

# NERC

NORTH AMERICAN ELECTRIC  
RELIABILITY CORPORATION

## Security and Reliability Training Working Group Recommendation

Approve

David Zwergel, RSTC Vice Chair

NERC Reliability and Security Technical Committee Meeting

March 2021

RELIABILITY | RESILIENCE | SECURITY



- The Security and Reliability Training Working Group (SRWTG) was created by merging the Reliability Training Working (RTWG) and the Security Training Working Group (STWG)
- The RTWG carries forward the work from the former Personnel Subcommittee (PS).
- The RTWG are working under directions from the OC which approved their scope in March 2020
- The STWG is a group that arranged for various security related presentations and briefings during the week if CIPC face-to-face meetings

- The Stakeholder Engagement team that created the RSTC focused on increasing efficiency/effectiveness and eliminating redundancy
- The RSTC EC believes that training is not part the RSTC core proposition as a technical committee
- The RSTC Executive Committee (EC) has reviewed the deliverables of the SRTWG and notes significant redundancy in effort between the WG and industry as a whole.
- The EC recommends disbanding the SRTWG

- The RSTC Executive Committee recommends disbanding the SRTWG and requests that the Reliability and Security Technical Committee **Approve** this action



# Questions and Answers

- SRTWG Draft Scope Document has the following Deliverables:
  - Prepare a Security and Reliability Training Working Group (SRTWG) work plan that aligns with the RSTC work plan
  - Develop and maintain resources to identify and communicate NERC standards that include a training requirement
  - Develop and maintain training guidelines and/or templates to improve BES knowledge to ensure consistent educational programs
  - Provide training recommendations based on Lessons Learned, Reliability Guidelines, Event Analysis Reports, and the annual ERO Reliability Risk Priorities Report provided by the Reliability Issues Steering Committee (RISC)

- Prepare a Security and Reliability Training Working Group (SRTWG) work plan that aligns with the RSTC work plan
- Develop and maintain resources to identify and communicate NERC standards that include a training requirement.
  - This is part of the standard development process and is coordinated with the Standard Drafting Team and NERC Staff.
  - Many entities also have this performed in-house

- Develop and maintain training guidelines and/or templates to improve BES knowledge to ensure consistent educational programs.
  - These items are geared towards “Train-the-trainer” activities.
  - Many entities have in-house staff to provide these work products and most, if not all, vendors provide this a part of their training packages
  - The PER-005-2 Standard requires RC, TOP and BA to “use a systematic approach to develop and implement a training program for its System Operators” (R1) and “shall design and develop training materials *according to its training program*, based on the BES company-specific Real-time reliability-related task list created in part 1.1” (R1.2)



- Provide training recommendations based on Lessons Learned, Reliability Guidelines, Event Analysis Reports, and the annual ERO Reliability Risk Priorities Report provided by the Reliability Issues Steering Committee (RISC)
  - *Lessons Learned and Event Analysis* reports are shared with industry via webinars and industry announcement regarding the publication of these items through the Event Analysis Subcommittee
  - *RISC Report* – The RISC holds a webinar to review their findings. The RSTC leadership will be holding quarterly touch points with RISC leadership throughout 2021 to coordinate risk identification and mitigation going forward

- Continued

- *Reliability Guidelines*: RSTC Charter (Section 8, Reliability Guidelines) states:

### **3. Communication of New/Revised Reliability Guidelines, Security Guidelines and Reference Documents**

In an effort to ensure that industry remains informed of revisions to a Reliability Guideline or Reference Document or the creation of a new Reliability Guideline or Reference Document, the RSTC subcommittee responsible for the Reliability Guideline will follow an agreed upon process.

*{Note: This process was developed by the OC and can be found here:*

*[https://www.nerc.com/comm/OC/Related%20Files%20DL/OC\\_RG\\_RD\\_Communication\\_Process.pdf](https://www.nerc.com/comm/OC/Related%20Files%20DL/OC_RG_RD_Communication_Process.pdf)*

- Continued

- *Reliability Guidelines*: RSTC Charter (Section 8, Reliability Guidelines) states:

- 4. Coordination with Standards Committee**

Standards Committee authorization is required for a Reliability Guideline to become a supporting document that is posted with or referenced from a NERC Reliability Standard. See Appendix 3A in the NERC's ROP under "Supporting Document."

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## Performance Analysis Subcommittee (PAS) Scope

Approve

Brantley Tillis, PAS Chair

Reliability and Security Technical Committee Meeting

March 2, 2021

RELIABILITY | RESILIENCE | SECURITY



- Scope document and work plan development
  - Chair: Brantley Tillis
  - Vice Chair: David Penney
  - Sponsor: Jeff Harrison
  - PAS members
  - NERC Staff

- Purpose

- Review, assess, and report on reliability of the North American Bulk Power System (BPS) based on historic performance, risk and measures of resilience

- Activities

- Annually review, assess and report the state of reliability based on metric trends and technical analysis, and emerging issues.
- Develop and enhance performance metrics and indices that align with an Adequate Level of Reliability (ALR);
- Develop methods to recognize
  - The reliability risks to the industry and measurement methods to quantify those risks; the relationship between risks, standards, and performance including identification of data requirements and that provide key performance indicators to a variety of audiences about the reliability of the bulk power system performance using metric information and trends;

- Define data collection and reporting guidelines;
  - Publish periodic website updates, webinars, and high level assessments on bulk power system reliability performance;
  - Coordinate with the NERC RSTC, Standards Committee (SC), Reliability Issues Steering Committee (RISC), and other appropriate groups to provide an integrated view of reliability performance.
  - Request user groups, as required, to support analysis and work products; provide direction to and prioritize areas of investigation by the user groups.
- Deliverables
    - State of Reliability Report

Task	Task Type
State of Reliability Report (SOR)	Assessment
Review proposed new metrics	Monitor
Conduct annual metric review	Process
Section 1600 Data Request	Data Collection





# Questions and Answers

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# Energy Reliability Assessment Task Force (ERATF)

## Approve Scope and Work Plan

Peter Brandien

NERC Reliability and Security Technical Committee Meeting

March 2021

RELIABILITY | RESILIENCE | SECURITY



- Sufficient amounts of energy are needed to meet the energy needs of the end-use consumer
- Historically, industry ensured energy requirements solely through capacity and reserve margins (with adjustment to hydro)
- The Grid Transformation (from RISC) is resulting in a system that has a higher level of energy uncertainty, regardless of fuel type
- The focus needs not to be fuel type, but energy adequacy
- The current tools, rules of thumb, and approaches were not designed to ensure energy adequacy with the types of resources in the transformed grid

- Mid-to-long term planning (1-5 year timeframe)
  - Ensure that resources are planned that can provide options to obtain sufficient and flexible energy resources
  - Review tools, rules-of-thumb and processes to support the need for these energy resources
- Operational planning (1 day to 1 year)
  - Ensure sufficient resources are available and able to provide energy to meet demand and off-set ramping requirements
  - Electrical energy production needs to reflect status of energy availability given the uncertainties
- Operations (0-1 day)
  - Ensure sufficient amounts of capacity, energy, and ramp flexibility are available from available resources

