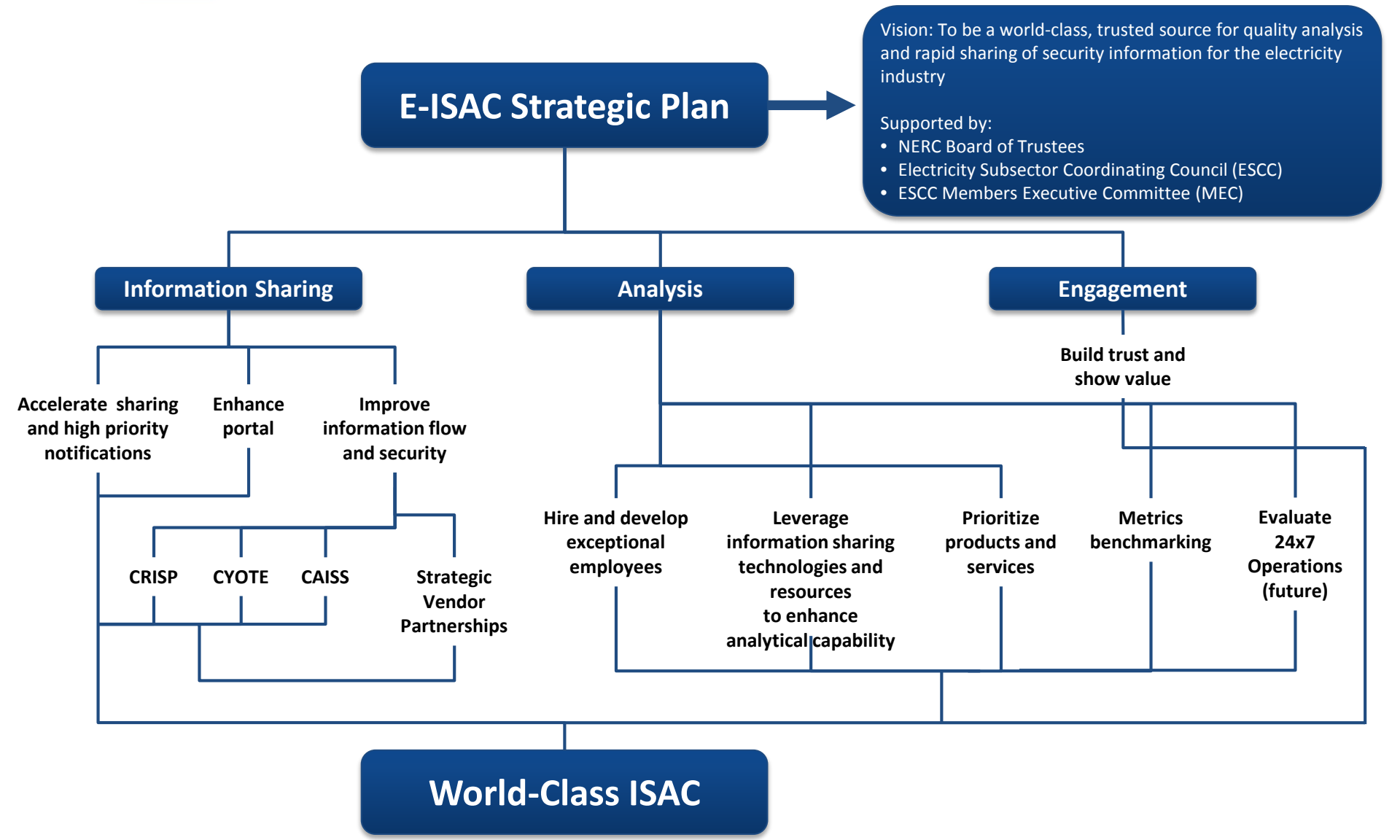
"Originator-controlled classification system developed to encourage greater sharing of sensitive (but unclassified) information with external entities."

