

## Agenda

# Eighth Annual Monitoring and Situational Awareness Conference – Session 1

Theme: Energy Management System Reliability and Resiliency in the Pandemic

September 24, 2020 | 1:00 p.m. – 3:00 p.m. Eastern

### Welcome and Introduction

- Venkat Tirupati, Chair of NERC EMS Working Group

### Analysis of EMS Event Outages

- Wei Qiu, NERC

### Bulk Power System Awareness - Situational Awareness 2020

- Bill Graham, NERC

### Session Summary

- Matthew Lewis, NERC, Manager of Event Analysis

# Speaker Biographies<sup>1</sup>

## Eighth Annual Monitoring and Situational Awareness Conference – Session 1

Theme: Energy Management System Reliability and Resiliency in the Pandemic

September 24, 2020

### Venkata Tirupati



**Venkat Tirupati** is currently the Director of Grid and Market Solutions at Electric Reliability Council of Texas (ERCOT) in Austin, TX. In this role, he serves the teams that develop and support

solutions for Energy and Market Management Systems. Prior to joining ERCOT, he was the Director, Line of Business at Lower Colorado River Authority (LCRA) in Austin, TX serving teams responsible for supporting wholesale power and water business units with their IT needs. He also held Manager, Market Systems and Supervisor, EMS and Advanced Applications roles at LCRA. Prior to LCRA, Venkat worked as a Senior Reliability Engineer in the Reliability Risk Management Group of NERC in Atlanta, GA and also worked a Senior Software Applications Engineer at Siemens Energy in Minneapolis, MN

Venkat's interests include Power Systems Engineering, Market Applications, IT/OT systems, software development and data analytics. Venkat earned his Bachelor of Engineering in Electrical Engineering from University of Mumbai, India and a Master of Science in Electrical Engineering from Illinois Institute of Technology, Chicago. He is registered Professional Engineer (P.E.) in the State of Texas.

### Wei Qiu



**Wei Qiu** is currently Senior Engineer of Event Analysis, in the Reliability Risk Management group at NERC. As an EMS SME, Wei is responsible for analyzing the EMS events reported, understanding the causes,

trending and working with the industry to develop remediation strategies.

Prior to NERC, Wei was a software manager managing the EMS applications especially state estimation and real-time contingency analysis at GE Grid Solutions (formerly AREVA, Alstom) in Redmond, WA.

Wei earned his PhD in Electrical Engineering from Illinois Institute of Technology. He is a senior member of IEEE.

<sup>1</sup> Biographies are listed in order of presentation.

## Bill Graham

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**Bill Graham** joined NERC in October of 2011; currently performing the duties of a Principle BPSA Coordinator. In this position, he is responsible for monitoring electrical and other conditions affecting the BPS

and rapidly facilitating communication regarding abnormal or emergency conditions among NERC staff, appropriate stakeholders, and governmental agencies. Bill reports to the Director of Bulk Power System Awareness.

Bill has twenty-eight years of experience within the power generation industry. Most recently in the field, working as a shift supervisor at a 750 MW combined cycle generating facility in west Texas. Bill has provided project management support for power plants throughout the United States and Mexico. He has lead teams during root cause analysis investigations and procedure development, as well as, completed the duties of quality control inspector and safety auditor. Bill has a broad range of generation experience; he has been involved with projects at natural gas, coal, fuel oil, diesel, and nuclear facilities. Bill is a NERC certified Reliability Coordinator system operator.

## Matthew C. Lewis

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**Matthew Lewis** joined NERC on March 24, 2014 and currently serves as the Manager of Event Analysis and previously served as the Manager of Training and Education. He retired with over 25 years of service as a

U.S. Army officer. Matt served in a variety of leadership and staff positions in the fields of

operations, special weapons effects and response, technical intelligence, and joint exercises/training. During his military service, he participated in combat tours in Desert Storm and Iraqi Freedom. Matt has a Bachelor of Science in Physics from the University of Arkansas at Little Rock and a Master of Science in Applied Physics from the Air Force Institute of Technology. You can learn more about Matt's professional experiences at his [LinkedIn](#) page.

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# The 8th Annual Monitoring and Situational Awareness Technical Conference

Energy Management System Reliability and Resiliency in the Pandemic

Venkat Tirupati, Chair of NERC EMS Working Group  
September 24, 2020

RELIABILITY | RESILIENCE | SECURITY

- Welcome and Introduction
- A new meaning in the pandemic
- Thank you for keeping the lights on
- Goal of the conference
- Themes, agenda and topics for today
- Feedback
  - Wei Qiu – [Wei.Qiu@nerc.net](mailto:Wei.Qiu@nerc.net)
  - Phil Hoffer – [pehoffer@aep.com](mailto:pehoffer@aep.com)
  - Venkat Tirupati – [Venkat.Tirupati@ercot.com](mailto:Venkat.Tirupati@ercot.com)

A map of North America is shown in the background. The United States is colored in a dark blue, while Canada and Mexico are in a lighter blue-grey. A solid blue horizontal band runs across the middle of the map, passing through the United States. The text "Thank You & Enjoy !!" is centered within this band.

**Thank You & Enjoy !!**

The NERC logo consists of the letters "NERC" in a bold, black, sans-serif font. A horizontal blue bar is positioned directly beneath the text.

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# Analysis of EMS Outages

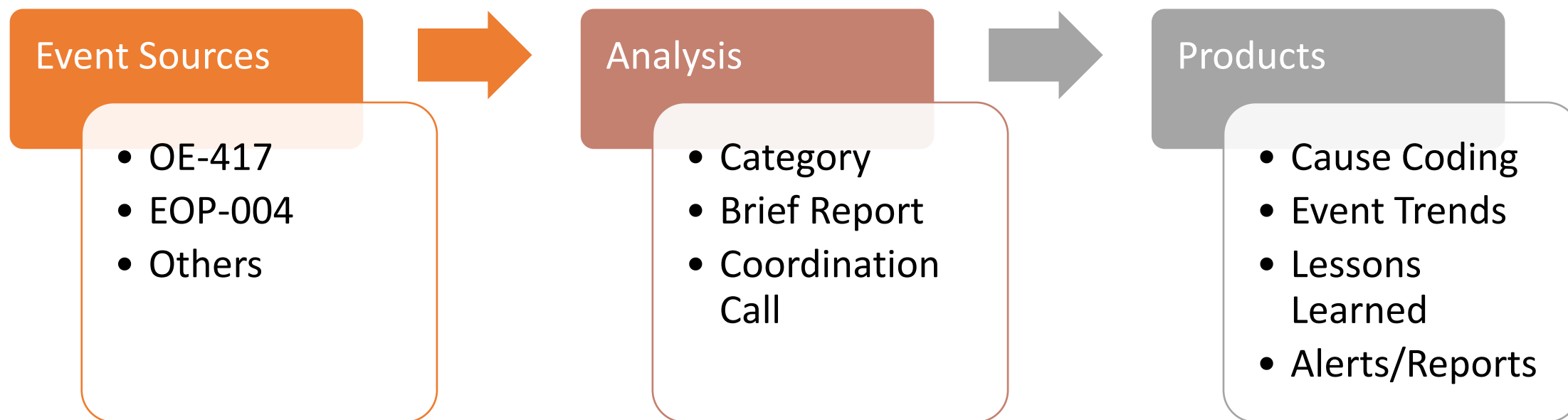
Wei Qiu, Senior Engineer of Event Analysis, NERC EA  
NERC 8th Annual Monitoring and Situational Awareness Conference  
September 24, 2020

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- ERO Event Analysis Process (EAP)
- Data, Analysis, and Trends
- Key Takeaways
- Q&A