Define  
Adequate  
Studies

Require  
Adequate  
Studies

Take action  
for all time  
horizons

Energy  
Adequacy

- Understanding energy adequacy, and by extension, fuel availability compared to capacity requires advanced consideration of multiple technologies and concepts
- Eleven Questions asked in the whitepaper entitled “Ensuring Energy Adequacy with Energy-Constrained Resources”
  - Evaluated each of the eleven questions against three time frames
  - The questions are categorized into 3 focus areas
    - Focus 1 – Energy Adequacy and Flexibility for Evolving Resource Mix
    - Focus 2 – Gas Delivery Security
    - Focus 3 - Metrics, Procedures and Analysis

- Coordinate energy reliability assessment activities with industry working groups
- Subject matter experts will be assembled to develop:
  - *Technical foundation for the three time horizons*
  - *Ways to identify the levels of energy that are required to meet the operational needs*
  - *Tool specifications needed to incorporate energy considerations into planning, operational planning and operations assessments*

- Engage industry R&D organizations (EPRI, DOE, Natural Resources Canada, National Laboratories, etc.) to validate the technical foundation(s) and development of the tool(s) and methods.
- Coordinate studies and plans with adjacent Balancing Authorities to identify enhanced collaborative regional support.
- Evaluate whether or not Standard Authorization Requests are needed to enhance existing or create new Reliability Standards to address fuel assurance and resulting energy limitations for the planning timeframe



- ERATF membership
  - RSTC members
  - RSTC active participants and observers
- Leadership
  - Chair appointed by the RSTC chair
- Observers
  - The ERATF chair may invite observers to participate in meetings
  - include additional NERC or Regional Entity staff

- The ERATF is requesting that the Scope and Work Plan is accepted (see attached Scope and Work Plan).
- Further, the RSTC members are requested to identify technical participants to provide technical expertise to address Energy concerns to support the goals of the ERATF.



# Questions and Answers

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# Reliability and Security Technical Committee Work Plan

Approve

David Zwergel, RSTC Vice Chair

NERC Reliability and Security Technical Committee Meeting

March 2021

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- The Reliability and Security Technical Committee (RSTC) Work Plan has been updated by NERC Staff liaisons and contains subgroup work plans for 2021
- The Work Plan will be updated monthly and posted on the RSTC web page
- RSTC Work Plan updates will be included in agenda packages for future meetings

- RAS

- 2021 Summer Reliability Assessment Report is planned for RSTC review April 28 – May 11. Publication is at the end of May.
- RSTC will be requested to Endorse via electronic ballot

- PAWG - Approve
  - 2020 Probabilistic Assessment Scenario Case
  - Data Collection Approaches for Probabilistic Assessments Technical Reference Document
- RS - Approve
  - Operating Reserve Management Guideline
  - ACE Diversity Interchange Guideline
  - Integrating Reporting Ace with the NERC Reliability Guideline
- RTOS - Approve
  - Reliability Guideline: Gas and Electrical Operational Coordination Considerations
- SWG – Approve
  - Security Guideline for the Electricity Sector: Assessing and Reducing Risk

- **SPIDERWG:**
  - Two White Papers for review/ approval
  - Two Reliability Guidelines to request posting for industry comment periods.
- **SPCWG**
  - Revised Scope Document
- **PAS**
  - Accept State of Reliability Report
  - Endorse Section 1600 Data Request



- **Approve** the RSTC Work Plan



# Questions and Answers

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# NERC EMS Performance Special Assessment (2018-2019)

Phil Hoffer, EMSWG Chair  
RSTC Webinar  
March 2, 2021

RELIABILITY | RESILIENCE | SECURITY



- 2019 ERO Reliability Risk Priorities Report

- |                |  |                |   |
|----------------|--|----------------|---|
| <b>MANAGE</b>  | 1. Changing Resource Mix                                   | <b>MANAGE</b>  | 6. Loss of Situational Awareness              |
| <b>MANAGE</b>  | 2. Bulk Power System Planning                              | <b>MONITOR</b> | 7. Extreme Natural Events                     |
| <b>MANAGE</b>  | 3. Resource Adequacy and Performance                       | <b>MONITOR</b> | 8. Physical Security Vulnerabilities          |
| <b>MONITOR</b> | 4. Increasing Complexity in Protection and Control Systems | <b>MANAGE</b>  | 9. Cybersecurity Vulnerabilities              |
| <b>MONITOR</b> | 5. Human Performance and Skilled Workforce                 | <b>MANAGE</b>  | 10. Critical Infrastructure Interdependencies |



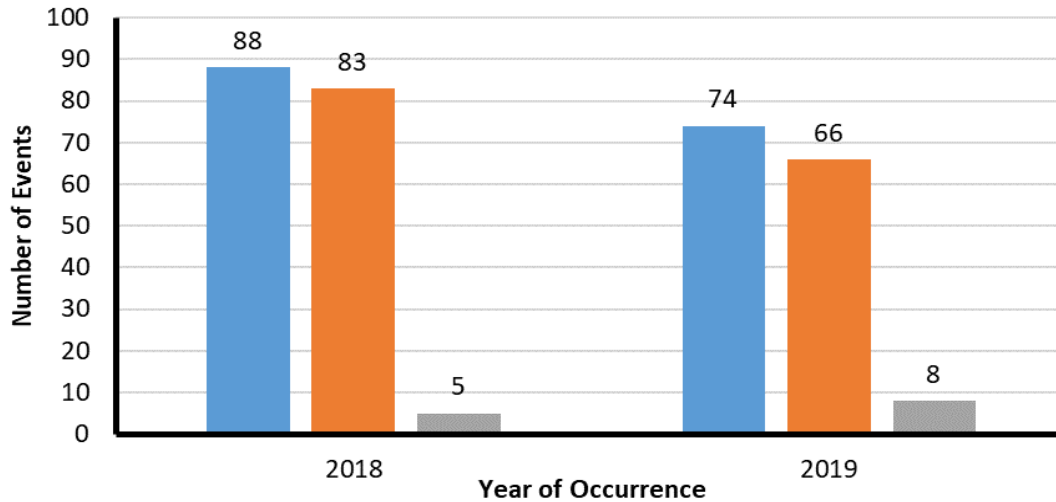
- The version 1 was approved by the OC in December, 2017
- The version 2 was approved by the OC in March, 2020
  - Analyzed 521 EMS events (10/2013 to 04/2019)
  - Identified and discussed risks of losing EMS functions
  - Shared mitigation strategies to reduce these risks

- Loss of monitoring or control at a control center such that it significantly affects the entity's ability to make operating decisions for 30 continuous minutes or more. (EA Process v. 4.0)
- Complete loss of monitoring or control capability at its staffed BES control center for 30 continuous minutes or more. (RC, BA, TOP) (EOP-004-4, April 2019)
- Complete loss of monitoring capability affecting a BES control center for 30 continuous minutes or more such that analysis capability (i.e., State Estimator or Contingency Analysis) is rendered inoperable. (RC, BA, TOP) (EOP-004-3, April 2017)

