NPCC Fall 2019 Workshop

Welcome and Kickoff

Scott Nied
Assistant Vice-President, Compliance
Newport, RI
November 20, 2019
Welcome – Before We Begin

Go to www.slido.com and enter “#NPCC2019”

OR

Get the slido app on your Phone and enter “#NPCC2019”
Rhode Island Facts

• How far are you from the oldest operating tavern in the U.S?
  – White Horse Tavern is ½ mile away. (since 1673)

• Rhode Island is really small
  – 4,000 could fit in the lower 48 states.

• There aren’t a lot of people in RI, right?
  – True, but 2nd most densely pop state. 1,022/sq mile

• The 1st circus in the U.S. was held in Newport in 1774
November 20 Classroom Tracks
2:15 pm, 3:15 pm, 4:15 pm

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<thead>
<tr>
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<th>2:00 pm</th>
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<tbody>
<tr>
<td>Track 1</td>
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<td>Track 2</td>
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<td>Track 3</td>
<td>C</td>
<td>A</td>
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A: Compliance Classroom #1 (in Main Ballroom)
B: Compliance Classroom #2 (in the Weatherly Room)
C: Entity Risk Assessment Team (in the Freedom Room)

EXAMPLE: If you are assigned to Track 1, your room rotation is ABC in that order.
Thursday

• We are offering a box lunch
• NO we are not having a raffle for those who attend the end
Compliance Solutions!

- AMICO Security Products
- Cooper Compliance
- Proven Compliance Solutions
- SOS Intl
- Force5
- Utility Services
- FoxGuard Solutions, Inc.
- PPKeys Power Partners
NPCC Workshop Disclaimer

This information, developed by Northeast Power Coordinating Council, Inc. ("NPCC") staff, provides nonbinding guidance to industry stakeholders regarding existing and/or emerging Reliability Standards. If anything herein conflicts with the applicable Reliability Standard, approved Implementation Guidance, or any other applicable rule, order, regulation, etc., the latter will govern. This information is specific to NPCC and should not be relied upon in any other Regional Entity or at NERC. Compliance with Reliability Standards ultimately depends on the facts and circumstances, quality of evidence, and the language of the Reliability Standard.
News Flash: ERO Push for Collaboration

• Not only in CMEP arena
• RAPA, Planning, Operating
• Emerging issues...OC, PC, CIPC are going away
  — Reliability and Security Technical Committee
• NERC and FERC
• Battlefield
Two Results

- Stakeholders viewpoint
- Stronger ERO
What NPCC has done in 2019...

• Self-report guidance – April
• Root Cause Analysis
• Evaluation of internal controls
• Implementing NERC COP process
Moving toward 2020

• 2020 ERO CMEP Implementation Plan
  – Streamlined
• 2020 Monitoring Schedule
• 2020 Self-certification with evidence
  • CIP-002, CIP-003, Sample evidence
  • Assessment of controls as part of the monitoring engagement
Align Project Update

• To ensure data security, refine compliance audit and investigation business processes, and address stakeholder concerns, Align release 1 has been delayed until 2020

• The project team will continue with its other scheduled activities:
  ▪ Completing user acceptance testing
  ▪ Identifying critical enhancements
  ▪ Developing Training Material
How will Release 1 delay impact the Release 1 training schedule?

- The previously scheduled Release 1 training will be postponed due to the release delay.
- Exact dates for Release 1 training are still being determined.
- Release 1 training will likely be completed in Q1/Q2 2020.
- The remainder of Q4 2019 will be used to refine training materials.
- Project team will ensure that there will be ample time to register for training once schedule is published.
How will Release 1 delay impact the Release 1 system features?

• The delay will not impact the system features scheduled for Release 1 of Align
• Release 1 will still include self-reporting, self-logs, mitigation, and enforcement activities.
What benefits can we expect from Align?

• Align will deliver on the same business objectives originally communicated, which are to:
  - Provide a common portal for registered entities, enabling consistency of experience;
  - Offer real-time access to information, eliminating delays and manual communications;
  - Improve capability to support the risk-based compliance oversight framework;
  - Enhance quality assurance and oversight, enabling consistent application of the CMEP;
  - Improve analytics, including visibility into compliance and reliability risks;
  - Increase capability to implement audit best practices and processes (planning, fieldwork, reporting, and quality assurance);
  - Standardize the implementation of common business processes and workflows, enabling increased productivity; and
  - Reduce application costs across the ERO Enterprise.
• Align project team will provide regular updates on our progress toward Release 1

• We encourage you to review the Align newsletters, attend regional workshops featuring Align, and reach out to your Align change agent

• If you have any additional questions regarding Align, please feel free to reach out to the Align project team

• For more information on Align, please visit the Align web page and refer to our previous Align FAQ document
ERO Challenges

- Industry Expectations
- Invertor proliferation
- Human Perf – levels of awareness
- Cyber Threat Matrix
- 3 – D’s
Why the ERO Exists

**WHY ARE WE HERE?**

We are here to assure a highly reliable and secure bulk power system for the benefit of society.

Electricity is a critical part of the fabric of modern society.

We exist to strengthen that fabric.
The ERO Golden Circle
Why, How, What

The ERO Enterprise
Independence & Objectivity
Top Talent & Expertise
Collaboration with Industry
Innovative & Risk-Based Programs
A Highly Reliable and Secure Bulk Power System

Effective, Efficient, Collaborative
NPCC Version

Why, How, What

Assess: Rigor and Thorough, Educate/Guide

Leverage Staff and ERO/Stakeholder Partnerships

Secure, Reliable NE NA
ERO Strategic Focus

1. Expand risk-based focus in all Standards, Compliance Monitoring, and Enforcement programs
2. Assess and catalyze steps to mitigate known and emerging risks to reliability and security
3. Build a strong, E-ISAC-based security capability
4. Strengthen engagement and collaboration across the reliability and security ecosystem in North America
5. Capture effectiveness, efficiency, and continuous improvement opportunities
• Questions during workshop? (Please be reasonable)
• Send comments/questions through slido
• We will vet them for the speaker

snied@npcc.org
Fall NPCC Compliance and Standards Workshop
November 20-21, 2019
Newport, RI