https://www.us-cert.gov/tlp

Strategic Plan Background

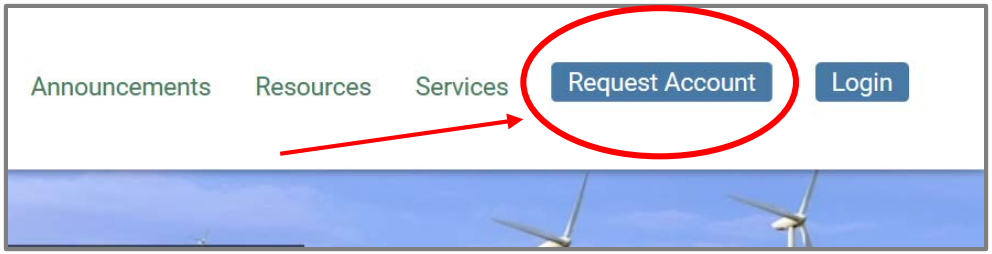
- The E-ISAC underwent a strategic review with the Electricity Subsector Coordinating Council (ESCC) in 2015
- The ESCC created the Member Executive Committee (MEC), which is a CEO-led stakeholder advisory group
- The MEC provided input into the *E-ISAC Long-Term Strategic Plan,* developed in 2017
- The NERC Board approved the plan in 2017 and included it in the NERC Business Plan and Budget for implementation in 2018 and beyond
- The E-ISAC continues to grow in both staff, tools, and capabilities to realize its vision

Strategic Plan

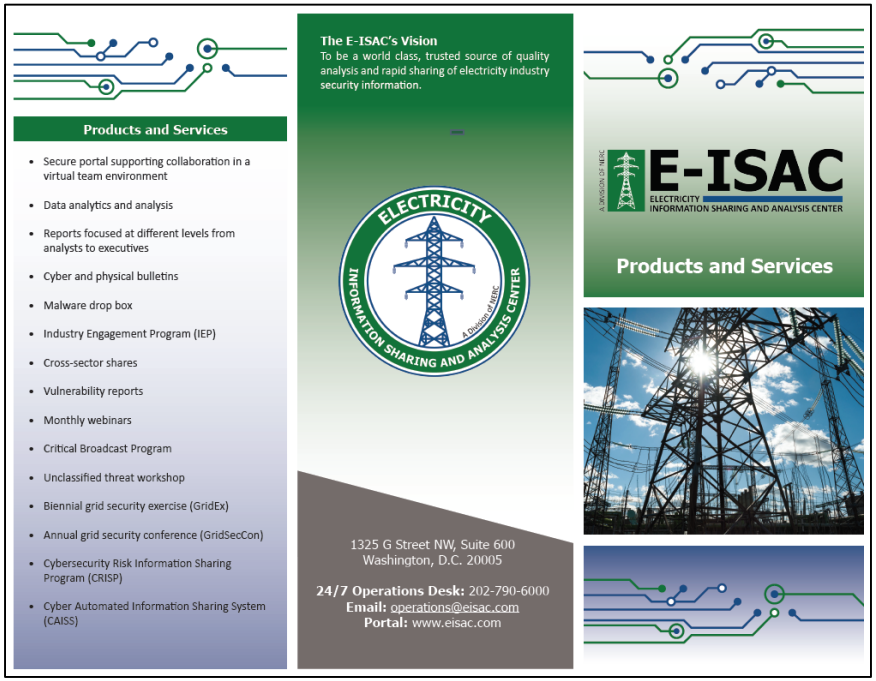


Getting Started

- Request an account at www.eisac.com



- Download our brochure for more information



Products and Services

Products

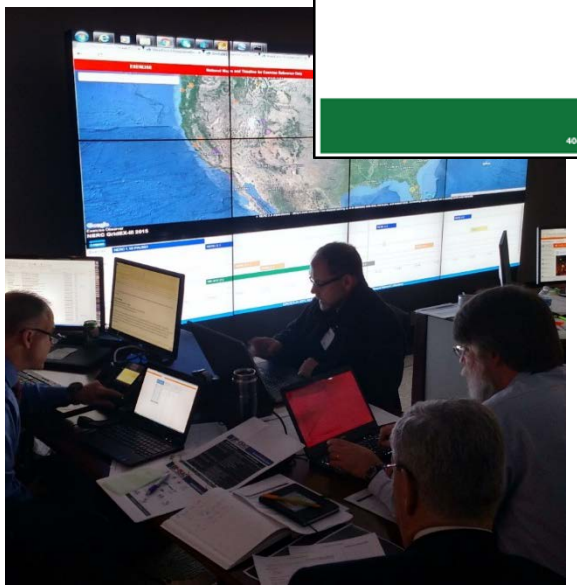
- Incident (cyber and physical) bulletins
- Weekly and monthly summary reports
- Issue-specific reports