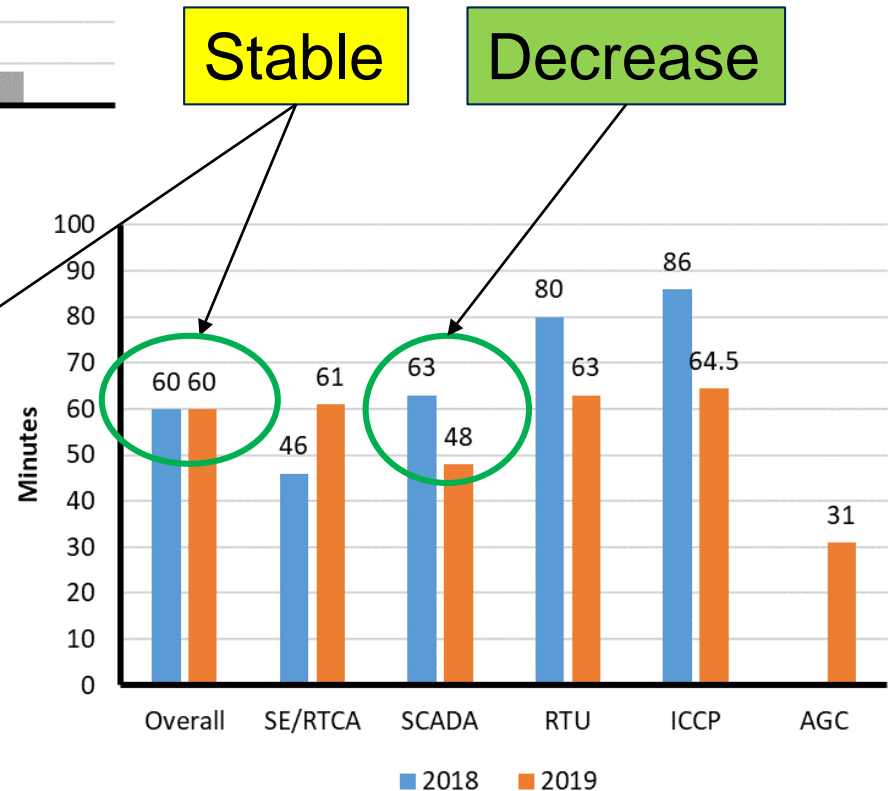
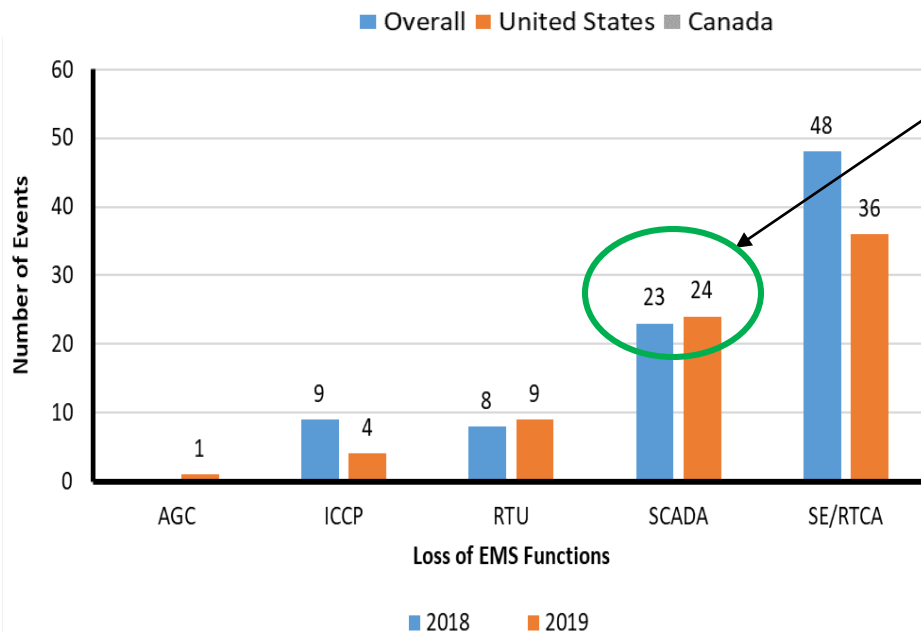


- Assess the EMS performance based on
  - Outage duration
  - EMS functions: SCADA, AGC, ICCP, RTU, SE, and RTCA
  - Entity reliability functions: RC, TO/TOP, and BA
- Evaluate the effect of EOP-004-4 on EMS partial function loss reporting
  - One of main data sources for ERO Event Analysis Process
  - Only complete loss of monitoring or control capability required
  - Effective: April 1<sup>st</sup> 2019 in U.S. and some Canadian provinces
- Offer recommendations to improve EMS reliability, security, and resiliency of the BPS

# Finding 1: EMS was highly reliable (2018-2019)



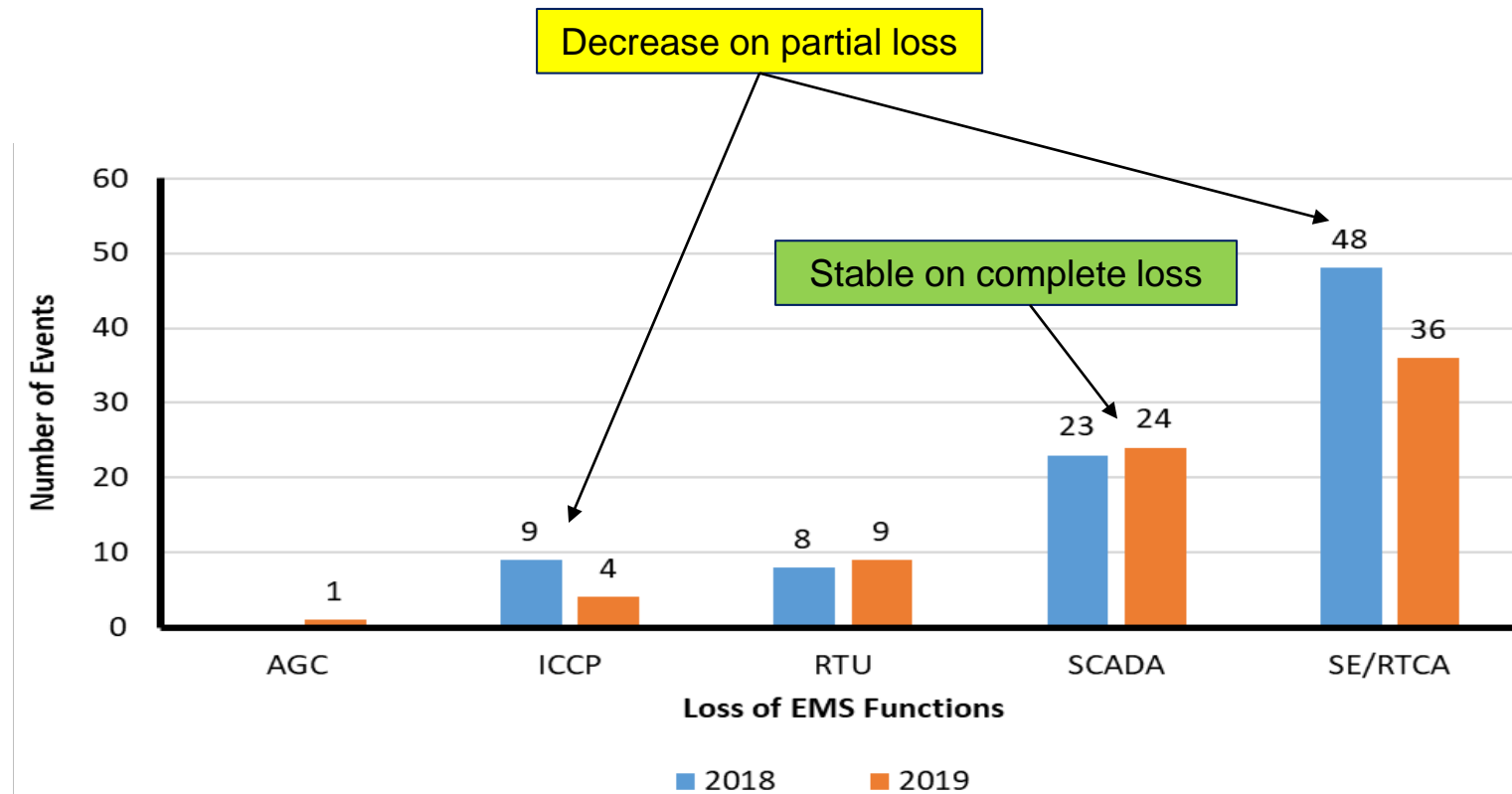
- Loss of EMS functions did not directly lead to the loss of generation, transmission lines, or customer load