Reliability Standards Outlook

Guy V. Zito
NPCC AVP - Standards
Discussion Items:

- Overview of Standards Development Projects
- Technical Rationale/GTB
- Standards Efficiency Review
- RISC Emerging Risks and Resilience/HEMP
- Process and Stakeholder tools
- Distributed Energy Resources (DER)
- NPCC’s Regional Standard
- NPCC Criteria Services
- NPCC Regional Standards Committee
NERC Standards Development

- Overview- NERC Reliability Standards Development Plan (RSDP) 2020-2022, NERC Board of Trustees (BOT) Approved
  - High Priority
    - Project 2018-04 Modifications to PRC-024-2 (GO, for Quebec- TO and PC-)
    - Project 2016-02 Modifications to CIP Standards (BA, DP, GOP, GO, RC, TOP, and TO)
    - Project 2015-09 Establish and Communicate System Operating Limits - FAC-010, FAC-011, FAC-014 (PC, RC, TOP, TP, ) (GO, TO)
    - Project 2019-01 Modifications to TPL-007-3 (PC, TP, TO and GO)
    - Project 2019-03 Cyber Security Supply Chain Risks (RC, BA, TO, TOP, DP, GO, and GOP)
  - Medium Priority
    - Project 2019-05 Modifications to PER-003-2 (RC, BA, and TOP)
  - Low Priority
    - Project 2019-04 Modifications to PRC-005-6 (GO)
NERC Standards Development

– Additional Considerations

• Reliability Issues Steering Committee (RISC)
• Industry Feedback Loops (e.g. Events Analysis, Compliance, RAPA)
• IEEE 1547 and VER Modeling
• Standards Efficiency Review
• Standards Grading
• DOE Report and NOPR to FERC (Resiliency concerns)
• High Impact Low Frequency events –EMP
• Further penetration of Distributed Energy Resources (DER)
NERC Standards Development

- Cost Effectiveness:
  - Analysis of the Risk being reduced
  - Costs that may be egregious considering reducing that risk
  - Standards Drafting Teams, Periodic Review Teams, and Standards Grading
  - **Drafting Teams asked to develop cost effective alternatives**
  - **Add question(s) to the Comment forms**
  - Application to all Standards projects
Technical Rationale for Reliability Standards

- Technical Rationale Transition Plan
  - Track 1 and 2 (CGP?)
- Remove from Reliability Standards (supporting documentation)
  - Guidelines and Technical Basis
  - Technical Rationale
  - Implementation Guidance
- FERC Approved parts of the Standard (mandatory and enforceable)
  - Applicability
  - Requirements
  - Implementation Plan
  - Effective Date
  - VRFs and VSLs
- May contain Compliance Guidance but not processed through the CGP
- Supporting Documents Section 11 of the SPM
- To be located with Standards to which they apply but as separate documents
- All standards going forward
- GTB Teams will begin the process of review of supporting documentation from the standards.
NERC Standards Efficiency Review (SER)

• What is it?

• What’s been done to date?
  – SER Phase 1 approved by industry, BOT and filed with the FERC- approximately 84 requirements (INT, FAC, PRC, and MOD)

• Current Activities
  – SER Phase 2 on O&P
  – SER CIP
  – SER Concepts for increasing efficiency
    • Evidence Retention
Reliability Issues Steering Committee (RISC)


• Risk Profile #1: Grid Resource Transformation
  – BPS Planning
  – Resource Adequacy
  – Increased Complexity in Protection and Control Systems
  – Human Performance and Skilled Workforce
  – Changing Resource Mix

• Risk Profile #2: Extreme Natural Events
  – GMD and other

• Risk Profile #3: Security Vulnerabilities
  – Physical
  – Cyber
  – EMP

• Risk Profile #4: Critical Infrastructure Interdependencies
  – Communications, Water, Wastewater etc.
Resilience

• Four outcome-based abilities of resilience (framework) are as follows:
  – Robustness – the ability to absorb shocks and continue operating
  – Resourcefulness – the ability to detect and manage a crisis as it unfolds
  – Rapid recovery – the ability to get services back as quickly as possible in a coordinated and controlled manner and taking into consideration the extent of the damage
  – Adaptability – the ability to incorporate lessons learned from past events to improve resilience

• FERC Chairman-“Top priority of the Commission” address concerns- DOE Staff Report and NOPR”

• FERC terminated the DOE NOPR and developed a FERC NOPR
  – what resilience of the bulk power system means and requires;
  – understand how each RTO and ISO assesses resilience in its geographic footprint; and
  – use this information to evaluate whether additional Commission action regarding resilience is appropriate at this time.

• RISC Report on Resilience
Resilience

Prior to an Event
The ability to absorb shocks and keep operating

During an Event
The ability to manage a disruption as it unfolds

After an Event
The ability to get back to normal as quickly as possible

Incident Focused

Post-Incident Learning

ROBUSTNESS → RESOURCEFULNESS → RAPID RECOVERY

ADAPTABILITY/LESSONS LEARNED
The ability to absorb new lessons after a disaster
Electromagnetic Pulse (High Altitude “HEMP”)  
• Electric Power Research Institute EPRI Study of E1  
  – Study released Spring 2019  
  – Study uses wave guides and direct injection  
  – Study identified vulnerabilities such as digital relays  
• FERC  
  – Reviewing the study  
  – Potential for a NOPR to address possible BES E1 risks  
  – Potential for a similar approach as GMD, one for operational and one for planning (i.e. EOP-010 and TPL-007)  
  – Critical facility list development identifying where potential weaknesses may exist  
• NERC  
  – [EMP Task Force Strategic Recommendations Report](#) approved by NERC BOT 2019
HEMP – High Impact Low Frequency Risk

