Standards

Howard Gugel, Senior Director of Standards and Education
Board of Trustees Meeting
May 11, 2017
• Background
  ▪ Reflect change in NERC Compliance Registry
  ▪ Align WECC voting sectors with NERC voting segments
  ▪ Streamlined processes
  ▪ Clarified treatment of Standard Authorization Requests
  ▪ New section on field tests
  ▪ Minor revisions to clarify language

• Action
  ▪ Approve WECC Reliability Standards Development Procedures
Questions and Answers
Sections 600 and 900 of the Rules of Procedure Amendments

Howard Gugel, Senior Director of Standards and Education
Board of Trustees Meeting
May 11, 2017
• Start of comprehensive review
• Clarify responsibilities and scope
• Remove programmatic requirements
• Clarify scope of Personnel Certification Program
• Remove Personnel Certification Governance Committee (PCGC) governance covered in the program charter
• Remove items covered in program manual
  ▪ Exam and credential maintenance
  ▪ Dispute resolution
  ▪ Disciplinary action
• Clarify PCGC’s responsibilities
  ▪ Exam
  ▪ Applicants
  ▪ Employers
• Clarify purpose of Training and Education Program
• Clarify governance of Continuing Education Program
• Consider defining terms
• Stakeholder review of manual changes
• Concern about removing specific criteria
• Lengthen credential period
• Specify period of manual review
• Concern about moving specific criteria to charter or manual
• Clarification of roles and responsibilities
Questions and Answers
2017 Summer Reliability Assessment

John Moura, Director of Reliability Assessment and System Analysis
Board of Trustees Meeting
May 11, 2017
• **Resource Adequacy**
  - Sufficient Planning Reserve Margins projected
  - Delayed generation to impact NPCC-New England reserve margins

• **Management of Renewables in Over-supply Conditions**
  - Flexible, load-following resources must be available
  - Abundant hydro resources in California
  - Higher than average curtailments of renewables expected

• **Aliso Canyon Outage in Southern California**
  - No anticipated reliability impact to bulk power supply

• **Solar Inverter Dynamics and Disturbance Performance**
  - NERC Alert (to be published) identifies potential risks for certain inverter designs

• **2017 Solar Eclipse**
  - No anticipated reliability impact to bulk power supply
Summer 2017 Anticipated/Prospective Reserve Margins Compared to Reference Margin Level
2017 Resource Adequacy Measurements

Summer 2016-2017 Anticipated Reserve Margins Year to Year Change
Management of Renewables in Over-Supply Conditions

EIA: California Drought Status
Management of Renewables in Over-Supply Conditions

EIA: California Snow Water Equivalent
Aliso Canyon Outage in Southern California

Over 100 MW built in less than 6 months
(Source: GTM Research)
• On August 16, 2016, the Blue Cut Fire caused thirteen faults on 500 kV transmission lines
• No qualified events but Entities volunteered to work with the ERO to understand the occurrences
Findings and Next Steps for Alert

• NERC-led task force of inverter experts to investigate event and develop solutions to system problems:
  ▪ Inverter manufacturers
  ▪ Solar plant and inverter operations experts
  ▪ NERC and WECC staff

• Focus areas:
  ▪ Understand causes of inverter tripping, develop potential solutions
  ▪ Develop guidance or clarity to necessary standards

• Preliminary Finding:
  ▪ Phase Lock Loop (PLL) instability and inverter response
  ▪ Frequency detection methods and response to measured frequency

• Technical report published in early June
• NERC Alert to closely follow published technical report
• **Purpose:**
  - To evaluate potential reliability consequences of the August 21, 2017 total solar eclipse on the BPS, with a focus on peak system operations.

• **Main Objectives:**
  - Develop an extreme case using ideal weather conditions under peak system operations
  - Scenario eclipse test case which includes hourly load data, forecasted photovoltaic generation with a built in range
  - Identify and assess the eclipse test cases for any potential system reliability and/or operational impacts
Direct normal irradiance by annual average (Wh/m²/day), eclipse bands and locations of transmission photovoltaic resources.
California forecasted ending hour peak load: 51,233 MW (4 PM)
- 95% obscuration Northern California
- California is projected to have **11 GW** of utility PV resources (additional **7 GW** of distributed resources)

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**California Projected PV generation for high band and low band PV scenarios**

- **Nameplate PV**
  - High Band PV: 3,577 MW
  - Low Band PV: 4,136 MW
  - Total: 11,444 MW
- **Transmission PV**: 7,250 MW
- **Distribution PV**: 725 MW

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**Solar Direct Normal Irradiance by Annual Average (Wh/m²/day)**
- 2999 and Below
- 3000 to 3999
- 4000 to 4999
- 5000 to 5999

**Electric Generation by Net Summer Capacity (MW)**
- 10 to 241.5
- 5 to 10
- 0.05 to 5
2017 Solar Eclipse Key Results

• **Results of the total eclipse:**
  - Showed no impacts to the reliability of the BPS, but will impact operations in solar-dense areas
  - Some states with a large amount of PV resources are expected to have:
    - Increased load
    - Changes to ramping profiles, unit commitment, and balancing