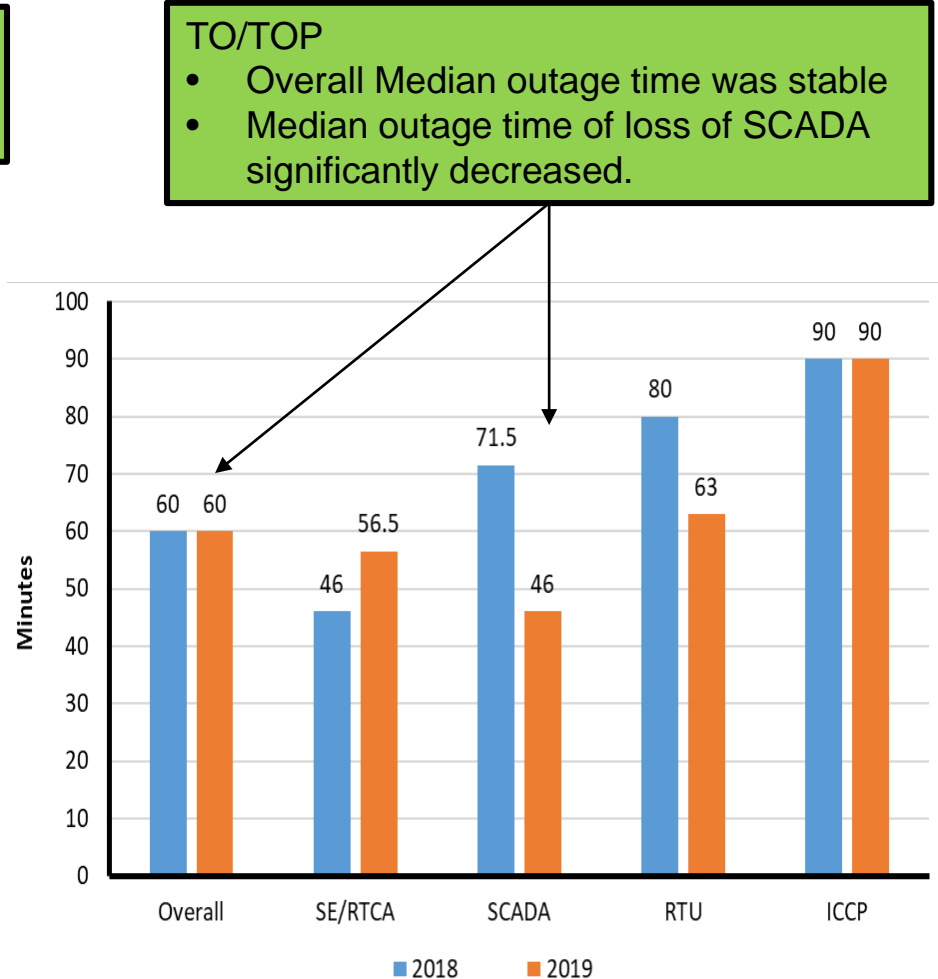
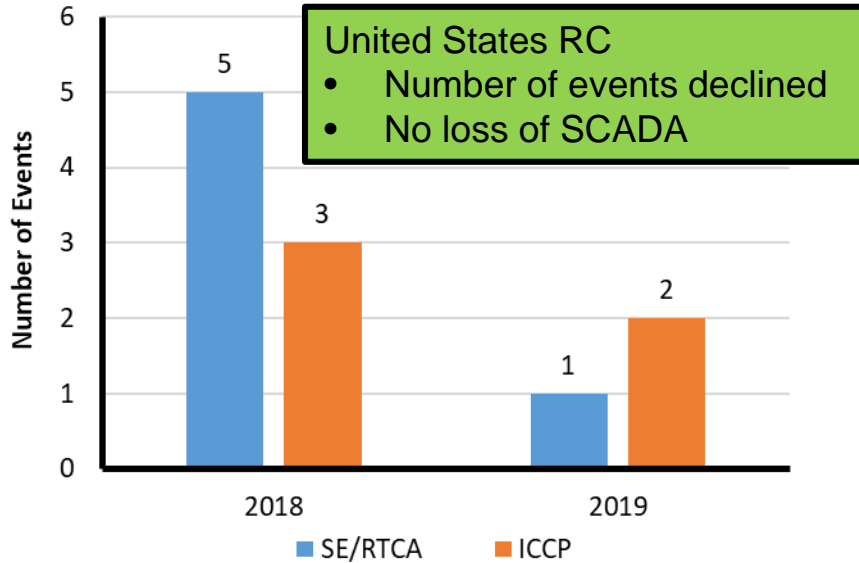


# Finding 2: EOP-004-4 is likely affecting EMS event reporting

- EOP-004-4: a main data source for ERO Event Analysis Process
- Only complete loss of monitoring or control capability required