• Executive Order, March 26, 2019

  Coordinating National Resilience to Electromagnetic Pulses
  – Update all U.S. Federal Plans to recognize EMP
  – Identify critical infrastructure (public health and safety)
  – Identify infrastructure most vulnerable to EMP
  – Review existing standards, identify gaps
  – Conduct a magnetotelleuric survey (within 4 years)
  – Analyze technology options and test them
  – Report cost effective approaches to President
Stakeholder Tools

Compliance Guidance Policy-a Standards perspective:

• Process for developing approaches useful in providing guidance for implementing standards
• November 4-5, 2015 BOT approvals (NERC Comp. and Enf. Webpage)
• Two Types of Guidance:
  – CMEP Implementation Guidance:
    • Approaches on how entities could comply with standards
    • Led and developed by SME; vetted by pre-approved organizations, not NERC
    • Not necessarily the only approach to comply with a standard
    • Endorsed for Deference by the ERO
  – CMEP Practice Guide-Auditor Instructions
    • Initiated by ERO Policy
    • Initiated by ERO in response to a specific issue
• Section 11-”Process for Approving Supporting Documents” of the SPM under revision
• Upon ERO approval, provides compliance deference
Compliance Guidance Policy Pre-approved Orgs.

- American Public Power Association (APPA)
- Canadian Electricity Association (CEA)
- Edison Electric Institute (EEI)
- Electricity Consumers Resource Council (ELCON)
- Electric Power Supply Association (EPSA)
- ISO/RTO Council
- Large Public Power Council (LPPC)
- National Association of Regulatory Utility Commissioners (NARUC)
- National Rural Electric Cooperative Association (NRECA)
- North American Generator Forum (NAGF)
- North American Transmission Forum (NATF)
- Northwest Public Power Association (NWPPA)
- Transmission Access Policy Study Group (TAPS)
- Western Interconnection Compliance Forum (WICF)
- NERC Planning Committee (PC)
- NERC Operating Committee (OC)
- NERC Critical Infrastructure Protection Committee (CIPC)
- Regional Entity Stakeholder Committees
Stakeholder Tools

Request for Interpretation (RFI):

• Standard Processes Manual (SPM) Section 7 outlines the process for developing an interpretation. Eight criteria for rejecting a request.

• A valid interpretation provides additional clarity about one or more requirements, but does not expand on any requirement and does not explain how to comply with any requirement.

• Any entity that is directly and materially affected by the reliability of the North American Bulk Power Systems may request an interpretation.

• The NERC Standards and Legal staff shall make a recommendation to the Standards Committee whether to accept the Request for Interpretation (RFI).
Stakeholder Tools

Request for Interpretation (RFI) cont.:

• Reasons to reject RFIs Section 7 SPM
  – Requests approval of a particular compliance approach;
  – Identifies a gap or perceived weakness in the approved Reliability Standard;
  – Where an issue can be addressed by an active standard drafting team;
  – Where it requests clarification of any element of a Reliability Standard other than a Requirement;
  – Where a question has **already been addressed in the record**;
  – Where the Interpretation identifies an issue and proposes the development of a new or modified Reliability Standard, (such issues should be addressed via submission of a SAR);
  – Where an Interpretation seeks to expand the scope of a Reliability Standard; or
  – Where the meaning of a Reliability Standard is **plain on its face**.
Stakeholder Tools

Stakeholder tool developed by the Regional Standards Committee to document DER issues identified and pursue how they be addressed. Posted on NPCC Website.

1) Issue Identification (Stakeholder, RAPA, or Event Analysis)- Form
2) Evaluation (Preliminary screen, Scope, Type, Importance)- RSC and RCC
3) NERC or Regional solution, Recommendation (NPCC action taken?)
4) Creation of a Forum to discuss issues
5) Develop a draft DER Guidance paper
DER Activities

• NPCC DER Forum-
  – DER Impact Reporting Form
  – NPCC Guidance Document- Approaches to Preserve System Resilience and Reliability for a High DER Penetration Future

• NERC DER Position Paper and Regional Coordination

• NERC Activities- e.g. IRPTF, SPIDER
NPCC Regional Standards

- PRC-006-NPCC-1 Revision to:
  - Review for potential revisions made necessary by:
    - NERC PRC-006-1/PRC-006-2 Automatic Underfrequency Load Shedding
    - NERC PRC-024-1/PRC-024-2 Generator Frequency and Voltage Protective Relay Settings standards.
  - Review for Dispersed Generation (DG) issues
- Developed to enable retirement of NPCC Directory 12
- Three 45-day formal postings for comments
- 30 day pre-Ballot Review and 10 + day ballot in fourth quarter 2018-approved by Stakeholders
- Approved by NPCC Board of Directors
- NERC BOT approval November 5, 2019
- File with FERC and Provincial Governmental Authorities
NPCC Criteria Services

• Maintain and Revise Directories and Criteria
• A-10 “Classification of BPS Elements” Revision
• Cost Effectiveness and Resilience Pilot on two Directories
• Revise Directory Development and Revision Manual
• SPS to RAS Transition, Directory 7
• Criteria Enforcement Program
• Applicability (Member or Tariff)
NPCC Regional Standards Committee

- Interface with RISC- emerging issue identification
- Review and comments on NERC/ERO and Eastern Interconnection Regional Standards
- Develops Ballot Recommendations for NERC/ERO Standards and Interpretations
- Participates in NERC Standards drafting and influence processes through various groups-formal and informal
- Oversees the Development and Maintenance of NPCC Regional Standards
- Oversees the Development and Maintenance of NPCC Regional Directories
- Regional Delegation Agreement-Standards Program Area
- Review all FERC Orders, Rulings, NOPRs and Petitions related to Standards
- Participates in Feedback loop mechanisms to improve standards
- Conducts DER Forum activities
“Intelligence is the ability to adapt to change.”- Stephen Hawking

Stephen Hawking (Jan 1942-March 2018)

Questions or Comments?
Standards Efficiency Review

Phase 2: Evidence Retention
Project Update

Dr. Michael Puscas, Ed.D.
Compliance Manager
ISO-NE
Standards Efficiency Review Update

John Allen, Manager Reliability Compliance, City Utilities of Springfield
October 22, 2019
Introduction