• **General Recommendation:**
  - Areas should secure non-PV resources for system operations
  - Perform advance coordination with neighboring systems for transfers
Questions and Answers
2017 State of Reliability
Preview of Key Findings

James Merlo, Vice President, Reliability Risk Management
Board of Trustees Meeting
May 11, 2017
No Significantly Impactful Days
All Qualified Events (Cat 1 - Cat 5)
Event Severity Remains on Good Glideslope

Daily eSRI
(2011 - 12/31/2016)

SAS-calculated Baseline trend line slope = -0.00000765, with 95% confidence values between -0.00002365 and +0.00000835
Continued Decline in Average Transmission Outage Severity

- Significant Positive Correlation With Transmission Severity
- Significant Negative Correlation with Transmission Severity
- No Significant Correlation with Transmission Severity

Correlation with Transmission Severity:

- Misoperation 1
- Failed AC Substation Equipment 2
- Power System Condition 3
- Human Error 4
- Fire 5
- Contamination 6
- Lightning 7
- Other 8
- Failed AC Circuit Equipment 9
- Combined Smaller ICC Groups 10
- Weather, Excluding Lightning 11
- Unknown 12
- Foreign Interference 13
Misoperations Rates Continuing to Decline

![Bar chart showing misoperations rates for different regions and years with annotations for statistically significant increases and decreases between connected years.]

Regions:
- FRCC
- MRO
- NPCC
- RF
- SERC
- SPP
- TRE
- WECC
- NERC

Years:
- Year 1 (Q4 2012–Q3 2013)
- Year 2 (Q4 2013–Q3 2014)
- Year 3 (Q4 2014–Q3 2015)
- Year 4 (Q4 2015-Q3 2016)
Frequency Response Trend Varies by Interconnection

Western Interconnection

Eastern Interconnection
Frequency Response Trend Varies by Interconnection

ERCOT Interconnection

Québec Interconnection
<table>
<thead>
<tr>
<th>Date</th>
<th>Event Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 22, 2017</td>
<td>Report sent to Board of Trustees (Board) for review</td>
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<tr>
<td>June 8, 2017</td>
<td>Board teleconference and vote to accept report</td>
</tr>
<tr>
<td>June 13, 2017</td>
<td>Target release</td>
</tr>
</tbody>
</table>
Questions and Answers
• January 7, 2017: U.S. and Mexican governments sign bilateral reliability principles
• March 8, 2017: Signing of memorandum of understanding between NERC and Mexican governmental authorities
• May 30, 2017: Initial Steering Group Meeting (CRE, CENACE, NERC)
Establish implementation priorities and next steps:

<table>
<thead>
<tr>
<th>Topic</th>
<th>Proposed Next Steps</th>
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</thead>
<tbody>
<tr>
<td>Reliability Standards</td>
<td>Prioritize additional standards for adoption; work with CRE and CENACE on process for consideration and adoption in Mexico Grid Code</td>
</tr>
<tr>
<td>Reliability Assessments</td>
<td>Review Mexican plans and design for system expansion for reliability recommendations; work with CRE and CENACE to develop Long-term Reliability Assessment approach for Mexico</td>
</tr>
<tr>
<td>Cyber Security</td>
<td>Continue engagement and facilitate access and participation in E-ISAC, GridEx, ESCC</td>
</tr>
</tbody>
</table>

Governance and funding
International Electric Reliability Organization

Map showing regions in North America with various abbreviations:
- FRCC: Florida Reliability Coordinating Council
- MRO: Midwest Reliability Organization
- NPCC: Northeast Power Coordinating Council
- RF: ReliabilityFirst
- SERC: SERC Reliability Corporation
- SPP-RE: Southwest Power Pool Regional Entity
- TRE: Texas RE
- WECC: Western Electricity Coordinating Council

Legend:
- WECC: Western Electricity Coordinating Council
- MRO: Midwest Reliability Organization
- NPCC: Northeast Power Coordinating Council
- RF: ReliabilityFirst
- SERC: SERC Reliability Corporation
- SPP-RE: Southwest Power Pool Regional Entity
- TRE: Texas RE
- FRCC: Florida Reliability Coordinating Council

Note: The map highlights different regions and their respective reliability organizations.
Questions and Answers
E-ISAC Quarterly Update

Marcus Sachs, Senior Vice President and Chief Security Officer
Board of Trustees Meeting
May 11, 2017
Summary of Q1 2017

• Sharing and reporting
  ▪ 147 E-ISAC staff posts to the portal (-45% from Q4)
  ▪ 69 member posts to the portal (+21%)
    o 31 unique organizations shared (+19%)
    o 11 of those 31 organizations had never shared before (+57%)
  ▪ 312 new portal accounts (+13%)

• Engagement (monthly average during the quarter)
  ▪ 363 webinar attendees (+23% from Q4, and +41% from Q1 2016)
  ▪ 367 downloads of the daily report (-12%)