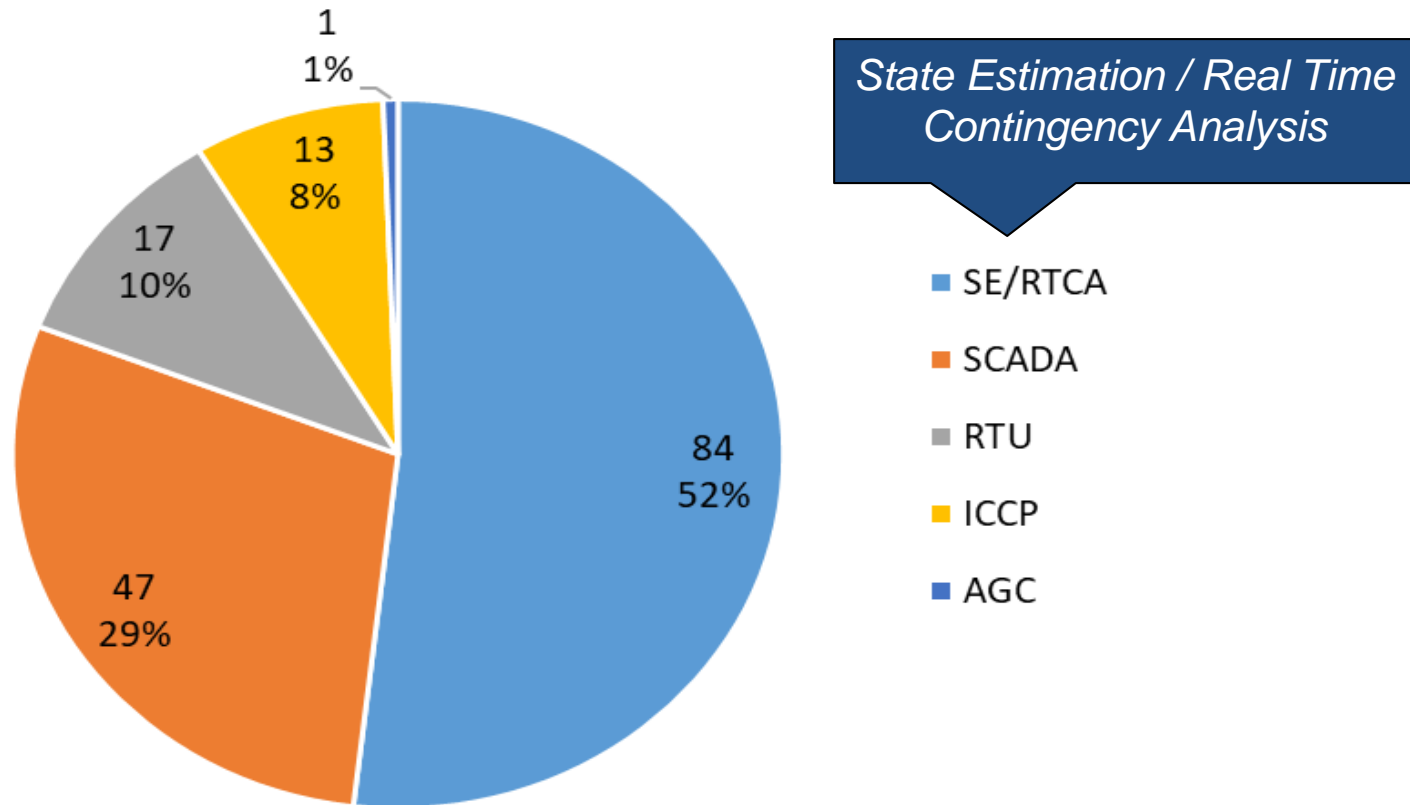


# Finding 3: Entities minimized the operational degradation



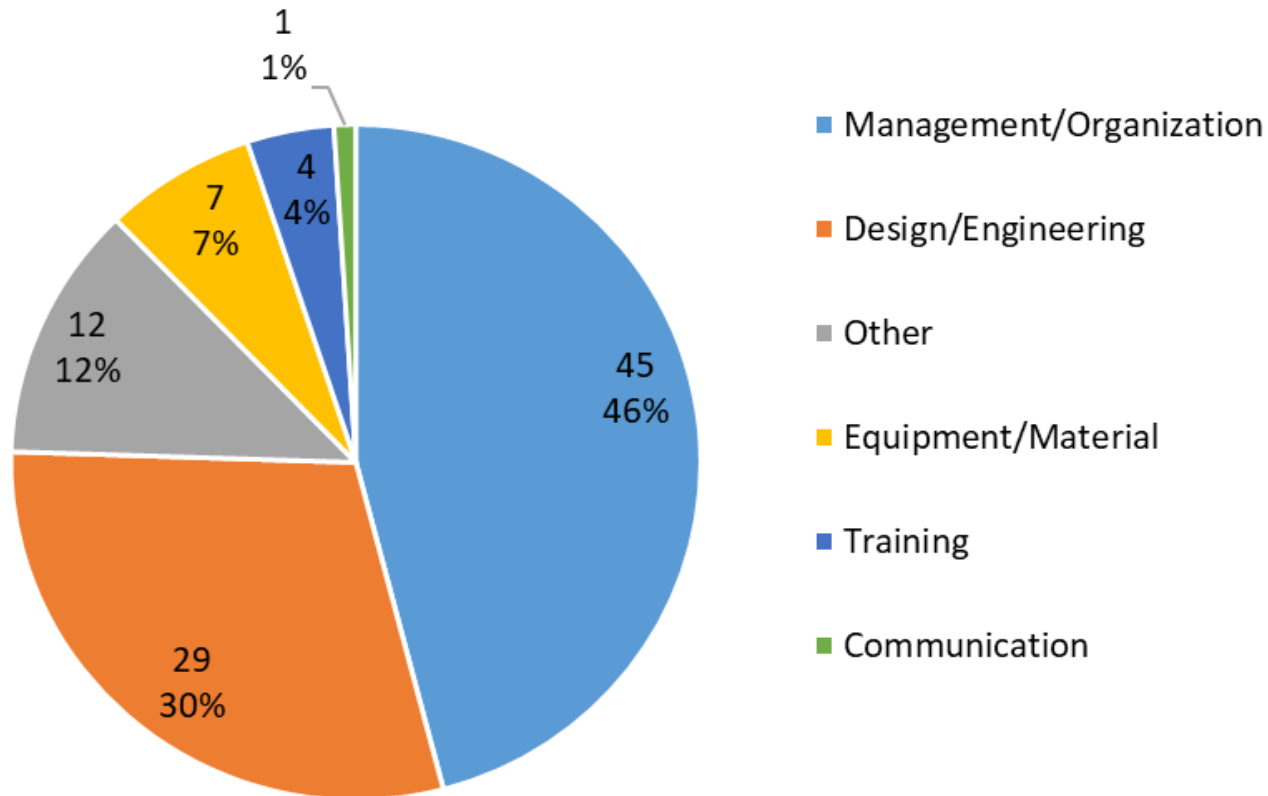
# Finding 4: Loss of SE/RTCA most prevalent EMS failure

- 52% (84) events out of all reported EMS events (162)



# Finding 5: Leading root cause was Management/Organization

- Job scoping, work package, change management, etc...