• SER Phase 2 Project Purpose and Scope
• List 5 Evidence Retention Schemes and Associated Recommendations
• Emphasis on High Risk Standards and Requirements
• Next Steps
Overall: Evaluate NERC Reliability Standards using a risk-based approach to identify potential efficiencies through retirement or modification of Reliability Standard Requirements. This project seeks to identify potential candidate requirements that are not essential for reliability, could be simplified or consolidated, and could thereby reduce regulatory obligations and/or compliance burden.
CIP: Using a risk-based approach, evaluate NERC CIP Reliability Standards in order to identify potential efficiencies through retirement or modification of Reliability Standard Requirements.
SER Phase 2 Project Scope

• **Phase 2:** Evaluate NERC Reliability Standards (O&P and CIP), as informed by implementation experiences and compliance practices, to develop and recommend standards-based solutions intended to reduce inefficiencies and unnecessary regulatory burdens for the purpose of supporting continued safe, secure and reliable operations.
Phase 2 Industry Survey

- Gauged level of support (1-10) of each concept from 75 participants, equally weighted
  - Concept 1: Evidence Retention (8.12)
  - Concept 5: Consolidate Information/Data Exchange Requirements (8.11)
  - Concept 3: Move Requirements to Guidance (7.85)
  - Concept 2: Prototype Standard (7.78)
  - **Concept 6**: Relocate Competency-based Requirements to the Certification Program/Controls Review process (6.85)
  - **Concept 4**: Consolidate & Simplify Training Requirements (6.19)

- Reviewed industry survey responses, comments, and concerns
- Evaluated and prioritized concepts based on potential benefit, feasibility and effort of implementation
• Analysis of ~140 Data/Information Requirements

• Common Themes
  - Horizon: Planning, operations, event driven
  - Purpose: Planning assessments, OPA, RTA, RTM
  - Timeframe: Real-time, on demand, annual
  - Mode: Digital, Email, Verbal

• Initial Observations
  - Consolidate
  - Trigger on unresolved non-performance
  - ROP Options (Section 1600, CMEP, etc.)
Requirements to Guidance
Recent Activities

- Phase 2 Team on hold
- NERC developing guiding principles
- ERO risk mitigation framework
- Draft white-paper
CI P Standards Efficiency Review
• Approach is very similar to SER Phase 1
• Industry input using SER Matrix ended August 26 (~30 responses)
• Working team formed
• Kickoff meeting in November
• Analysis of industry feedback
• Draft SAR
Evidence Retention
Evidence Retention

Goals

- Build on 2014 Data Retention White Paper
- Achieve Objectives:
  - Identify 2014 applicable recommendations
  - Identify inconsistencies in current retention schemes
  - Identify a short list of simplified retention schemes
  - Identify solutions for each high risk requirement
  - Identify best path for implementation
Evidence Retention Timeline

- Informal industry survey ended September 23
- Consider feedback and finalize report - October/November
- Develop final recommendations - November/December
- Transition to implementation - TBD
Evidence Retention Problem

- The Evidence Retention team discovered over 50 different evidence retention schemes strewn throughout CIP and O&P Standards and requirements.

- Because of confusion everyone keeps everything for as long as possible
Example: Current Schemes

- It’s All ONE Scheme: **12 Calendar Months**
  - 12 Calendar Months Following Completion of each CAP
  - One Calendar Year
  - Current Year
  - Last 12 Calendar Months
- Two Calendar Years vs. Current Calendar Year Plus One Previous Calendar Year
RISK: VRF Examination

VRF Percentage Levels for O&P and CIP Requirements

- 380, 32%
- 282, 23%
- 534, 44%
- 14, 1%
- 3, 0%

Legend:
- Lower VRF
- Medium VRF
- High VRF
- No VRF Assigned
- To Be Determined
## Five Evidence Retention Schemes

<table>
<thead>
<tr>
<th>Recommended Data/Evidence Retention Schemes</th>
<th>Rationale for the Data/Evidence Retention Scheme</th>
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<tbody>
<tr>
<td>1. <strong>Current plan, model, agreement, methodology, study, program or procedure with a revision history specifying changes and dates of review. If revised within the last year, the prior version should also be retained.</strong></td>
<td>This satisfies the need for auditors to see the most recent documentation in a variety of areas. What is most important is the current document and that document should have a revision history showing that it is regularly reviewed and updated. In some instances, evidence retention may exceed a three year period.</td>
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## Five Evidence Retention Schemes

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<tbody>
<tr>
<td>2. Most recent full testing records with evidence of previous testing intervals.</td>
<td>This satisfies the requirements to complete and document various tests and includes the requirement to have evidence of the previous full testing records. In some instances, evidence retention may exceed a three year period.</td>
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<tr>
<td><strong>3. Rolling 3 Months data retention period for voice and audio recordings and 12 months for operating logs</strong></td>
<td>Voice and audio recordings take up a lot of space on computer systems. Therefore, only 3 months of rolling history are necessary. Similarly, only 12 months of rolling history are necessary for operating logs</td>
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</table>
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<td>4. Rolling 12 Months data retention period.</td>
<td>This satisfies existing evidence retention scheme requirements to have at least 12 months of data. Given the type of data, it’s not necessary to have 3 or more years of data.</td>
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# Five Evidence Retention Schemes

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<th>Rationale for the Data/Evidence Retention Scheme</th>
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<td><strong>5. Rolling 36 Months data retention period.</strong></td>
<td>Many existing evidence retention schemes call for a three year (36 month) retention schedule. The 36 month data retention is retained with the addition of “rolling”.</td>
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Recommendations

- Pursue Rules of Procedure changes for evidence retention to minimize administrative burden. (NERC Staff)
- Retire Compliance Bulletin #2011-001 Data Retention Requirements, once ROP changes are in effect or publish CMEP guidance to supersede the bulletin. (NERC Staff and CCC)
Recommendations

• Concurrent with ROP changes, update Standard Drafting Teams (SDTs) references and notify active SDTs, with the minimum options for risk-based data retention schemes, as described above. In addition, the headings within Reliability Standard should be consistently named “Data and Evidence Retention Period”. (SC)
Recommendations