Services

- Monthly briefing series
- Grid Security Conference (GridSecCon)
- Grid Security Exercise (GridEx)
- Industry Engagement Program (IEP)

Tools

- E-ISAC Portal (www.eisac.com)
- Critical Broadcast Program (CBP)
- Cyber Risk Information Sharing Program (CRISP)
- Cyber Automated Indicator Sharing System (CAISS)



E-ISAC CBP

- Launched rapid information sharing call capability in 2018:
  - **February 7: Need info here**
  - November 29: vendor compromise (524 participants)
  - December 20: Indictments of Advanced Persistent Threat Actors (1,284 participants – including Oil and Natural Gas industry)
- **All-Points Bulletins**
  - Part of the CBP; used to alert industry on critical, time-sensitive security events
  - Provide additional context and mitigation on time-sensitive issues beyond a traditional cyber or physical bulletin without need for a CBP call

Customer Relationship Management (CRM) Tool

- Will enhance how the E-ISAC interacts and serves members

Portal Upgrades

- Developing updated Portal governance and security controls will further safeguard sensitive security information

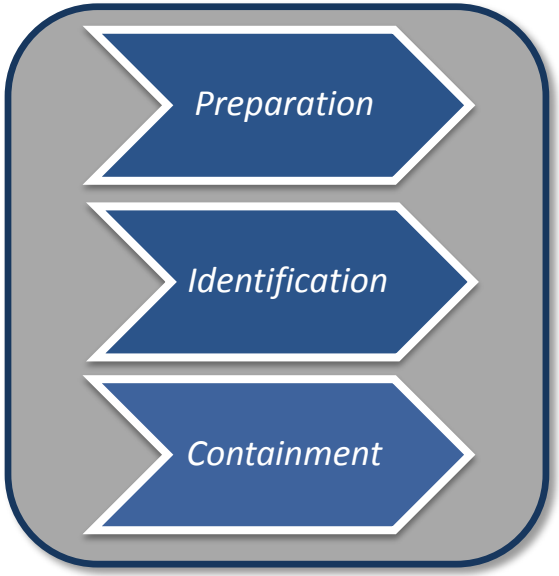
- Established in 2018
- Formerly known as the Industry Augmentation Program
- Multi-day **immersive learning** experience at the E-ISAC
- **Raise awareness** of E-ISAC cyber and physical security analysis processes
- **Enhance information exchange** between the E-ISAC and industry
- Increase the opportunities for the E-ISAC to **receive specific feedback from industry** on tools and communications protocols
- Strengthen utility programs and staff expertise by providing a **professional development** opportunity
- Six IEPs held each year

GridEx

- **GridEx is an unclassified public-private exercise designed to simulate a coordinated cyber and physical attack with operational impacts on electric and other critical infrastructures across North America to improve reliability, resilience, and security**
- The first GridEx occurred in 2011 and is conducted every other year
- Due to the sensitive nature of the scenario discussion, this exercise program is not open to the general public or the media
- The GridEx planning team designs the exercise to allow each organization to participate in a way that is consistent with its available resources and real-world operational environment

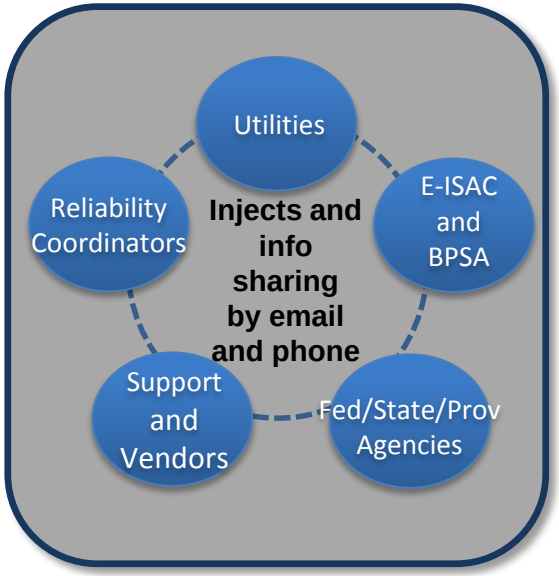
GridEx Components

Move 0 Pre-Exercise



Operators may participate in Cyber Intrusion detection activities

Distributed Play (2 days)