- Improve overlapping coverage of situational awareness
- Develop, implement, and practice system recovery and restoration plans
- Keep on-line model up-to-date and communicate the changes to neighboring entities
- Maintain network devices with the latest vendor information. An assessment management system is recommended
- Regularly testing and maintain the power supply redundancy
- Build in-house expertise
- Participate in the ERO Event Analysis Process



# Questions and Answers

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# Geomagnetic Disturbance Research

## Work Plan Results and Recommendations

Emanuel Bernabeu, GMDTF Chair

RSTC Meeting

March 2, 2021

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- The ERO Enterprise reduces risks to the Bulk Power System from severe GMD events through three main efforts:
  - State of the art Reliability Standards
  - Supporting partnerships for leading-edge research and tool development
  - Data collection program to improve knowledge and understanding
- The GMD Task Force (GMDTF) has supported NERC in establishing its GMD mitigation strategy

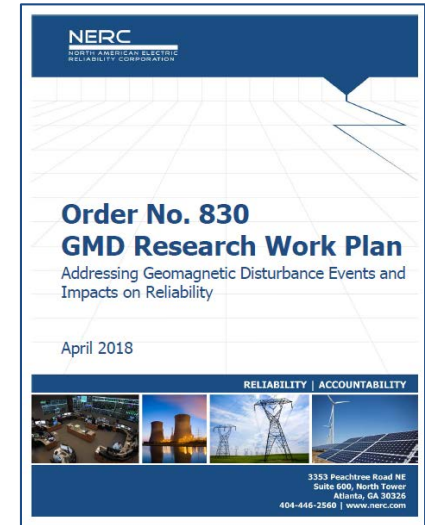




- Industry Subject Matter Experts worked with diverse stakeholders through the GMDTF:
  - Department of Energy and U.S. National Labs
  - Electric Power Research Institute (EPRI)
  - North American Transmission Forum (NATF)
  - NASA, Canadian Space Agency
  - U.S. Geological Survey (USGS) and Natural Resources Canada
  - U.S. Space Weather Prediction Center (SWPC)
  - Utilities from all regions in North America

- GMDTF Scope was updated in December 2016 to support NERC in meeting obligations of FERC Order No. 830
  - Order approved Reliability Standard TPL-007 and directed NERC to modify the standard, perform additional research, and implement data collection
- GMDTF activities in scope included:
  - Develop the [NERC GMD Research Work Plan](#) and vet results
  - Support NERC in developing the Rules of Procedure Section 1600 Data Request for GMD Data ([GMD Data Request](#))
  - Provide Technical and subject-matter support to the (GMD) Standards Drafting Team
- GMDTF has completed activities in the approved scope

- Two-year research effort with Electric Power Research Institute (EPRI) concluded in 2020
  - Promotes further knowledge of severe GMD event impacts and addresses FERC directives for research
  - Over 17 publications were produced
  - Final EPRI white paper published in August 2020  
*Research Findings for GMD Research Work Plan* ([EPRI Report 3002019720](#))
- GMDTF has reviewed deliverables throughout the project
- All EPRI reports and tools in this project are available to the public at no charge
- NERC must file research results with FERC

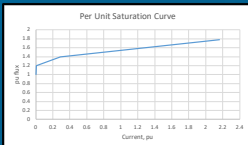


Work Plan is [Posted](#) on the GMDTF site

## Improved Earth Conductivity Models



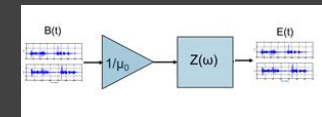
## Improved Harmonic Analysis Capability



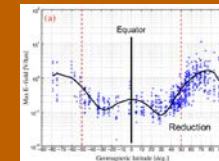
## Delivered Products:

- GIC Harmonics Tool
- 84 Transformer Thermal Models
- Updated Earth Models for Calculating GIC using new measurements
- Technical reports supporting TPL-007 GMD Assessments

## Geoelectric Field Evaluation



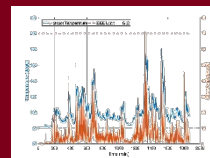
## Latitude Scaling Factor



## Harmonic Impacts



## Transformer Thermal Impacts



## Spatial Averaging

$$E_{\text{peak}} = 8 \times \alpha \times \beta \text{ (V/km)}$$

$\alpha$ = Geomagnetic Latitude Scaling Factors

$\beta$ = Conductivity Scaling Factor

## Highlights addressing FERC Order No. 830 research objectives:

- Analysis of the latest space weather data sets supports the TPL-007 *Benchmark GMD Event* for assessing GMD risk to the BPS
  - Confirms the benchmark represents a 100-year event
- Improved earth model maps based on new measurements provide for more accurate geoelectric field calculations
  - Published models and scaling factors available for use
- Transformer thermal screening approach in TPL-007 is effective at identifying potentially vulnerable transformers
  - Published models support industry performance of TPL-007 requirements
- GIC-related transformer vibrations from severe GMD events are not likely to impact transformer mechanical integrity

Task No	Task Name	Task Description	Requested RSTC Action	Status
1	Final Report on NERC GMD Research Work Plan	Review Findings and ERO Recommendations based on GMD Research Work Plan	Information	<b>Complete;</b> NERC file with FERC in 2021
2	Data Reporting Instruction for GMD Data Request	Develop Data Reporting Instruction for GMD Data Request	Information	<b>Complete.</b> Data collection portal is implemented.
3	Analyze data from GMD events.	Analyze collected data and other information to further understand GIC effects on BES facilities.	Information	<b>Ongoing-</b> As reportable events occur, NERC Staff and Real-time Operations Subcommittee, and others as appropriate review data and reported impacts, if any.

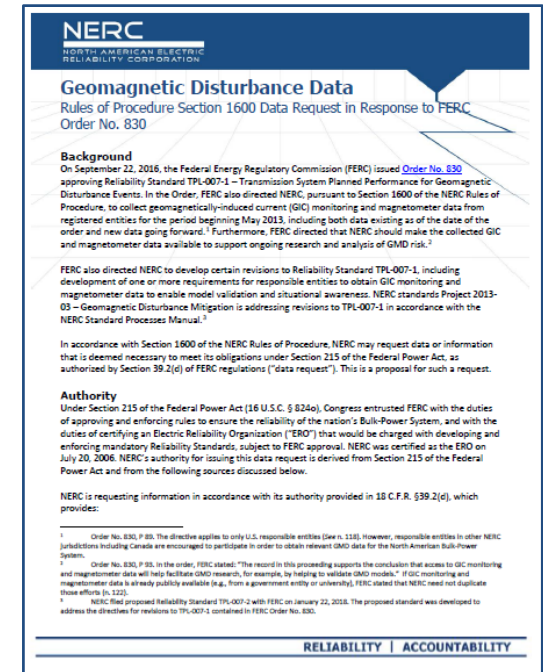
- RSTC disband the GMDTF per the Organizational Structure
- Include GMD monitoring in scope for Real-time Operations Subcommittee (RTOS)