• If desired, concurrent with ROP changes, establish a project to revise evidence retention schemes for enforceable Reliability Standards with a Standard Drafting Team, Periodic Review team, or other mechanism. (SC and NERC Staff)
Recommendations

- Ensure changes to CMEP evidence retention processes are made in associated documents and communicated with ERO Enterprise staff, such as NERC Auditor’s Manual, training materials, etc. (NERC Staff)

- Lastly...
Recommendations

- Ensure final recommendations of SER Evidence Retention are circulated with the CCC, SC, and NERC staff, and recommendations are incorporated into respective work plans in 2020. (CCC, SC, NERC Staff)
Evidence Retention Questions
Trend Analysis of ERO-wide Event Analysis Program (EAP) Events for Study Period 2015 thru 1st Quarter 2019

November 21, 2019
Key Objectives

• Use of event Severity Risk index (eSRI) as a measure of Impact/Resilience
• Development of pseudo-eSRI values for NPCC’s Extreme Contingency (EC) tests
• Comparison of ERO-wide EAP events vs. NPCC’s Actual Events and Extreme Contingency (EC) testing to identify past resilience performance
• Promoting Lessons Learned development.
### EA Program Qualifying Events as of 10/14/19

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<td></td>
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<td>4</td>
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<td>5</td>
<td>9.00001</td>
<td>999.99999</td>
<td></td>
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</tr>
</tbody>
</table>
extreme contingency eSRIs by NPCC Area

10/30/2019
extreme contingencies vs actual events

Ontario

- min
- avg
- max

- eSRI
- EC
- threshold

10/30/2019
extreme contingencies vs actual events

Quebec

- min
- avg
- max

- eSRI
- EC
- threshold

10/30/2019
extreme contingencies vs actual events
extreme contingencies vs actual events
extreme contingencies vs actual events
extreme contingencies vs actual events
By and Far the greatest by-product of the Event Analysis program is Lessons Learned (LL).

The sharing of the knowledge gained by each of us during and after an event is only accomplished by the development and publishing of LLs (anonymously).

If you are not developing your own or reading those already published, you are losing out on what this program is all about --- increasing RELIABILITY!
<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
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<tr>
<td>Team*</td>
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<td>0</td>
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<td>0</td>
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<td>5</td>
<td>4</td>
<td>10</td>
<td>6</td>
<td>2</td>
<td>4</td>
<td>3</td>
<td>41</td>
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<td>1</td>
<td>3</td>
<td>4</td>
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<td>1</td>
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<td>4</td>
<td>2</td>
<td>2</td>
<td>0</td>
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<td>0</td>
<td>11</td>
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<td>8</td>
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<td>2</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>0</td>
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</tr>
<tr>
<td>WECC</td>
<td>0</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>25</td>
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<tr>
<td>Total</td>
<td>23</td>
<td>22</td>
<td>18</td>
<td>14</td>
<td>19</td>
<td>16</td>
<td>13</td>
<td>9</td>
<td>15</td>
<td>10</td>
<td>159</td>
</tr>
</tbody>
</table>
Events Analysis

The NERC has established an enhanced, industry wide Event Analysis program based on the recognition that many events which occur on the bulk power system beyond the reporting requirements in place today can have varying levels of significance to the electric system, providing otherwise unrealized lessons to be learned from these events and providing the opportunity for the trending of such events to identify possible reliability concerns. By integrating a “bottom-up” approach to a disturbance review within the framework of the NERC Event Analysis Program, consistency, comparability, flexibility and timeliness in the event analysis process will be promoted by NPCC, the registered entities and NERC in a collaborative initiative.

Upon the identification of an event, the goal of the Event Analysis Program is to:
- identify what transpired;
- establish the sequence of events;
- understand the essential root causes of the event;
- identify recommendations or corrective actions; develop, and disseminate to the industry, lessons to be learned so that the operational reliability of the bulk power system can be further enhanced.

The adoption by NERC of the Event Analysis Program in its Rules of Procedure brings clarity and certainty about what system events are relevant to analyze and to what level of detail, targeting potential vulnerabilities to the reliability of the bulk power system for detailed and in depth analysis.
Events Analysis - Documents

Lessons Learned Overview

In an attempt to provide information gleaned from events that have occurred not only within the NPCC region, but continent-wide as well, the table below has been provided.

This table's objective is to act as an index of the regional insights/lessons learned (both posted on the NERC website and those still in the queue or regionally specific) indicating their area(s) of focus as they relate to the six areas (headers) listed below.

<table>
<thead>
<tr>
<th>Category</th>
<th>Lessons Learned</th>
<th>NPCC Review</th>
<th>NERC LL</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMS/SCADA (41)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Generation (5)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>System Protection (23)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transmission (5)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

How about this One? This provides links to some NERC LLS and the associated regional insights provided by our NPCC TFs on the LL.
Questions
FERC NPCC 2019 Workshop presentation is not available for distribution.
Centralized Organization Registration ERO System (CORES) Update

November 20, 2019
The CORES platform enables entities to manage their registration information, contact information, and functional relationships from one application.

The application is accessed through a common platform – the ERO Portal.

- Link to access: https://eroportal.nerc.net

The Centralized Organization Registration ERO System (CORES) was launched on July 15, 2019, to provide consistency and alignment across the ERO for registration activities.
CORES Package

MFA on ERO Portal

CORES on ERO Portal

ERO Enterprise Help Desk
Timeline of Work

Q1 2019: Development began

June 2019:
Multi-Factor Authentication implemented for the ERO Portal

Aug 2019:
Focus group & testing participants began validation process

May 2019:
Focus group & registered entity pilot testing

Mid-July 2019:
CORES Go-Live
- New Registrations
- Change Requests

Q4 2019:
Continue the rollout process by requesting entities to begin the validation process
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Q4 2019:
Continue the rollout process by requesting entities to begin the validation process
• CORES is a new system and the ERO wants users to have a positive user experience and to have the resources available to assist users with registration activities.