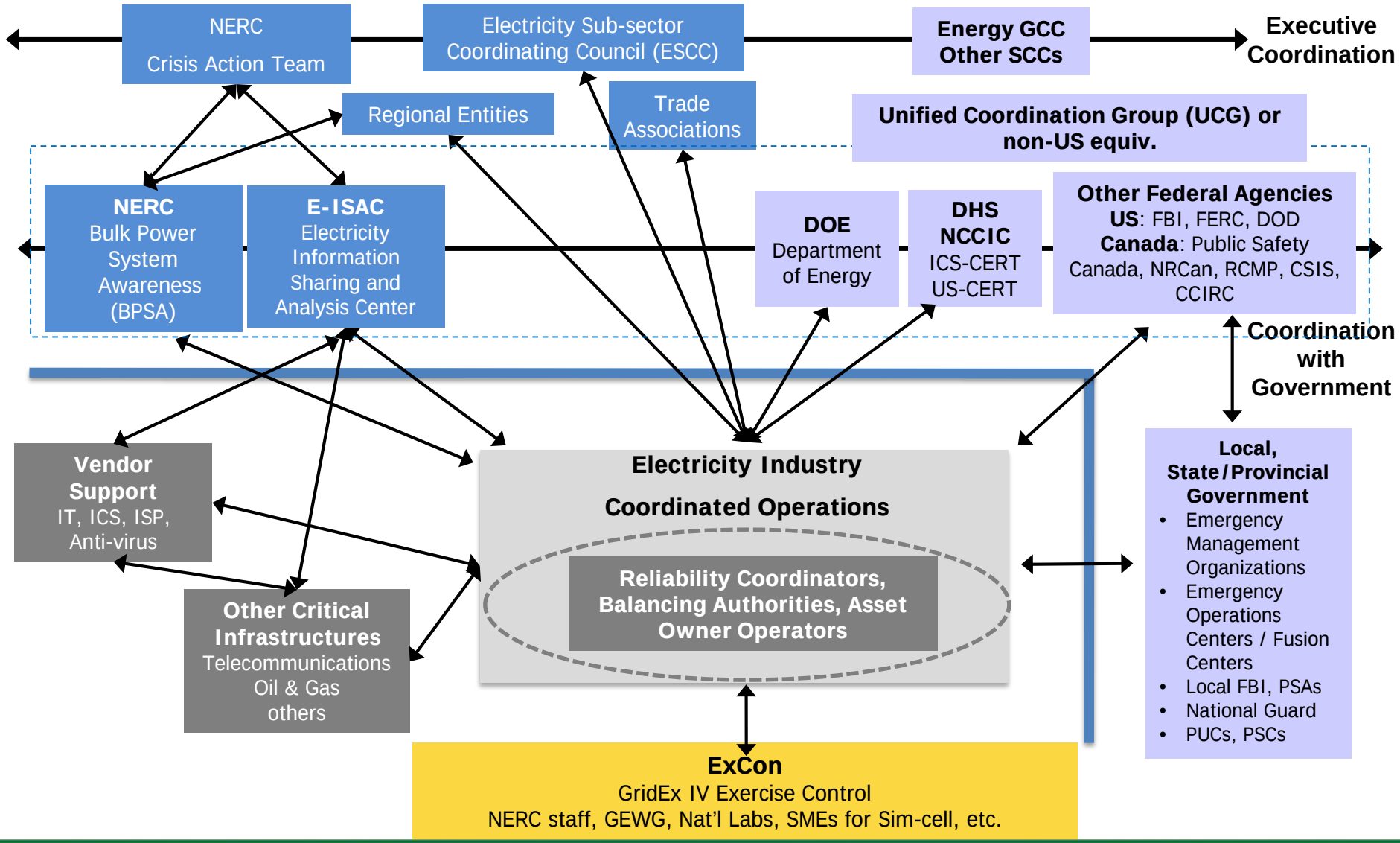


Players across the stakeholder landscape will participate from their local geographies