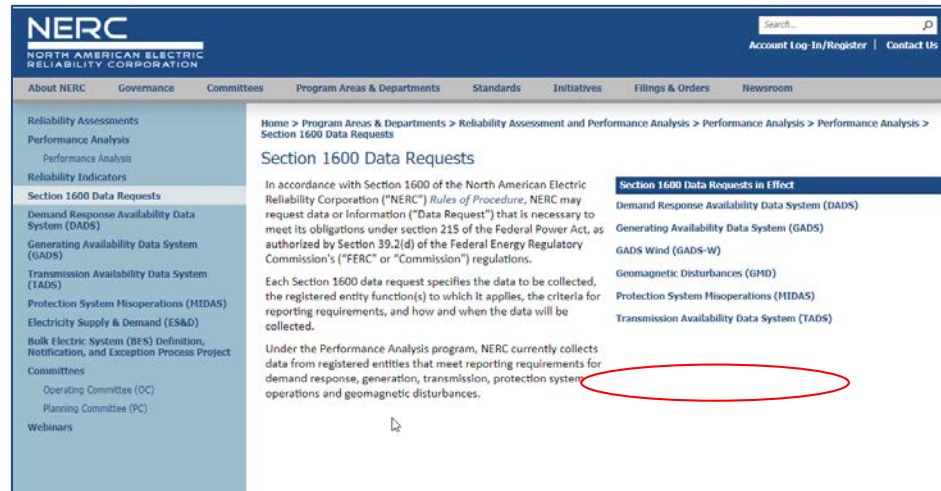
# Questions and Answers



- NERC Board approved Rules of Procedure Section 1600 data request for collecting GMD data in August 2018
  - Responds to FERC Order No. 830 directives for collecting data to “improve our collective understanding” of GMD risk
  - NERC developed the GMD Data Request with GMD Task Force (GMDTF) and Planning Committee input



Approved by NERC Board in  
August 2018



- Data will be collected for GMD events that meet or exceed  $K_p = 7$ 
  - On average, 200  $K_p = 7$  GMD events occur in 11-year solar cycle
- Applies to Transmission Owners and Generator Owners with GIC and/or magnetometer data
- Collection portal became operational in October 2020

- **Purpose:** continue investigating and evaluating the risk to the bulk power system posed by geomagnetic storms
- **Membership:** over 50 regular stakeholder participants
  - Representatives from NERC-registered entities are members
  - Subject matter experts from government, manufacturers, vendors, and research partners contribute as observers
- **Leadership:**
  - **Chair:** Emanuel Bernabeu, PJM Interconnection
  - **Vice-Chair:** Ian Grant, TVA

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# Data Collections Technical Reference Document

## Approaches for Probabilistic Assessments

Andreas G. Klaube, NPCC, PAWG Chair  
NERC Reliability and Security Technical Committee  
March 2, 2021

RELIABILITY | RESILIENCE | SECURITY



- The NERC PAWG promotes the coordination and alignment of probabilistic assessments across North America, identifying recommended best practices and improvement opportunities
- Reference document provides technical considerations to advise industry planners in performing probabilistic resource adequacy studies
- Supplements recommendations from the Probabilistic Adequacy and Measures Report (PC approved, 2018) and 2020 LTRA
  - Provides a foundation for the ERO and industry to advance probabilistic assessments and improve techniques

- Provides general data inputs and related considerations for loss-of-load probabilistic assessments commonly used by industry system planners
- Major data input categories and methods considered:
  - demand, thermal resources, energy-limited resources, emergency operating procedures, and transmission representation
- Raises industry awareness of available probabilistic methods and techniques to conduct reliability assessments for complex systems under increasing uncertainties

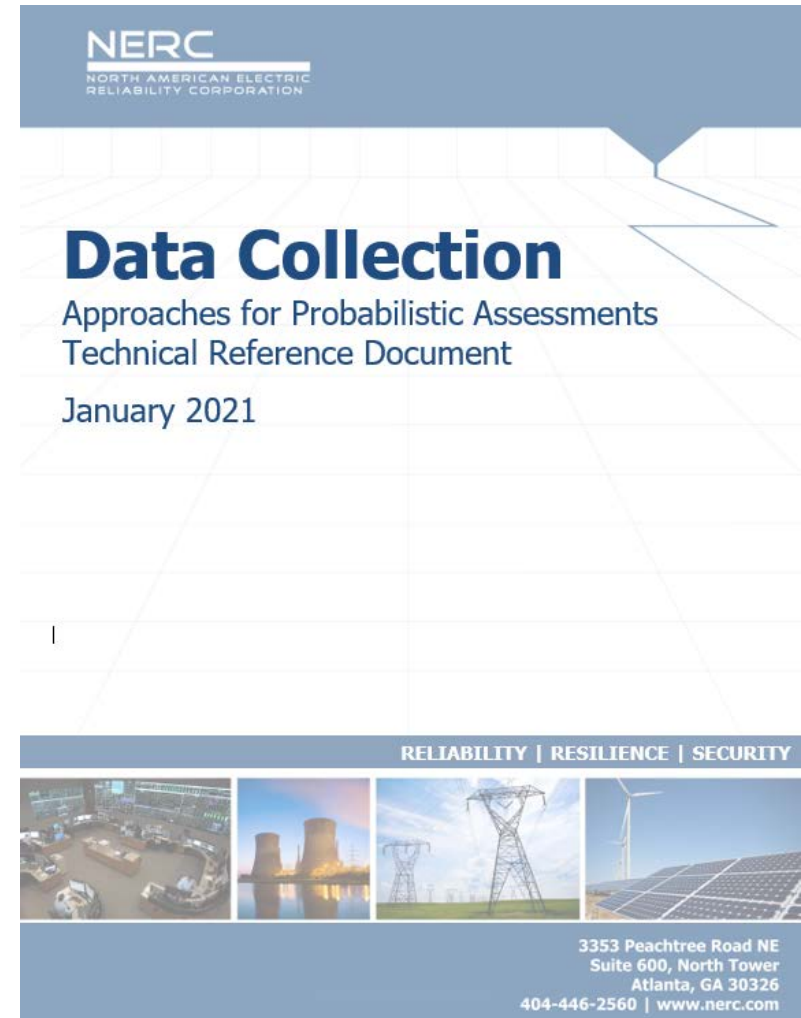
- Resource and system demand uncertainties can be addressed through proper data techniques, such as scenario or load-level development, distributions, and available weather data
- System planners across the North American BPS rely upon a wide range of data sources and mechanisms to develop key assumptions and conduct probabilistic studies
  - (i.e., government sources, Registered Entities, GADS)
- Careful understanding of a system's underlying operational characteristics to ensure that data sources, assumptions and techniques are appropriate



- Assessment evaluations and techniques should continue to evolve to address the future needs and uncertainties of the system
- Probabilistic studies require a wide range and quantity of data that may or may not be publicly available to planners, entities
  - Efforts should be made, where possible, to ensure that industry planners can access data needed to conduct probabilistic studies



- Seeking RSTC reviewers to review the draft Data Collections Technical Reference Document and provide feedback to PAWG/RAS





# Questions and Answers

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# 2020 NERC Probabilistic Assessment