• There are three groups in the Managed Release –
  1. High priority entities that have registration requests that need to be processed immediately
  2. The initial pilot entities and focus group
  3. The remainder of the entities in all the regions

• The software will be released to the remainder of entities over the next several months on a regional basis
  ▪ There were several enhancements that have been made or are close to being completed that we received from registered entity feedback.
  ▪ The remainder of the entities will be provided access according to each Regional Entity’s plan.
ERO Portal Access

ERO Portal

- CFR
- MIDAS
- UMR
- Membership
<table>
<thead>
<tr>
<th>ERO Portal Access</th>
<th>Additional Logins</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Align (Upcoming)</td>
<td>• System Operator Certification and Continuing Education (SOCCED)</td>
</tr>
<tr>
<td>• Centralized Organization Registration ERO System (CORES)</td>
<td>▪ <a href="https://nerc-socced.useclarus.com/login?forward_url=/">https://nerc-socced.useclarus.com/login?forward_url=/</a></td>
</tr>
<tr>
<td>• Coordinated Functional Registration (CFR)</td>
<td>• BESNet and SBS both use the same login</td>
</tr>
<tr>
<td>• Misoperation Information and Data Analysis System (MIDAS)</td>
<td>▪ Bulk Electric System Exceptions (BESnet)</td>
</tr>
<tr>
<td>• Email Lists / Extranet (UMR / Groups)</td>
<td>▪ <a href="https://identity.eroenterprise.com/account/signin">https://identity.eroenterprise.com/account/signin</a></td>
</tr>
<tr>
<td>• Membership</td>
<td>▪ Standards Balloting System (SBS)</td>
</tr>
<tr>
<td></td>
<td>▪ <a href="https://identity.eroenterprise.com/account/signin">https://identity.eroenterprise.com/account/signin</a></td>
</tr>
<tr>
<td></td>
<td>• GADS Wind</td>
</tr>
<tr>
<td></td>
<td>▪ <a href="https://gadswind.nerc.net/">https://gadswind.nerc.net/</a></td>
</tr>
<tr>
<td></td>
<td>• NERC Alerts</td>
</tr>
<tr>
<td></td>
<td>▪ <a href="https://www.nercalerts.com">https://www.nercalerts.com</a></td>
</tr>
</tbody>
</table>
• CORES is not currently planned to be used for
  ▪ Compliance Monitoring and Enforcement Functions – see the Align project.
    ○ [link]
  ▪ Certification or Certification Reviews
    ○ No system in place for certification or certification reviews at this time
  ▪ BES Processing
    ○ BES processing will continue to utilize the BESnet application
      – [link]
The information collected in CORES will be based upon the Common Registration Form:

- Entity names
- Contact information
- Functional registration request information
- Parent company and affiliate information
The information collected in CORES will include:

- Joint Registration Organization (JRO) information
- Multi-Regional Registered Entity (MRRE) information
- Functional model relationships
- Role information for specific contacts
- *New information to be collected will be Outsourced Compliance Companies
- **November 20** - NPCC Workshop Update
- **November 21** - NPCC After the Workshop Early Release Training & Validation Reviews Session
- **December 10 at 10 AM** - NPCC Webex Training Session & Validation Reviews

- Entities access is restricted. In preparation for the events, the appropriate permissions will be assigned and the software will be released to registered entity contacts with roles.
- Each Region will be providing additional details at the Regional Entity workshops
- Multi-Regional Registered Entities will be accommodated and provided additional details specific to their registrations.
The expectation is to complete these milestones no later than **April 1, 2020** in preparation for the Align system release.

In the short term, contact information will not be updated in CORES.

- Contact records, usernames, permissions will be handled through the helpdesk for access.

CORES Milestones

- Data validation from migration
  - Functional Registrations and dates
- Entity relationships
- Functional mapping
- Coordinated Functional Registration
- Joint Registration Organization
One-Stop Shop for Training, Materials and Access to CORES and the ERO Enterprise Help Desk

- CORES Video Library for Training Material
  - [https://vimeopro.com/nerclearning/cores-video-library/page/1](https://vimeopro.com/nerclearning/cores-video-library/page/1)

- Project Page
  - [https://www.nerc.com/pa/comp/Pages/CORESTechnologyProject.aspx](https://www.nerc.com/pa/comp/Pages/CORESTechnologyProject.aspx)

- Registration Pages for NERC and NPCC
  - [https://www.nerc.com/pa/comp/Pages/Registration.aspx](https://www.nerc.com/pa/comp/Pages/Registration.aspx)
  - [https://www.npcc.org/Compliance/Compliance%20Registration1/Forms/Public%20List.aspx](https://www.npcc.org/Compliance/Compliance%20Registration1/Forms/Public%20List.aspx)

- ERO Enterprise Help Desk
  - [https://support.nerc.net](https://support.nerc.net)

- Link to access and register for ERO Portal (CORES is accessed via the ERO Portal)
  - [https://eroportal.nerc.net/](https://eroportal.nerc.net/)
Questions and Answers
• State of Reliability
• Identifying priority reliability risks
• Measuring impact of mitigation efforts
• Long-Term Reliability Assessment

– RELIABILITY PERFORMANCE AND TRENDS?
– WHAT SHOULD THE ERO WORK ON?
– IS THE ERO HAVING AN IMPACT?
– WHAT ISSUES LIE AHEAD?
– LET’S GO!
What’s Changing

Variable Resources
Generation Retirements
Inverter Controls and Integration
Distributed Energy Resources
Lack of Synchronized Generation
NERC-Wide On-Peak Generation Capacity Mix: 2008 vs 2018

### 2008
- **Coal**: 33.8%
- **Gas**: 28.4%
- **Nuclear**: 13.4%
- **Hydro**: 15.6%
- **Wind**: 0.1%
- **Biomass**: 0.1%
- **Pumped Storage**: 2.8%
- **Oil**: 5.6%
- **Other**: 0.2%