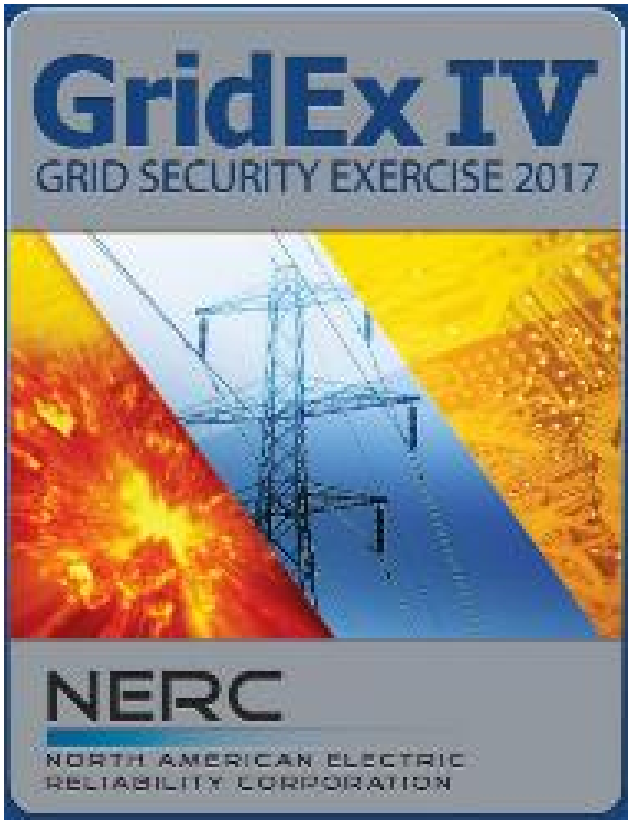
Executive Tabletop (1/2 day)

Senior decision makers participate in facilitated discussions to review distributed play and explore policy triggers

GridEx Communications



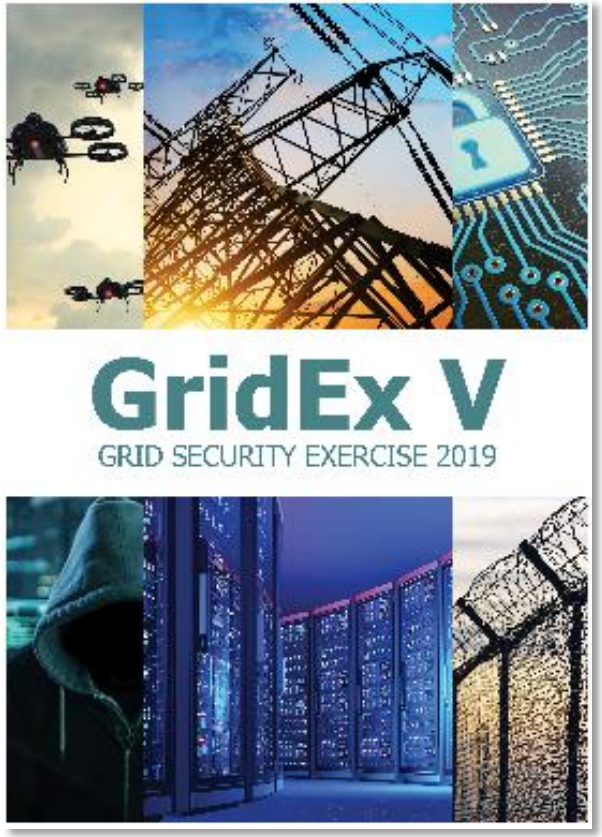
GridEx IV (2017) – Key Findings



- Participating organizations complete an after-action survey and share lessons learned following each exercise
- GridEx IV had the following key findings:
  - Relationship building with partners is key (e.g., cross-sector, law enforcement, emergency managers)
  - E-ISAC Portal improvements needed
  - Public Affairs and Corporate Communications vs. incorrect or misleading information important
  - Communication resiliency necessary for response
  - Electric Utility – Reliability Coordinator emergency communications critical
  - Cyber Mutual Assistance can aid response
  - On-keyboard cyber training important to utilities