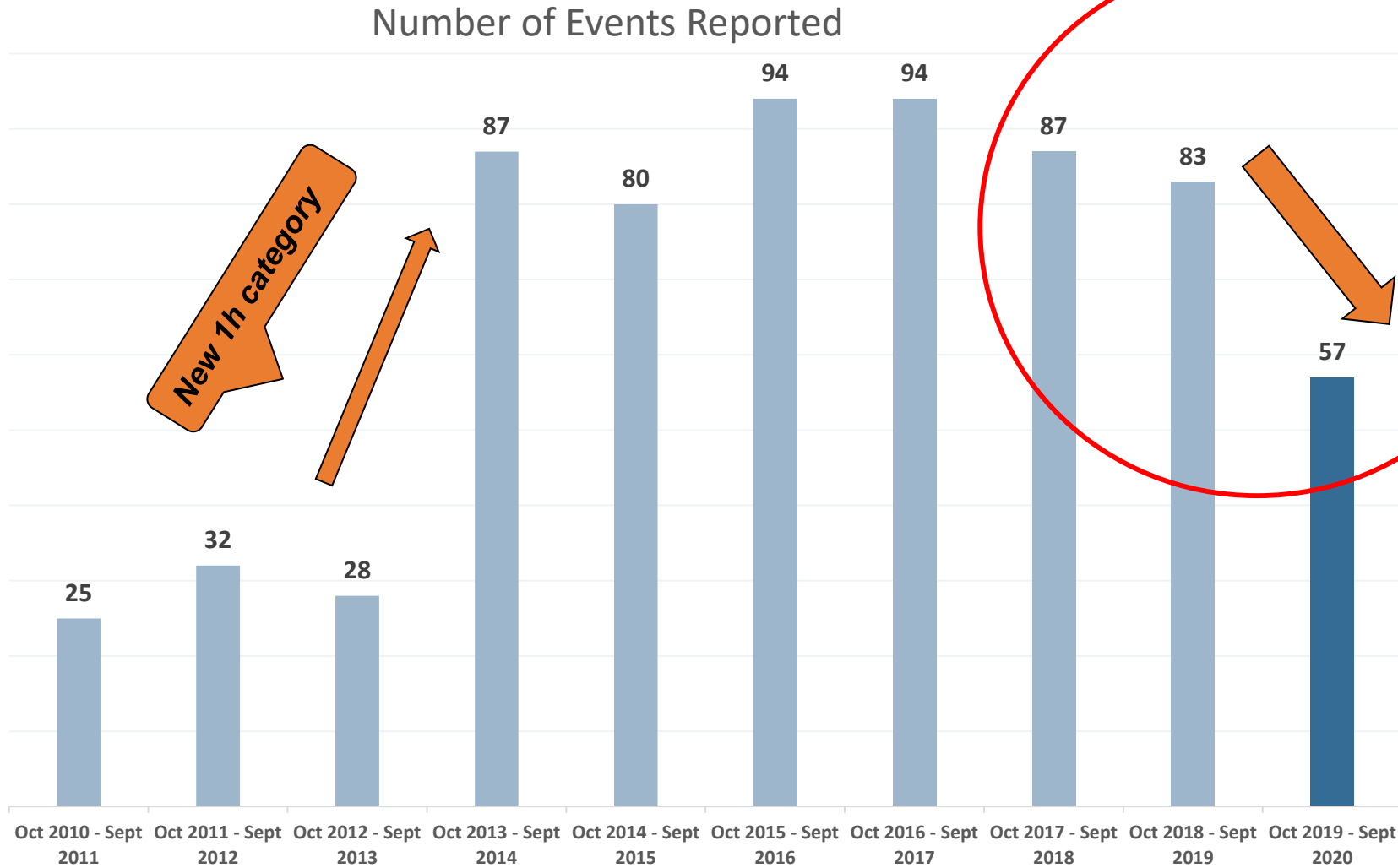
- Promote a structured and consistent approach to performing event analysis
- Learn from events and share information with industry
  - Not every event results in a succinct lesson learned, but we learn from every event
- Collaborate between registered entities, Regional Entities, and NERC

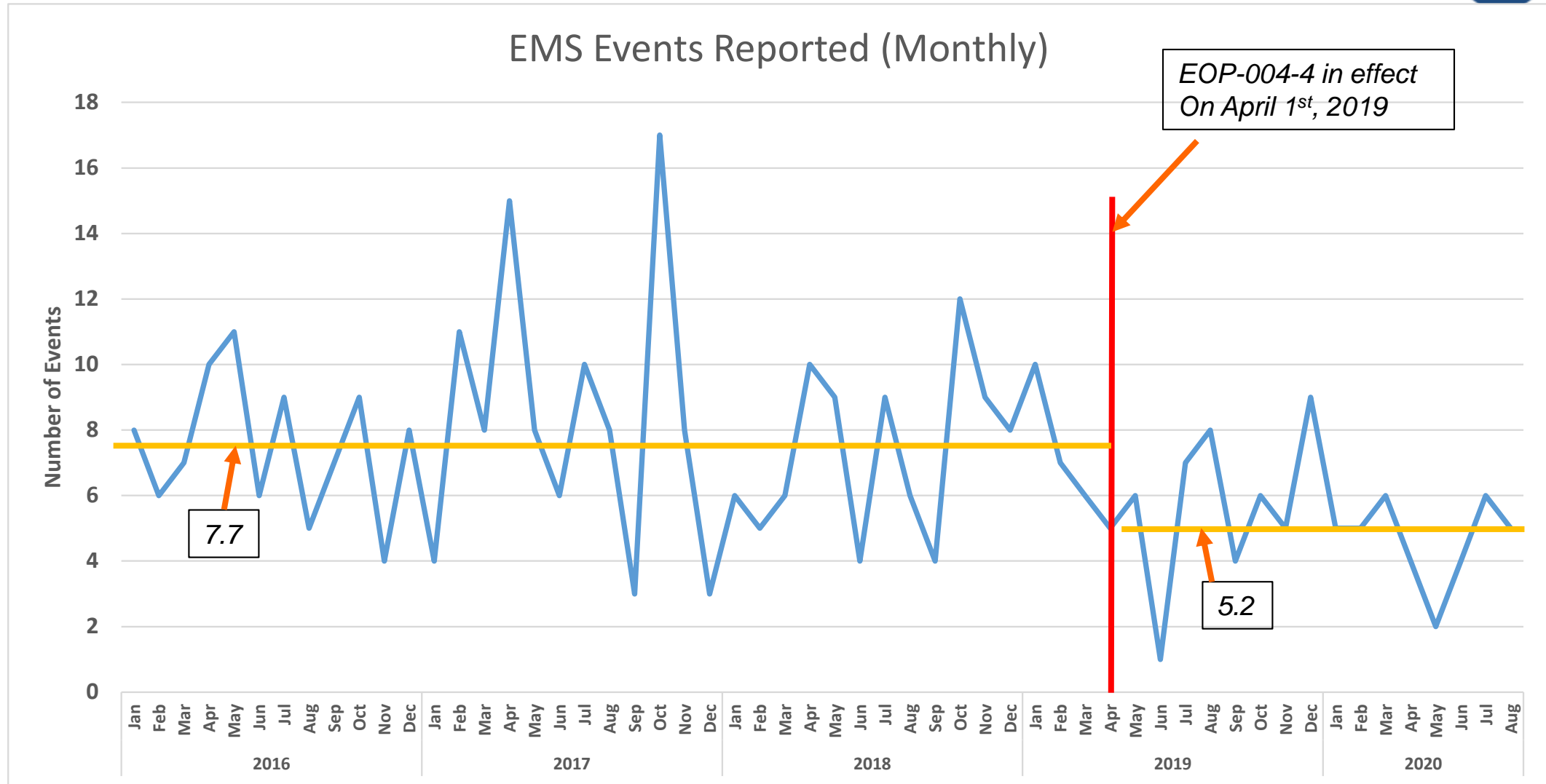


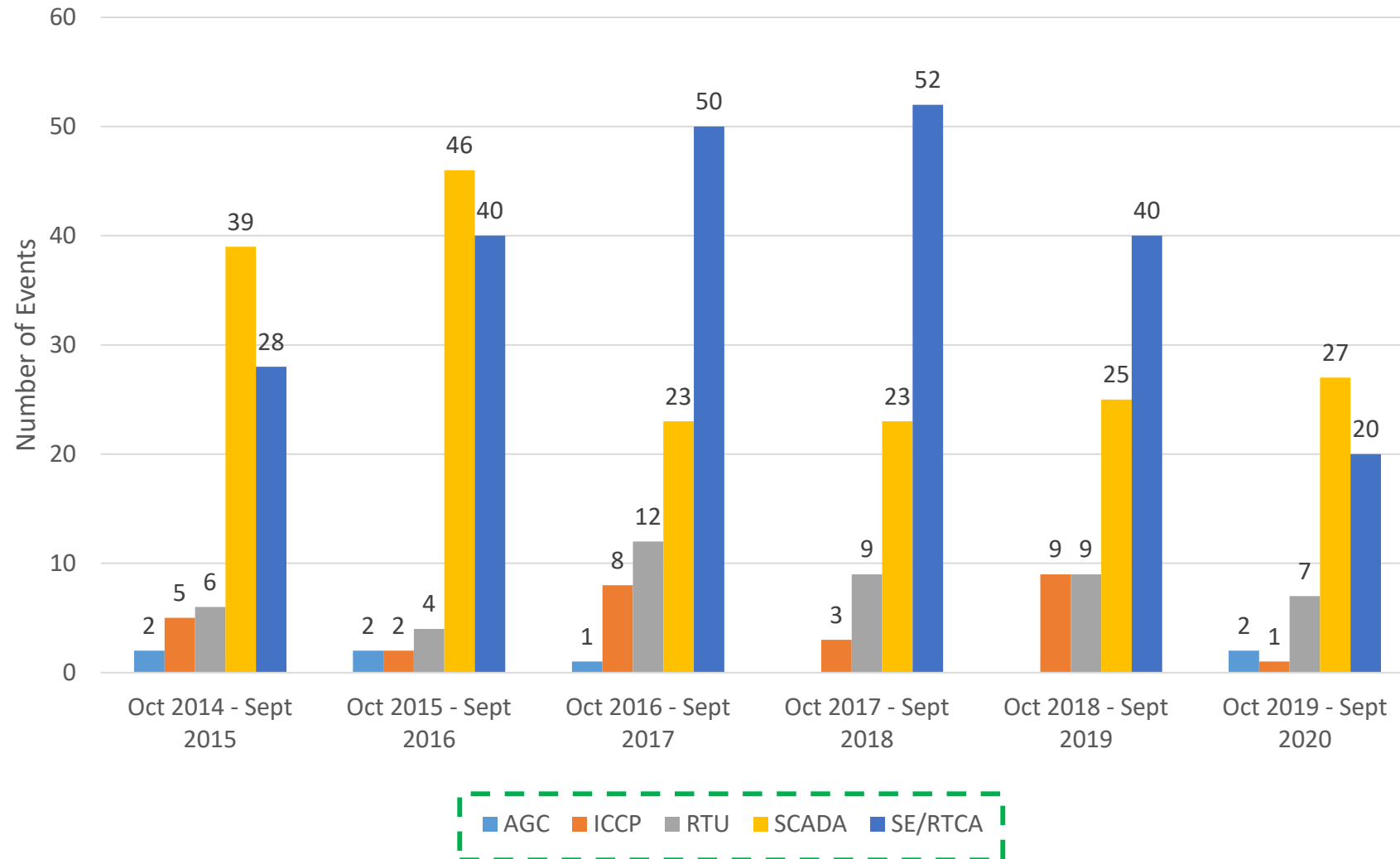
**1h - Loss of monitoring or control** at a Control Center such that it significantly affects the entity's ability to make operating decisions for **30 continuous minutes or more**.