• CAISS Pilot
  ▪ 17 companies participating
<table>
<thead>
<tr>
<th></th>
<th>2015 Total</th>
<th>2016 Total</th>
<th>2017 Q1 Total</th>
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</thead>
<tbody>
<tr>
<td><strong>Cases Opened</strong></td>
<td>788</td>
<td>1,553</td>
<td>532</td>
</tr>
<tr>
<td><strong>Reports Generated</strong></td>
<td>138</td>
<td>194</td>
<td>60</td>
</tr>
<tr>
<td><strong>Site Annexes</strong></td>
<td>259</td>
<td>442</td>
<td>200</td>
</tr>
<tr>
<td><strong>CASA Automated Reports</strong></td>
<td>~71,000</td>
<td>165,852</td>
<td>46,293</td>
</tr>
</tbody>
</table>
• Vermont event follow-up and lessons learned (January)
• Member Executive Committee (MEC) face-to-face strategic planning meetings (January and March)
  ▪ Provided background information and guidance for the E-ISAC’s Long-term Strategic Plan
• Published 2016 End of Year Report (February)
• GridExIV Midterm Planning Meeting (February)
  ▪ Exercise scheduled for November 15-16, 2017
• Cyber Risk Preparedness Assessment (CRPA) workshop at the SANS ICS Summit (March)
• DNG-ISAC Partnership launch (March)
Questions and Answers
E-ISAC Long-term Strategic Plan

Marcus Sachs, Senior Vice President and Chief Security Officer
Board of Trustees Meeting
May 11, 2017
Primary drivers

- Security threats continue to evolve and become more dangerous
  - Ukraine, IoT, and ransomware attacks are indicators
  - Geopolitical tensions and changing societal trends make North America a target
- Customer expectations for highly reliable energy continue to increase
  - Electricity entities need to be more agile and responsive to real-time risks
  - Rapid technology changes also increase the risk landscape
- More robust understanding and measurement of grid resiliency and security
  - Need new tools for collecting and analyzing grid security metrics data

- 2015 ESCC recommendations were to enhance the ES-ISAC
  - 2017 E-ISAC strategic plan builds on that foundation

Goal is to transform the E-ISAC into an intelligence collecting and analytical capability “industry cannot do without”
The E-ISAC’s vision is to be a leading, trusted source for the analysis and sharing of Electricity industry security information

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

Values

<table>
<thead>
<tr>
<th>Timely</th>
<th>Actionable</th>
<th>Credible</th>
<th>Trusted</th>
</tr>
</thead>
</table>

Information Sharing

Trusted technologies draw in and drive the flow and dissemination of high value information across the electricity subsector in a timely manner

Analytics

Credible, reliable analytics turn member, cross-sector, 3rd party, and government data into sector-specific insights & member action

Engagement

Member-first culture sets the E-ISAC’s direction while active two-way engagement and sharing groups increase value and leverage industry resources

Goals

Vision

Mission

Values

Goals
E-ISAC Goals and Milestones

2015-16
ES-ISAC – to E-ISAC enhancement

Information Sharing
Drive information sharing through consistent mechanisms

Analytics
Increase value-added, timely analytics

Engagement
Improve industry inputs and consumption of analytics

2017
Strengthen Foundation

Deploy trusted, secure multi-directional networks

2018-2022
Comprehensive Transformation

Become the credible source for actionable, big picture information

Move from hub-spoke model to active multi-level engagement

2023 And beyond
Continuous Improvement
Energy ISAC?
ICS/SCADA ISAC?
• MEC encouraged NERC to add necessary staffing to support long-term strategy
  ▪ Will take time to build capabilities and obtain resources

• Currently developing specific resource requirements and capabilities to meet the long-term strategy
  ▪ People, technology, facilities
  ▪ Capability expectations at different funding levels

• Initial 2018 draft budget will include base E-ISAC costs
  ▪ Addendum will cover E-ISAC resource requirements in 2018 as first step in supporting the long-term strategy
  ▪ Addendum will also address what capabilities the E-ISAC will provide with these added resources and the benefits to industry
• If implemented, the resource impact will likely be significant over time and will be managed carefully

• People
  ▪ Emphasis is on hiring analysts with expertise in specific technical areas
  ▪ Increase in administrative and technical support staff also needed

• Technology
  ▪ Emphasis on technical data collection, analysis, and visualization
  ▪ New platform comes online this year; will add new capabilities
  ▪ As membership grows, will need more robust CRM tools

• Facility
  ▪ Current facility is adequate for staff growth in the near-term
  ▪ Will need additional space to support the long-term strategy
• Member Executive Committee (MEC) approved the long-term strategic plan on April 24, 2017
  ▪ Endorsement will be provided as input to NERC’s business plan and budget request
• NERC Board of Trustees’ acceptance of the E-ISAC Long-term Strategic Plan
• Completion of detailed resource planning for 2018 budget
  ▪ Financial projections and recommended funding mechanisms
  ▪ Technology specifics
  ▪ Human capital needs
  ▪ Will be incorporated in 2018 NERC business plan and budget as an addendum and reviewed with the MEC
Questions and Answers