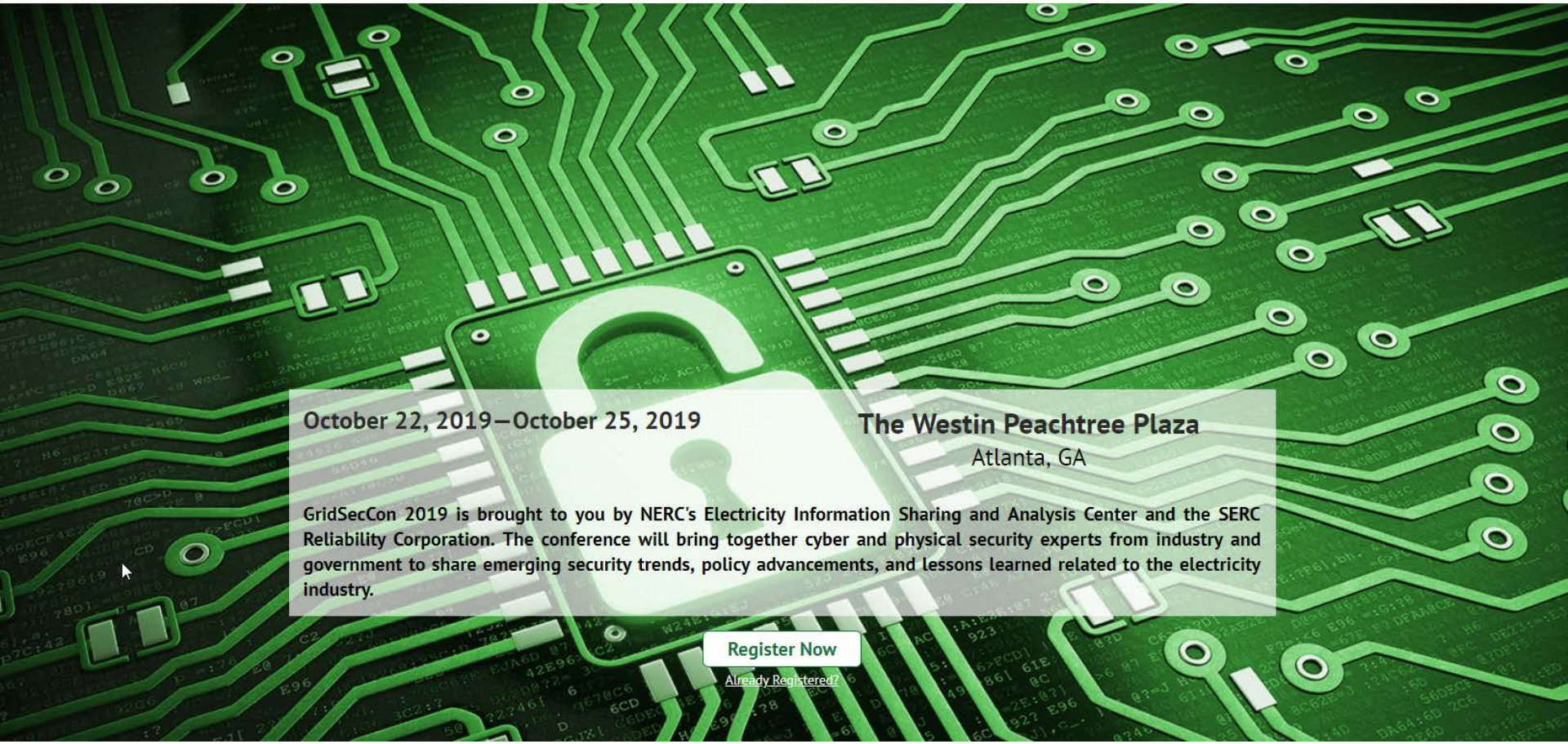
GridEx V – November 13-14, 2019

- Industry participants are able to engage from their regular work locations and respond to simulated events during the two-day exercise
- Participants respond with simulated internal and external operational activities as they would during an actual event
- Participants include:
  - Electric utilities;
  - Regional (local, state, provincial) and federal government agencies in law enforcement, Critical infrastructure cross-sector partners (ISACs and natural gas transmission pipeline operators); and
  - Supply chain stakeholder organizations



GRIDSECCON 2019
NERC • SERC

Home Agenda Hotel Parking Register Now



E-ISAC Key Takeaways

- Reliability, resilience, and security
- E-ISAC and NERC departments should, and do work together – carefully, and with limits
- In the second year of the *E-ISAC Long-term Strategic Plan*, the E-ISAC continues to grow in staff, capability, and impact
- The E-ISAC Portal is the central location for security information and products
- GridEx and GridSecCon are valuable sources of security information
- Cyber and physical security risk continues to grow as foreign nation-state adversaries target critical infrastructure

Questions and Answers