Some examples that should be considered for EA reporting include but are not limited to the following:

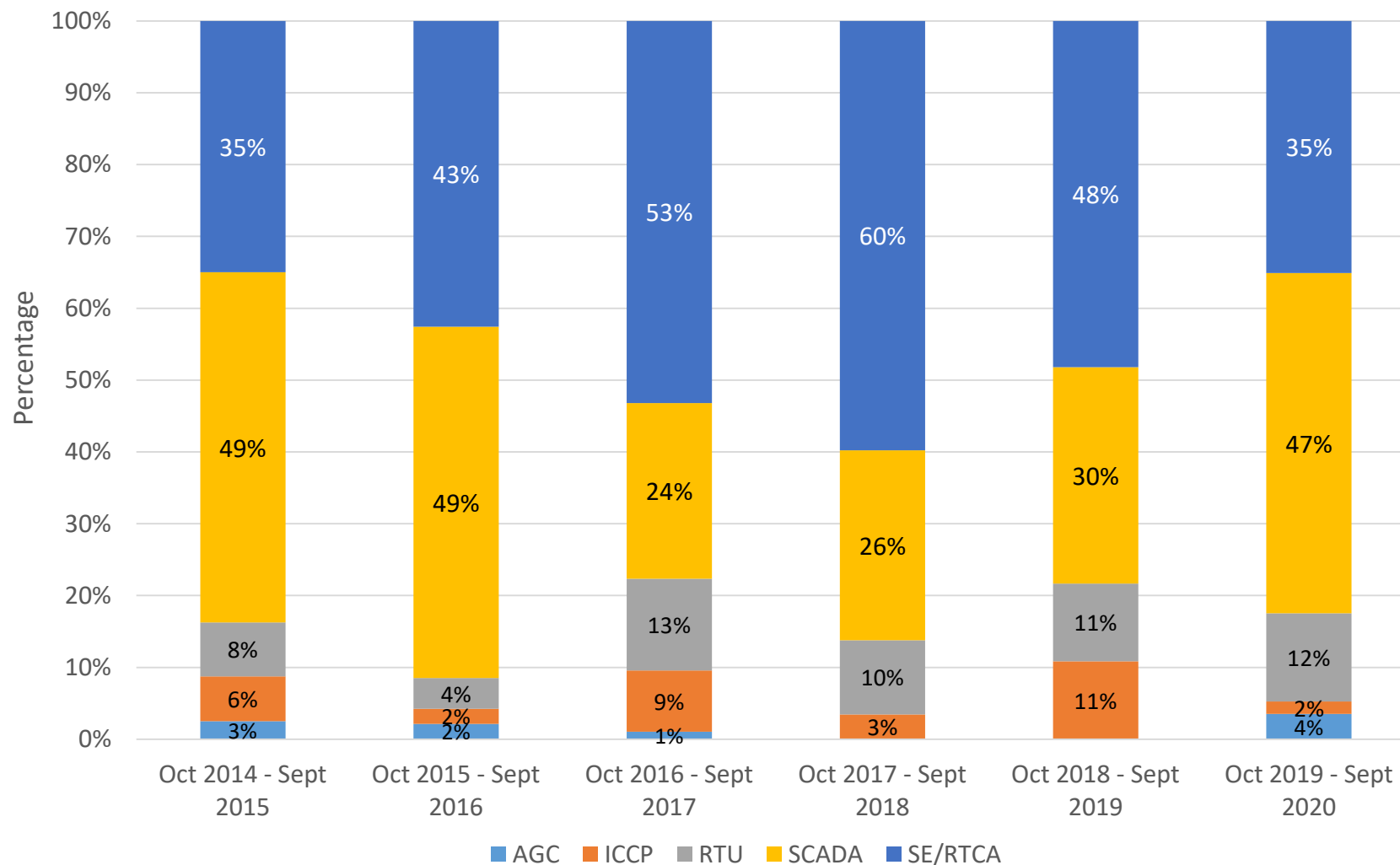
- I. Loss of operator ability to remotely monitor or control BES elements
- II. Loss of communications from SCADA Remote Terminal Units (RTU)
- III. Unavailability of ICCP links, which reduces BES visibility
- IV. Loss of the ability to remotely monitor and control generating units via AGC
- V. Unacceptable state estimator or real time contingency analysis solutions