## Regional Risk Scenario Sensitivity Case Report

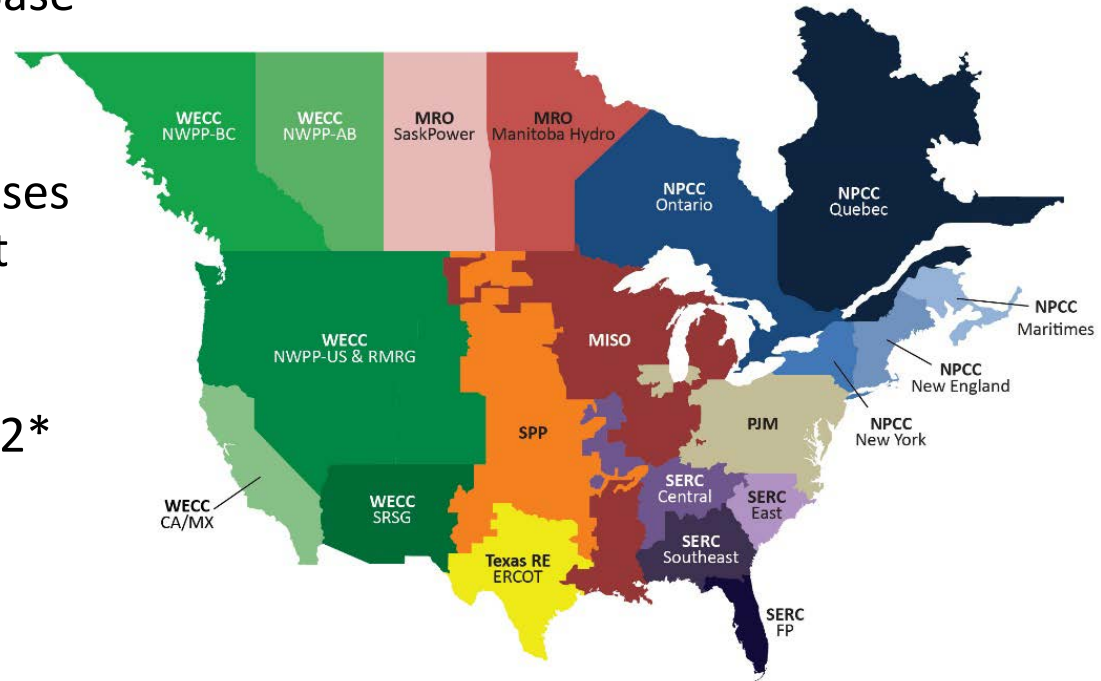
Andreas G. Klaube, NPCC, PAWG Chair  
NERC Reliability and Security Technical Committee  
March 2, 2021

RELIABILITY | RESILIENCE | SECURITY



- On a biennial basis, the NERC PAWG performs a Probabilistic Assessment (ProbA) Base Case to supplement the annual NERC Long Term Reliability Assessment (LTRA) analysis
  - 2020 ProbA Base Case published in the 2020 LTRA (Dec. 2020)
- PAWG encouraged regional flexibility in the 2020 ProbA Sensitivity Case by developing a Regional Risk Scenarios Model
  - Planners studied area-specific reliability risks, underlying uncertainties using probabilistic methods (EUE, LOLH indices)
- Assessment utilized a comprehensive peer-review process in coordination with the RAS (2019 – 2021)

- Maintain the calculation of EUE and LOLH probabilistic indices for Base and Scenario Cases
- Compare Base and Scenario Cases to evaluate sensitivities against purported risks
- Required year 4, optional year 2\* for Sensitivity Case
  - LTRA: 10-year study period
  - \*Assessment Area discretion based on anticipated resource changes as reported in the LTRA

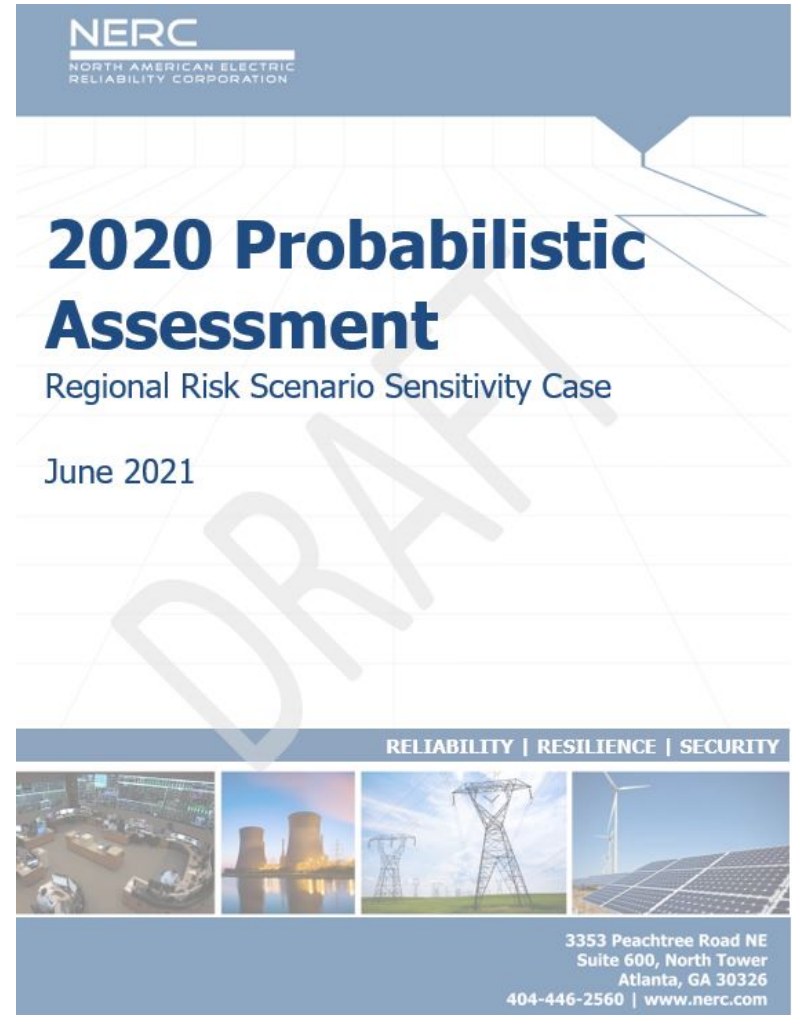


- Unique scenarios utilized by Region, Assessment Area to study Reliability Assessment risks identified in the LTRA
- Scenarios intentionally stressed assumptions to study their associated impacts
- 2020 ProbA Sensitivity Scenarios:
  - Increased demand response resources as a percentage of total resources (**MISO**)
  - System reliability impacts of low hydro conditions (**Manitoba Hydro, SaskPower**)
  - Low wind resource reliability risks (**SPP, ERCOT**)
  - Planned/expected future capacity or resources may not materialize (**NPCC, PJM**)
  - Planned maintenance outage system risks (**SERC**)
  - Potential coal retirement resource adequacy risks (**WECC**)

- Sensitivity results were varied across the study and dependent on underlying assumptions
  - Some Areas demonstrated purported risks were not significant, or could be mitigated using preventive planning and operating measures
- Results provide a base point to better understand underlying uncertainties and benchmark system risks
- PAWG recommends increasing coordination between industry operations and planning personnel to develop enhanced and complex scenario development for future reliability assessments



- Seeking RSTC reviewers to review the draft Risk Scenarios Report and provide feedback to PAWG/RAS







# Questions and Answers