### 2018
- **Coal**: 24.0%
- **Gas**: 43.0%
- **Nuclear**: 11.0%
- **Hydro**: 11.0%
- **Wind**: 2.0%
- **Biomass**: 1.0%
- **Pumped Storage**: 2.0%
- **Oil**: 4.0%
- **Other**: 1.0%
Number of Generator Owners (US ONLY)

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Owners</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>737</td>
</tr>
<tr>
<td>2002</td>
<td>793</td>
</tr>
<tr>
<td>2003</td>
<td>869</td>
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<tr>
<td>2004</td>
<td>903</td>
</tr>
<tr>
<td>2005</td>
<td>928</td>
</tr>
<tr>
<td>2006</td>
<td>966</td>
</tr>
<tr>
<td>2007</td>
<td>995</td>
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<td>2008</td>
<td>1,013</td>
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<td>2009</td>
<td>1,032</td>
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<td>2010</td>
<td>968</td>
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<td>2011</td>
<td>1,125</td>
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<td>2012</td>
<td>1,189</td>
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<td>2013</td>
<td>1,237</td>
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<td>2016</td>
<td>1,350</td>
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<tr>
<td>2017</td>
<td>1,365</td>
</tr>
<tr>
<td>2018</td>
<td>1,424</td>
</tr>
</tbody>
</table>
• Provide objective information to policy makers, industry, and the general public on issues affecting BPS reliability and resilience
  - Identify system performance trends and emerging reliability risks
  - Report on the relative health of the interconnected system
  - Measure the success of mitigation activities deployed
• High Reliability in 2018, No Non-Weather Category 3, 4, or 5 events
  ▪ Hurricane Michael and Florence Category 3
• Extreme weather events continue to be leading contributor to the largest generation and distribution outages
• Better than expected performance from Texas generation fleet helped meet 2018 summer peak demand; reliability risk in 2019 due to continued capacity deficit
• Continued downward misoperation rate trend
• Improving or stable frequency response performance in all interconnections
• Emerging reliability challenges identified as more inverter-based generation is added
4,353,740,908 MWh
2018 Actual Energy

99.92%
Time with no operator-controlled load shedding

1,028,629 MW
2018 Summer Peak Capacity

469,842 mi
Total Transmission Circuit Miles > 100kV

5,816
Number of Conventional Generating Units > 20MW

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

The ERO Enterprise: NERC and 7 Regional Entities

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

Bulk Power System Situation Awareness Inputs and Products in 2018

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

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

255 Daily Reports
5 Special Reports

0 Level 1 Alert
1 Level 2 Alerts
Event Analysis (2018, Trends, Causes)

Category 1: 169 events
- 56 — 3 or more BPS facilities lost (1a)
- 7 — BPS SPS/RAS Misoperation (1c)
- 1 — Voltage reduction > 3% (1d)
- 3 — Unintended loss 1,000-1,999 MW in ERCOT (1g)
- 102 — EMS (1h)

Category 2: 6 events
- 4 — Unintended loss of load (2f)
- 2 — IROL Violation

Category 3: 2 events
- Hurricane Michael
- Hurricane Florence

Category 4: 0 events

Category 5: 0 events

Graph showing the number of events from 2014 to 2018.

Pie chart showing the causes of events:
- Design/Engineering: 40%
- Management/Organization: 34%
- Equipment/Material: 8%
- Training: 6%
- Other: 4%
- Individual Performance: 4%
- Communication: 4%
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

Number of Non-Weather Events with Load Loss and Annual Average Load Loss

Total Category 1 Events by Year and Subcategory
• 10 NERC Lessons Learned published to date in 2019
  - 4 - Transmission Facilities
  - 2 - Generation Facilities
  - 4 - Communications

• 15 NERC Lessons Learned were published in 2018
  - 1 - Generation Facilities
  - 6 - Communications
  - 7 - Transmission Facilities
  - 1 - Relaying and Protection Systems
Reliability Indicators

Metrics are rated on a four-point color scale:

- **Green**: Improving
- **White**: Stable or no change
- **Yellow**: Monitor
- **Red**: Actionable, may lead to key finding
Reliability Indicator – Transmission
Related Events Results in Loss of Load

![Chart showing counts of events and average demand interrupted (MW) firm over years 2014 to 2018. The chart indicates a decrease in counts and average demand interrupted over time.]

- Count of Events
- Average of Demand Interrupted (MW) Firm
Reliability Indicator - Weighted Effective Forced Outage Rate, Conventional

Five-Year NERC WEOFOR
All Fuel Types, 6.98
Reliability Indicator – Frequency Response

2018 Frequency Response Performance Statistics and Trend Assessment

<table>
<thead>
<tr>
<th>Interconnection</th>
<th>2018 OY Arrestering Period Performance</th>
<th>2018 OY Stabilizing Period Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean UFLS Margin (Hz)</td>
<td>Lowest UFLS Margin (Hz)</td>
</tr>
<tr>
<td>Eastern</td>
<td>0.458</td>
<td>0.404</td>
</tr>
<tr>
<td>Texas</td>
<td>0.594</td>
<td>0.498</td>
</tr>
<tr>
<td>Quebec</td>
<td>1.075</td>
<td>0.678</td>
</tr>
<tr>
<td>Western</td>
<td>0.405</td>
<td>0.246</td>
</tr>
</tbody>
</table>
Reliability Indicator - Protection System Misoperation Rate

Annual Protection System Misoperation Rate

- Q4 2013 through Q3 2018

Five-Year Protection System Misoperation Rate by Region

- Q4 2013 through Q3 2018

NERC 8.56%
FRCC 7.96%
MRO 10.19%
NPCC 7.58%
RF 13.29%
SERC 7.78%
Texas RE 7.02%
WECC 5.69%
Severity Risk Index

- Load Loss: 60%
- Transmission Loss: 30%
- Generation Loss: 10%
Severity Risk Index (SRI) - Sorted

Ten Highest Stress Days with 2018 marked

3/2 Winter Storm
9/14 Hurricane Florence
11/15 Winter Storm
10/11 Tropical Storm Michael 4/15
1/16
5/
1/
1/2 Severe Cold Weather

SRI Log axis

Descending day of the year

2012 2014 2015 2016 2017 2018
Long-Term Reliability Assessment
Projected 2024 Peak Planning Reserve Margins

Key Finding: Anticipated and Prospective Planning Reserve Margin Shortfalls
• 10-year compound annual growth rate (CAGR) of peak demand increased for the first time in 15 years for North America. Summer growth is 0.63% and winter growth is 0.68%.
Tier 1 and 2 Planned Resources
Projected Through 2029

Over 330 GW of new BPS-level Wind and Solar Installed Capacity by 2029
Committed retirements through 2029 are expected to surpass those retired in the last 7 years.
• On-peak natural gas-fired capacity has increased to 455 GW, up from 359 GW in 2009.
• 100 GW of Tier 1 gas-fired capacity is planned during the next decade.