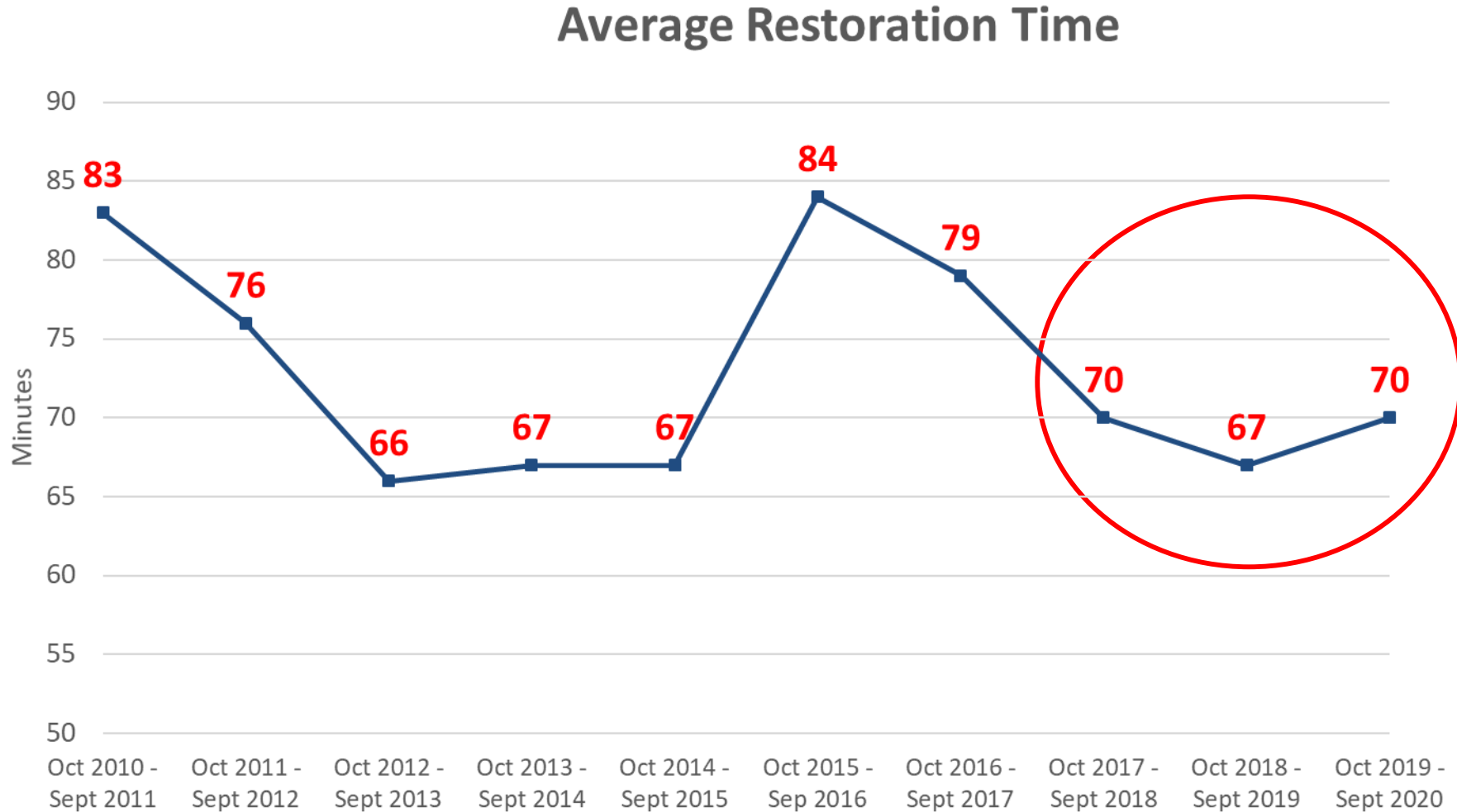


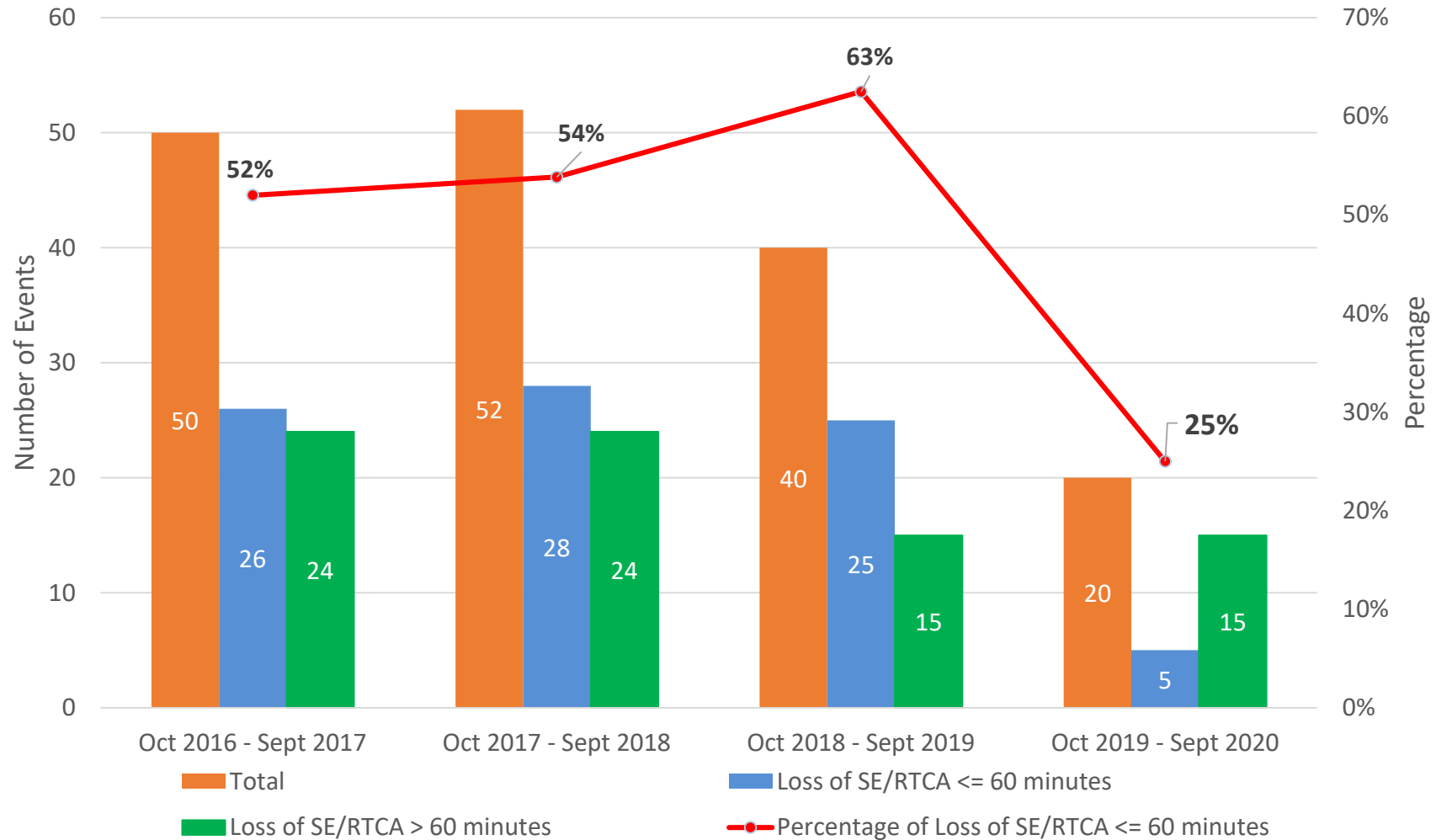




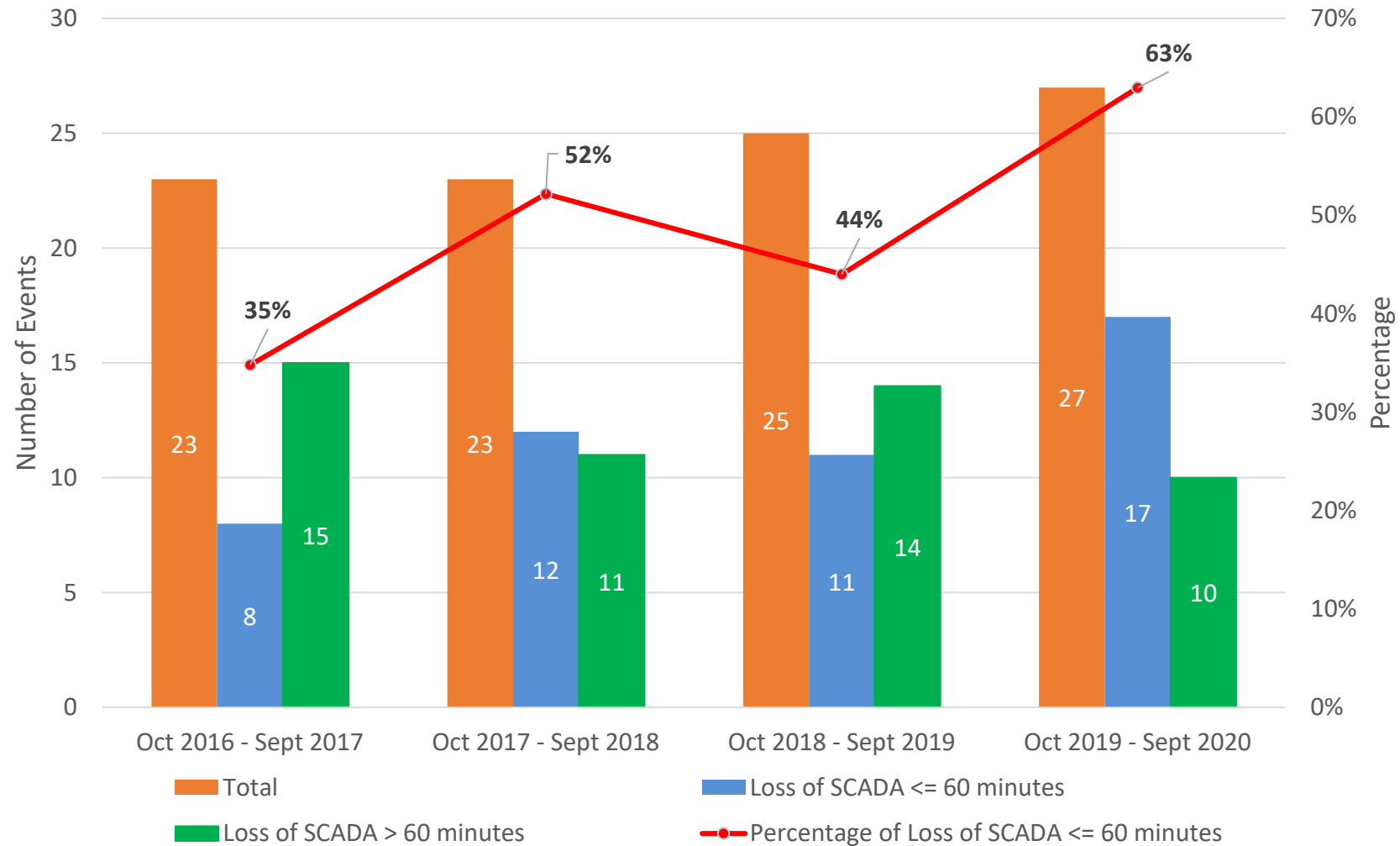
# Trend on EMS Functions (cont'd)











- The number of EMS events reported declines by 30% in the 2019-2020 period
- EOP-004-4 is likely affecting the EMS event reporting
  - Complete loss vs. Partial loss
- Loss of SCADA events is stable but became the most prevailing failure again
- Loss of SE/RTCA events significantly dropped
- Great efforts made by the industry
  - Implementing features and procedures
    - TOP-001-3 and IRO-008-2: Real Time Assessments
    - TOP-010-1(i) and IRO-018-1(i) R2: Real Time Assessment Quality of Analysis
    - Business continuity plans for COVID-19
  - Building and strengthening in-house expertise
    - Dedicated team (24 X 7)
    - Workshop, training for knowledge transferring from vendors

- Software Testing
  - Problem: Memory corruption, memory leak
  - Vendor: software quality
  - Entity:
    - A complete testing process: Scope/Design/Execution/Closure
    - Increase CPU and system memory usage to an extreme level if possible
    - “run to failure” testing

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## Lesson Learned

### Loss of Automatic Generation Control During Routine Update

**Primary Interest Groups**  
Transmission Operators (TOPs)  
Generation Operators (GOPs)  
Balancing Authorities (BAs)  
Reliability Coordinators (RCs)

**Problem Statement**  
During a weekly automatic generation control (AGC) software update, a critical AGC task aborted at one of two fully redundant control centers, and the same critical task aborted at the other control center four minutes later. As a result, generation schedules could not be set, and area control error (ACE) could not be automatically calculated until the issue was resolved. The cause was a modified line of code.

**Details**  
On December 10, 2019, a typical weekly AGC system build was being deployed. AGC was controlled from Control Center #1 with a completely redundant hot-standby system at Control Center #2. The standard process of work is to complete the deployment on the Control Center #2 AGC system and have the dispatcher transfer control to Control Center #2 AGC so the deployment can be completed on Control Center #1 AGC once that is complete. After the completion of that work, the dispatcher switches back to control using Control Center #1 AGC and remains in that state.

When the Control Center #2 AGC deployment was complete, the generation dispatcher was informed by software support staff that they could transfer control to the Control Center #2 AGC system so the software update could be completed on the Control Center #1 AGC system. Approximately 1 hour and 15 minutes after switching control to Control Center #2, a critical AGC task aborted and critical control functionality was lost. The software support staff immediately became aware of the problem and, after being unable to restart the task, advised the dispatcher to switch control back to Control Center #1 AGC since its software deployment had been completed. The dispatcher switched control to Control Center #1 AGC, and the same critical task aborted on the Control Center #1 AGC. At this point, the dispatcher contacted the generation plants under AGC control to confirm plant schedules and to instruct them to remain at their current generation levels. The RC was notified.

It was discovered that there was a change made to the primary inadvertent interchange (PII) alarm text during this AGC update that caused the failure. Prior to the update, when the PII value exceeded +/- 999 MW, the value in the alarm text defaulted to "\*\*\*\*\*," preventing dispatchers from having an accurate indication of the amount of PII change. This alarm comes in when the PII value has a change greater than +/-200MW. During this deployment, the two MW value fields in the PII alarm text were modified from i4 to i5 (4 digit integers to 5 digit integers) to allow for an additional digit. While the dispatcher was controlling from the Control Center #2 AGC, the PII value went from +71 to +338 (267 MW change), causing the alarm. The original alarm text array had 79 characters which almost hit the max character limit of 80, and the

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- Backup Control Center
  - Strengthen functions and capability
    - Remote access to servers at primary control center
- Remote Maintenance, Testing, and Deployment
  - Communication between working groups both directly involved and those potentially affected
  - Peer review
  - Arranging resources on site during the period.



- The version 2 was approved by the OC in March, 2020
  - More data (521 events from 10/2013 to 4/2019)
  - Details for mitigation strategies

[https://www.nerc.com/comm/OC/ReferenceDocumentsDL/Risks\\_and\\_Mitigations\\_for\\_Losing\\_EMS\\_Functions\\_v2.pdf](https://www.nerc.com/comm/OC/ReferenceDocumentsDL/Risks_and_Mitigations_for_Losing_EMS_Functions_v2.pdf)

- EMS reliability and resilience is continuously improving
- Loss of SCADA events was stable but became the most prevailing failure
- Loss of SE/RTCA events significantly dropped
- EOP-004-4 is likely affecting the EMS event reporting
  - Participation in EAP
- Things we all can improve
  - Software testing
  - Strengthening functions and capability at backup control center
  - Coordination and Collaboration during remote maintenance, testing, and deployment







# Questions and Answers

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# Bulk Power System Awareness

## Situational Awareness 2020

Bill Graham, Principle BPSA Coordinator  
2020 EMS Conference  
September 24, 2020

**RELIABILITY | RESILIENCE | SECURITY**



- Who We Are
- What We Do
- What We Don't Do
- Where We are Going
- Tools and Information Sources
- 2020 Events



Darrell Moore



Bill Graham



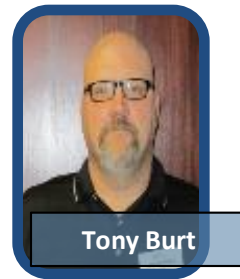
Mani  
Mardhekar



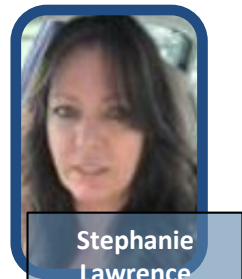
Ara Johns



Brent Kane



Tony Burt



Stephanie  
Lawrence

- Average 22 years industry experience
- North American Electric Reliability Corporation (NERC) Reliability Coordinator (RC) Certified
- Excellent communicators, maintaining and strengthening relationships
- Diverse bulk power system (BPS) regional knowledge and related experiences outside the electric industry

One Bulk Power System Awareness (BPSA) team of experience, talented and accountable system operations professionals, in unison with the regions and industry, equipped with the right tools and training, serving as the eyes and ears of NERC working with the Enterprise Reliability Organization (ERO) to improve and ensure the reliability of the North American BPS.

NERC's BPSA group acquires and disseminates timely, accurate and complete information regarding the current status of the BPS and threats to its reliable operation, to enable the ERO to effectively assure the reliability of the BPS. During major system disturbances, facilitate effective communications between industry and government stakeholders.

- Front end of the ERO Event Analysis (EA) Process
  - Receive reports and enter into TEAMS
  - Coordinate with Regions regarding potential EA submissions
- Participate in cause coding sessions (unique operational perspective and regional experience)
- Prepare and publish regular reports
  - “Morning Report” from TEAMS
  - “Daily Report” at 1000 EST, with conference call
- Special reports (usually email) to NERC senior leadership, ERO and government stakeholders for certain significant occurrences

- Receive EOP-004, and OE-417 reports
- Confirm large unit trips for Resources Subcommittee (RS) and NERC frequency response analysis
- Provide NERC staff support to the North American Generator Forum (NAGF)
- Assist in the acquisition, maintenance and divestiture of reliability tools
- Participate in North American SynchroPhasor Initiative (NASPI)

- Work closely with other NERC departments to support each other as needed for technical initiatives and analyses
- Build and strengthen relationships with technically oriented government agencies (US and Canada)
- Administer the NERC Alert programs
  - Administrative support, staffing and revision, publication, and user assistance
- Provide information, perspective, and technical support for E-ISAC government and sector