<table>
<thead>
<tr>
<th>Assessment Area</th>
<th>2024(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FRCC</td>
<td>78.1%</td>
</tr>
<tr>
<td>WECC-CAMX</td>
<td>68.2%</td>
</tr>
<tr>
<td>Texas RE-ERCOT</td>
<td>63.3%</td>
</tr>
<tr>
<td>NPCC-New England</td>
<td>52.3%</td>
</tr>
<tr>
<td>WECC-SRSG</td>
<td>51.8%</td>
</tr>
<tr>
<td>WECC-AB</td>
<td>51.8%</td>
</tr>
</tbody>
</table>
What keeps me awake at night?
What keeps me awake at night?

Do they have enough flexibility?
• May 2017 – CAISO first Stage 1 Emergency in 10 years
• October 2017 – EEA3 (demand response activated; no load shed)
• March 2018 – Record breakers:
  - All-time demand served by transmission-connected solar was 49.95%
  - 3-Hour upward net-load ramp was 14,777 MW; 1-Hour 7,545 MW
• Larger ramps in shoulder seasons; however, supply scarcity more likely during summer conditions
• June 2019 – Two EEA3
• Projected 2021 Maximum 3-Hour Ramp = 17,048 MW
Key Finding: DER Projections

Storage Projected to Increase over Five Years

Ten Year Projected Total Installed DER/BTM Solar PV
What keeps me awake at night?

Do they have enough flexibility?

Do they have enough capacity?
Key Finding: Anticipated and Prospective Planning Reserve Margin Shortfall

Texas-RE-ERCOT Reserve Margins

Anticipated Reserve Margin (%) vs. Prospective Reserve Margin (%) Reference Margin Level (%)

- 2019 2020 2021 2022 2023 2024
- Anticipated Reserve Margin (Red Line)
- Prospective Reserve Margin (Blue Line)
- Reference Margin Level (Black Line)
Weighthed Equivalent Forced Outage Rate
Comparison of NERC and Texas RE Units
April 2014 - October 2018
What keeps me awake at night?

Do they have enough fuel?

Do they have enough flexibility?

Do they have enough capacity?
New England: Gas Infrastructure vs. Gas Generation Build Out

Gas-Fired Generation Outpaces Natural Gas Pipeline Expansion

Source: Velocity Suite, FERC Form 2 Page 514
State Breakout of Miles of Transmission Lines
Monthly EFOR - Natural Gas

ISO-NE Gas WEFOR for Cold Weather Months 2014 - 2018

- ISO-NE Gas (monthly)
- ISO-NE Gas (annual - cold weather months)
- ISO-NE Gas (overall - cold weather months)
- NERC (overall - cold weather months)
- Linear (ISO-NE Gas (monthly))
What keeps me awake at night?

- Do they have enough fuel?
- Do they have enough flexibility?
- Do they have enough capacity?
Increasing Efforts in E-ISAC

![Bar chart showing the number of events by month.]

- **January**: 26 events
  - Watering Hole: 1
  - Vulnerability Probing: 12
  - Unknown: 7
  - Email: 16
- **February**: 18 events
  - Watering Hole: 2
  - Vulnerability Probing: 6
  - Unknown: 4
  - Email: 6
- **March**: 12 events
  - Watering Hole: 2
  - Vulnerability Probing: 4
  - Unknown: 2
  - Email: 4
- **April**: 20 events
  - Watering Hole: 1
  - Vulnerability Probing: 6
  - Unknown: 5
  - Email: 8
- **May**: 21 events
  - Watering Hole: 1
  - Vulnerability Probing: 7
  - Unknown: 4
  - Email: 9
- **June**: 17 events
  - Watering Hole: 1
  - Vulnerability Probing: 5
  - Unknown: 4
  - Email: 7
- **July**: 22 events
  - Watering Hole: 2
  - Vulnerability Probing: 5
  - Unknown: 6
  - Email: 9
- **August**: 28 events
  - Watering Hole: 3
  - Vulnerability Probing: 7
  - Unknown: 7
  - Email: 11
- **September**: 17 events
  - Watering Hole: 1
  - Vulnerability Probing: 5
  - Unknown: 3
  - Email: 8
- **October**: 26 events
  - Watering Hole: 1
  - Vulnerability Probing: 8
  - Unknown: 4
  - Email: 13
- **November**: 8 events
  - Watering Hole: 0
  - Vulnerability Probing: 4
  - Unknown: 2
  - Email: 2
- **December**: 25 events
  - Watering Hole: 1
  - Vulnerability Probing: 9
  - Unknown: 3
  - Email: 12
New England Operational Risk Analysis, Winter Peak

- Expected Operating Reserve + Extreme Peak Demand
- Capacity (GW)
- 2019–2020 Winter Anticipated Resources: 34.1 GW
- Typical Maintenance Outages: -0.7 GW
- Typical Forced Outages: -3.0 GW
- Resource Derates for Extreme Conditions: -0.3 GW
- Natural gas fuel risk scenario: -4.7 GW
- Operational Mitigations (Resources): 1.5 GW
- Expected Operating Reserve Requirement = 2.3 GW
- 2019–2020 Winter Total Internal Demand: 20.5 GW
- Extreme Winter Peak Demand: 21.2 GW
- All-time Winter Peak Demand (2004): 22.8 GW
Questions and Answers