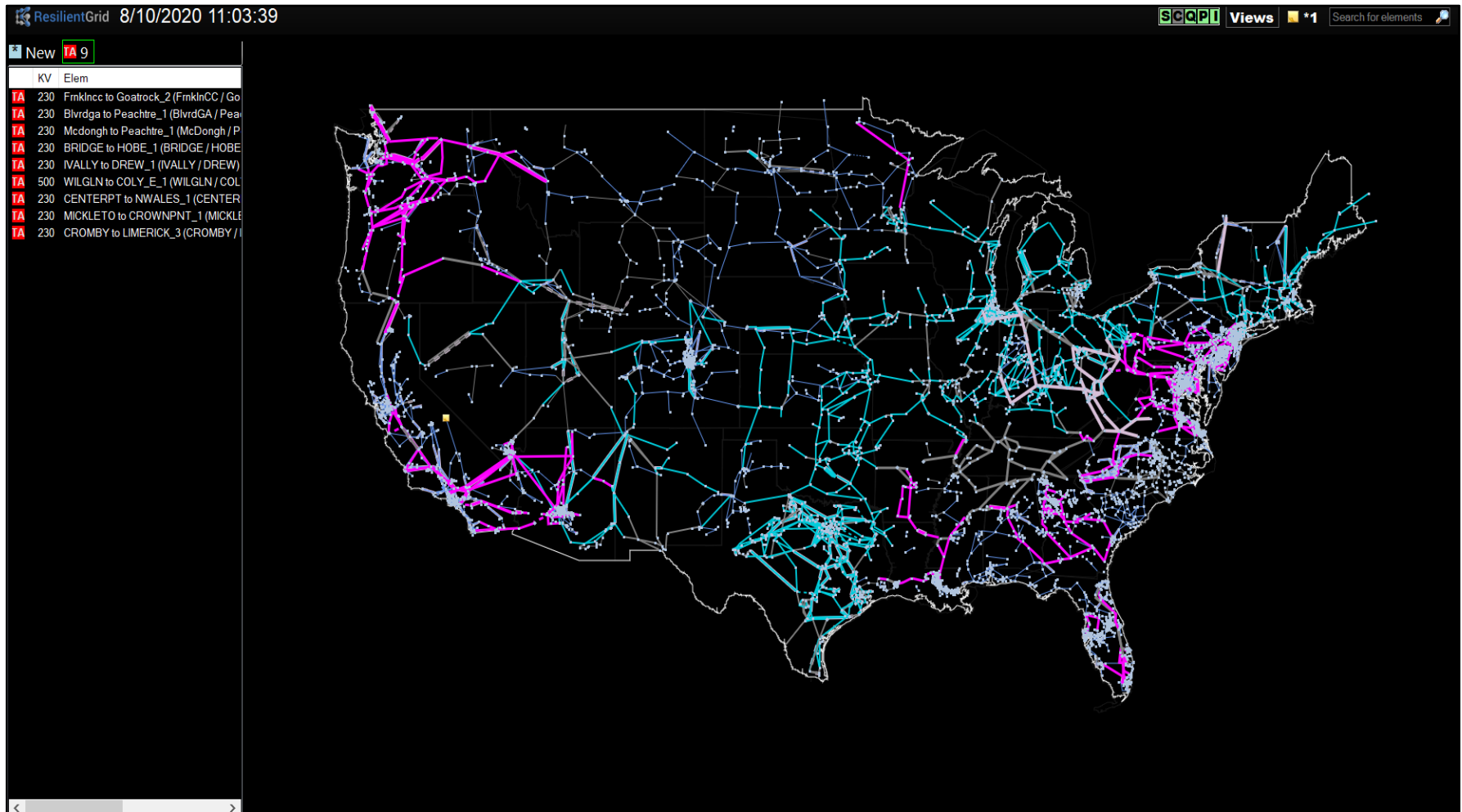


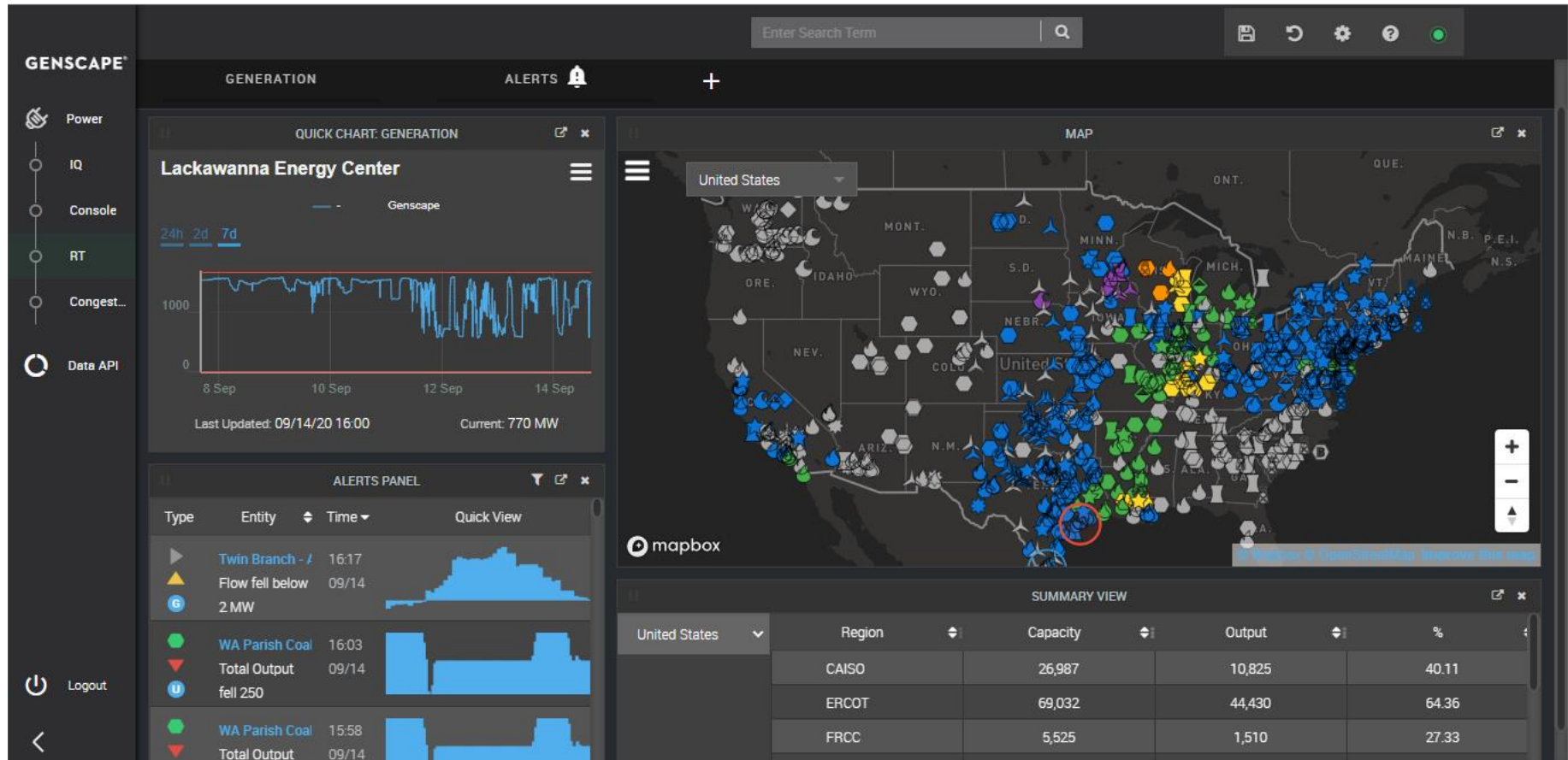
- Operate
- Control
- Intervene in anyone's real-time operations
- Anything involving compliance monitoring
- 24/7 shift work
- Stare at screens waiting for something to happen

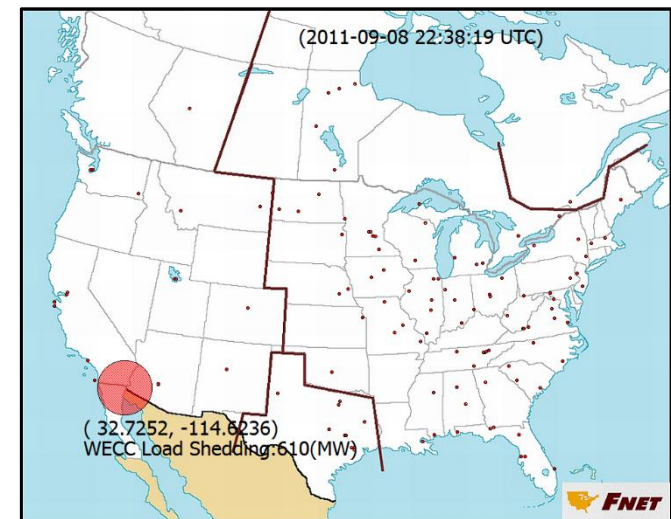
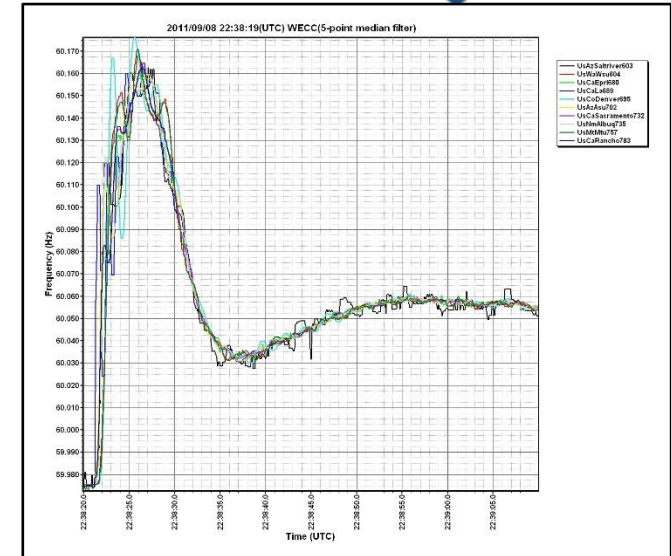
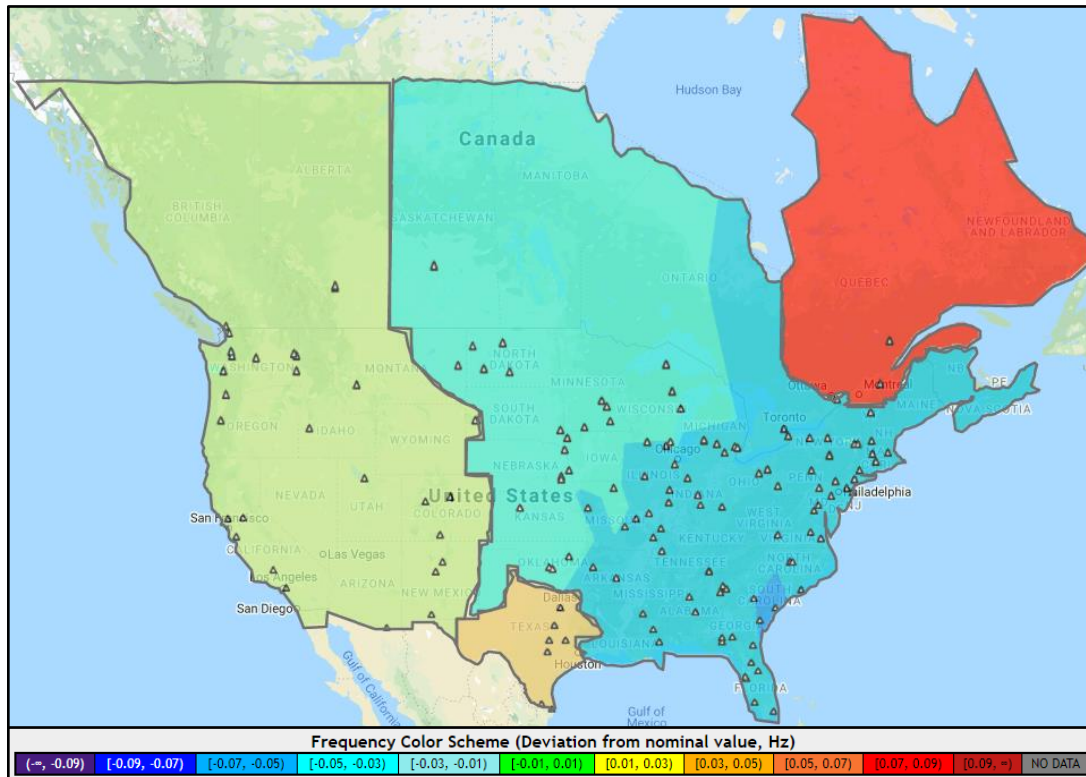
- Analysis of a high volume of disparate and sometimes conflicting information
  - Human subject matter experts (SMEs) provide the “so what?” from the tools’ data
  - Inherently an art and a science
- Learn something from every report and every event to build organizational memory
- Lots of automated tools...
- Experienced personnel with real-time analytic and operational experience

## NERC Published two Level II Recommendation Industry alerts

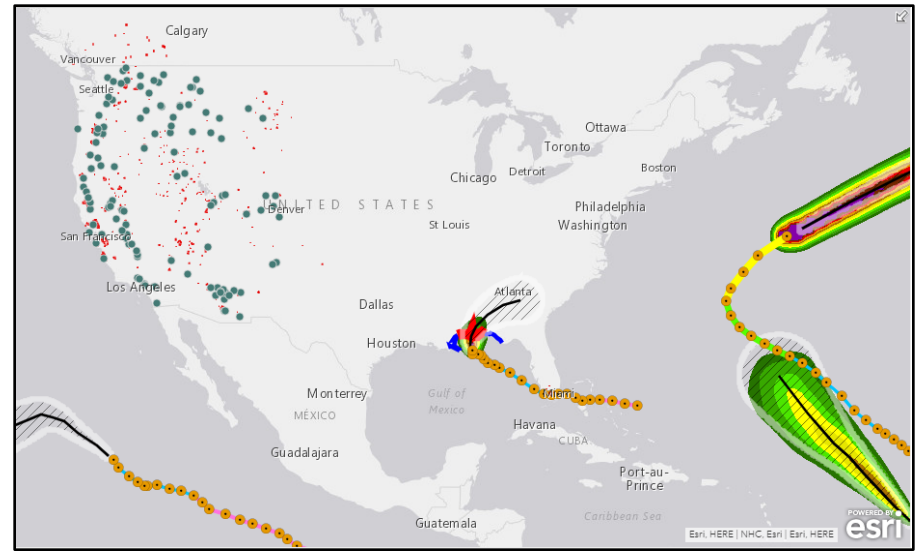
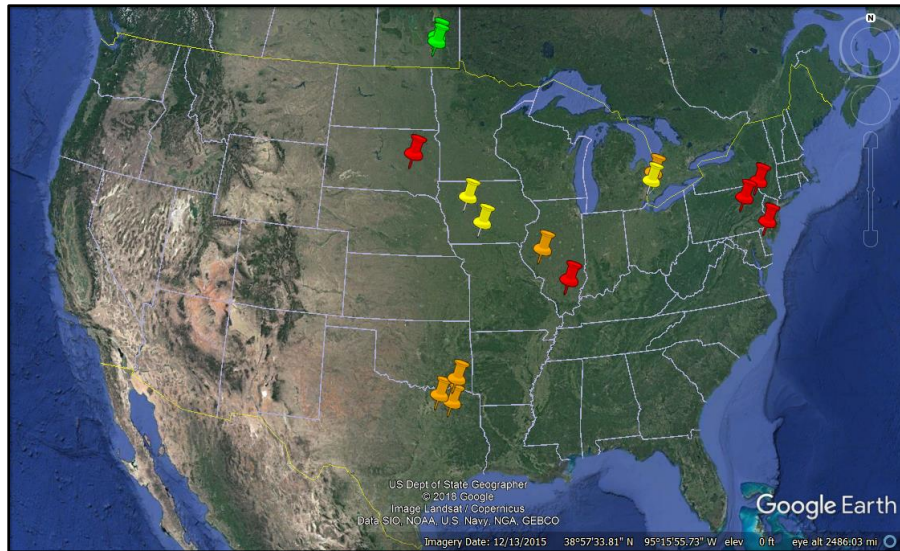
- Recommendation to Industry Coronavirus Disease (COVID-19) Pandemic Contingency Planning. Was published on March 10, 2020. This was a public alert no restrictions
- Recommendation to Industry Supply Chain Risk III alert was published on July 8, 2020. This was a private alert, restricted to internal use and necessary consultants.
  - In light of Executive Order (EO) 13920, “Securing the United States Bulk – Power System, “NERC is issuing this Recommendation to Industry to gather extent-of-condition information in order to better estimate the risk of installed bulk power system (BPS) electric equipment manufactured or supplied by certain foreign entities of concern.

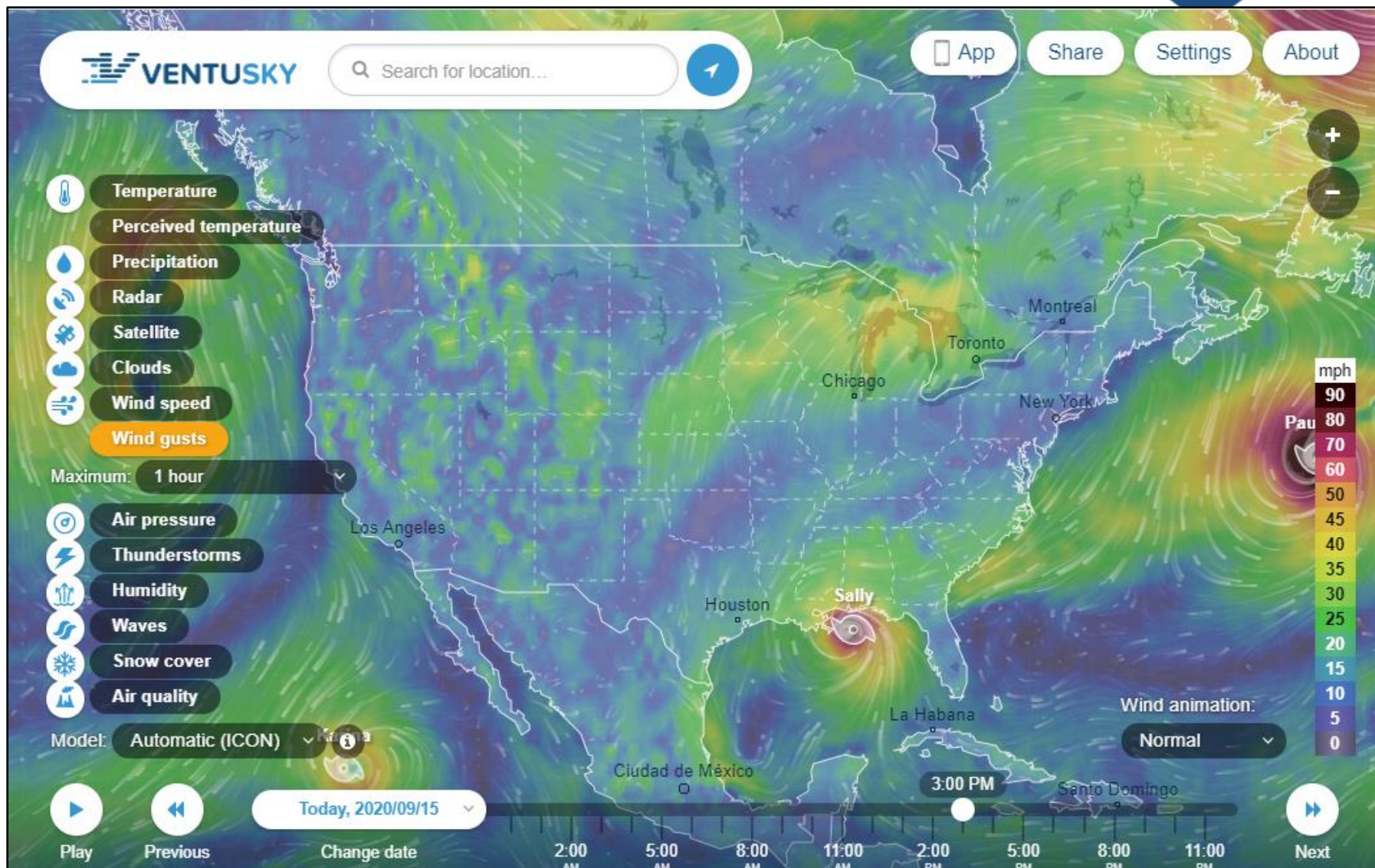














# Blog

1.5K
 


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## Emergency Response: Flooding at SaskPower's Island Falls Hydro Station

July 08, 2020

**PG&E** @PGE4Me · Sep 10

PSPS Update: For Customers Who Can Be Restored, Approx. 97% Now Have Power - Some Customers to Remain Out of Service Due to Ongoing Wildfire Threats, Smoke Impacts & Requests from First Responders to Keep Lines Deenergized to Support Firefighting Efforts [bit.ly/33c9wXz](https://bit.ly/33c9wXz)

### Public Safety Power Shutoff RESTORATION UPDATE

- Customers Restored**
  - 150,000 customers in 22 counties
  - Fully restored include: Alpine, Amador, Calaveras, El Dorado, Kern, Lake, Lassen, Mariposa, Nevada, Placer, Siskiyou, Sonoma, Tehama and Tuolumne
- Wildfire and Access Issues in Some Counties**
  - Mainly in the Northern Sierra, PG&E unable to restore electric service for three principal reasons: ongoing threats from wildfires, impacts from smoke impeding patrols and requests from first responders to keep power lines off to assist in firefighting efforts
- Remaining Customers to be Restored Thursday**
  - Approximately 5,000 customers who can receive service, but where company has not been able to perform patrols and inspection yet, are expected to remain out tonight in the following counties: Butte, Humboldt, Napa, Plumas, Sierra, Trinity and Yuba.

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 19
 33

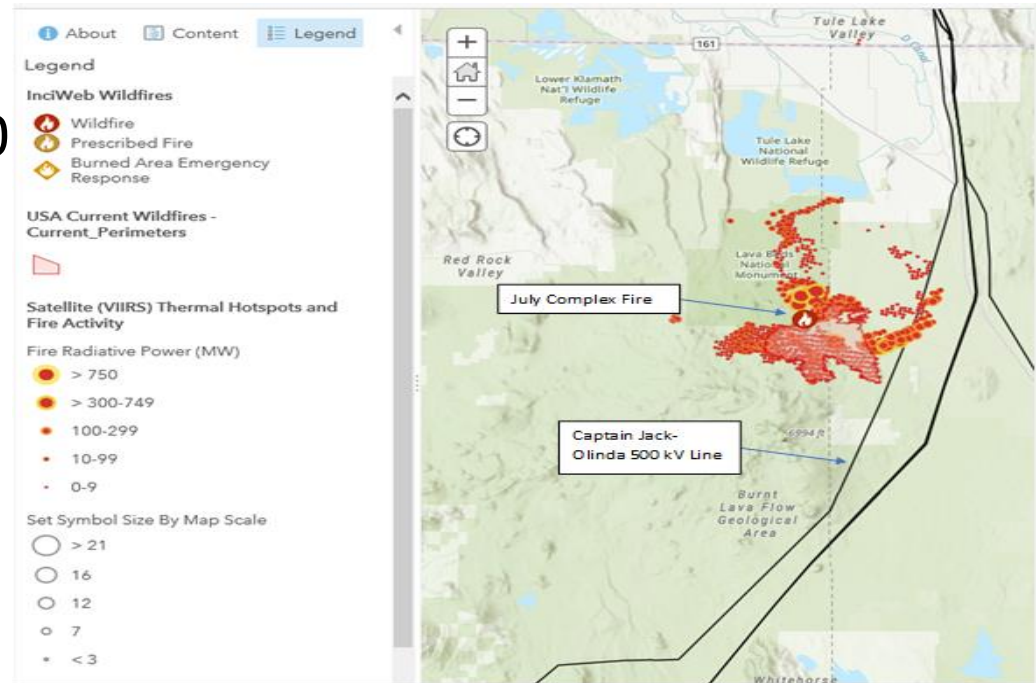
Hurricane Hanna made landfall on July 25, 2020 as a category one hurricane south of Corpus Christi, Texas on Padre Island at 6:00 p.m. Eastern with maximum sustained winds of 90 mph. Hanna made a second landfall as a category one hurricane at 7:15 p.m. Eastern in Kenny County, again with maximum sustained winds of 90 mph according to the National Hurricane Center.



- Total customer outage approximately 280k
- 17 ea. 138kV line outages
- 7 ea. 69 kV line outages
- South Texas nuclear project remained online at full output
- ERCOT issued Operation Condition Notice (OCN) and advisories during the event
- ERCOT reported that there were no reliability or stability concerns during the event

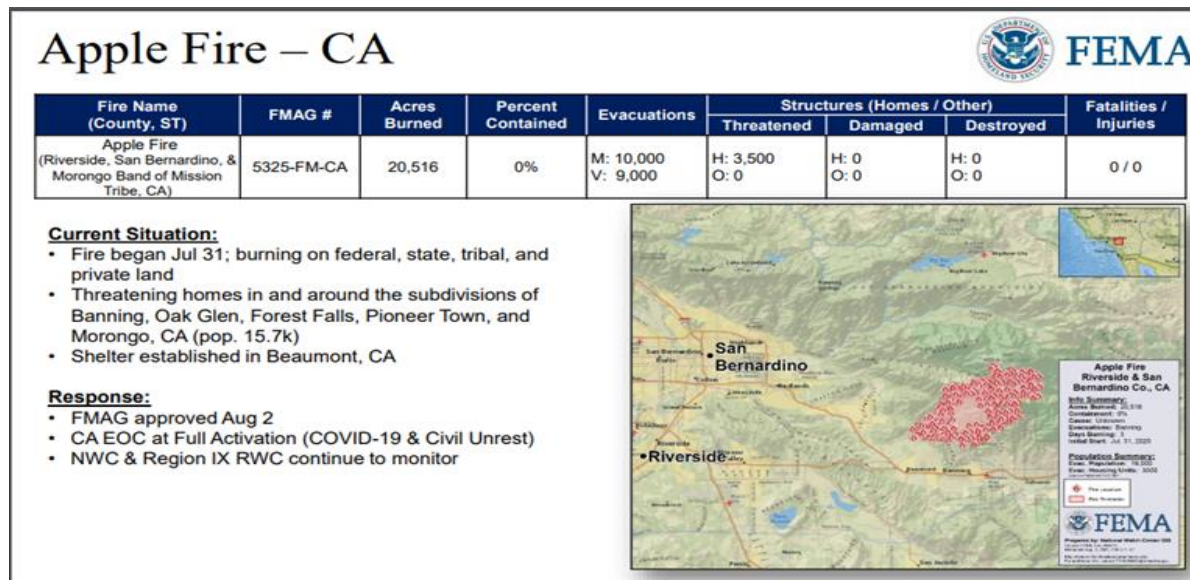
- Hurricane/Tropical Storm Isaias traversed across the Mid-Atlantic and into the Northeast from Friday, July 31, 2020 through Tuesday, August 4, 2020. Hurricane Isaias made landfall near Ocean Isle Beach, North Carolina as a Category 1 Hurricane with maximum sustained winds of 85 mph at approximately 11:00 p.m. Eastern on August 3, 2020.
  - U.S. Customer outages peaked over 3.8 million
  - 345 kV line outages
  - 230 kV line outages
  - 138 kV line outages
  - 115 kV line outage

- July Complex Fire
- Date of origin July 22, 2020
- Impacted Path 66
- 66,802 acres
- Cause under investigation





- Apple Fire CA
- Date fire originated July 31, 2020
- Impacted Dever-San Bernardino and El Casco-Devers 230 kV lines
- 20, 516 acres



To date there have been 14 public appeals reported/issued across the BPS.

- ERCOT August 1, 2020
  - Rio Grande Valley due to impacts from Hurricane Hanna
  - Localized impacts to Rio Grande area of Texas
- RC West & SPP West August 15-19, 2020
  - Due to excessive heat, high demand and deficient reserves
  - Additionally several REs issued public appeals; CAISO due to excessive heat and high demand across their footprint within RC West and SPP West August 13-18, 2020
- MISO August 27, 2020
  - Due to Hurricane Laura transmission lines damaged
  - Effective in area northeast of Huston, Texas



# Questions and Answers