Roadmap for Integrating Mexico into the International ERO

Laura Hussey, Director, International Relations
Member Representatives Committee Meeting
February 8, 2017
• Energy Policy Act 2005
  ▪ The Electric Reliability Organization (ERO) is to take steps to gain recognition in Canada and Mexico
  ▪ The U.S. president is to negotiate agreements with governments of Canada and Mexico to provide for compliance with reliability standards

• FERC Orders on Rules for, and Certification of, ERO
  ▪ NERC may seek recognition in Mexico after Mexico has a mandatory regulatory framework for reliability
  ▪ NERC ERO application adequately provides for NERC to be the international ERO

• NERC Bylaws:
  “When [NERC] receives recognition . . . in Mexico . . . the number of independent trustees will be increased by at least one, and the board composition . . . will be expanded to include Mexico . . . .”
• 2013-2014: Mexico enacted comprehensive energy reforms
  ▪ Expanded regulatory authority for reliability under the Mexican Energy Regulatory Commission (CRE)
  ▪ Implementation in progress
• 2015-2016: NERC and the Western Electricity Coordinating Council (WECC) worked with Mexican authorities
  ▪ Educate CRE, the National Energy Control Center (CENACE) and SENER on ERO, Reliability Standards
  ▪ Demonstrate value of international ERO
• January 7, 2017: U.S. and Mexican governments sign bilateral reliability principles
  ▪ Principles explicitly reference implementation through ERO that can function on an international basis (NERC)
Mexican Recognition of ERO

- Expect Q1 2017 signing of memorandum of understanding (MOU) between NERC and Mexican governmental authorities
  - Goal: Recognition of ERO
  - High-level; details to be worked out as implementation progresses
- Parallel effort to update WECC Membership and Operating Agreement (MOA) with Mexican regulator
  - Ensures regulatory consistency maintained for Baja California
  - MOU and MOA will be complementary
• Working with Mexican authorities to develop a quarterly plan
• Broad topics of this implementation plan:
  ▪ NERC Governance (Board, Committees, Rules of Procedure)
  ▪ ERO Operating Plan and Budget
  ▪ Reliability Standards Adoption
  ▪ Registration
  ▪ Compliance Monitoring and Enforcement
  ▪ Certification of Reliability Coordinator
  ▪ Security
Questions and Answers
ERO Enterprise Strategic Planning Process

Michael Walker, Senior Vice President and Chief Financial and Administrative Officer
Member Representatives Committee Meeting
February 8, 2017
Strategic Planning in 2016

- Consolidated and aligned strategic planning documents
- Established reduced set of metrics focused on measuring progress on reliability improvement
- Board of Trustees (Board) approved the *ERO Enterprise Strategic Plan and Metrics 2017–2020* in November
- Developed NERC efficiency and effectiveness metric with four measures to be presented to the Board for approval in February
- Historical data for metrics posted on NERC website with strategic planning documents
• Develop long-term strategy for the ERO Enterprise

• Terminology adjustments:
  ▪ ERO Enterprise Strategic Plan and Metrics to ERO Enterprise Operational Plan
  ▪ Remove year designation (e.g., 2018–2021)

• Risk prioritization by the Reliability Issues Steering Committee (RISC) and review of the ERO Enterprise Operational Plan undertaken every two years
  ▪ Opportunity for interim updates based on identification of any significant new emerging risks or operational goals
  ▪ Metrics are enduring; measures, thresholds, and targets adjusted annually
  ▪ Annual business plan and budget development based on latest operational plan and current metrics
• Scope of proposed longer-term strategy
• Change to updating RISC report, ERO Enterprise Operational Plan every two years instead of annually
• Improvements to development of the RISC priorities report
• Improvements to the development of updates to the ERO Enterprise Operational Plan
• Adequate stakeholder input provided in 2017 schedule
Questions and Answers
Key Findings

- Distributed energy resources (DER) penetration is rapidly increasing and altering the load mix.
- Technical and engineering challenges of integrating DERs on distribution system are well understood, but the reliability implications on the bulk power system (BPS) are less so.
- DERs will increasingly have capabilities for active power control and reliability services.
- Fundamental changes to modeling, planning and operations and conventional assumptions.
Recommendations for Next Steps

- Reliability Guidelines
  - Technical committee actions for load modeling, operations, forecasting
- Data sharing
  - Potential enhancement to NERC Reliability Standards
  - Continue to monitor in Long-Term Reliability Assessment
- System modeling
  - Consistency and best practices
  - Annual assessment
- DER component models
- Definitions
- Industry collaboration
  - IEEE, national laboratories, inverter manufacturers, control vendors
• Board requested MRC policy input regarding how and at what pace NERC should respond to the recommendations, based on the findings identified in the Distributed Energy Resources Task Force (DERTF) report
• NERC and DERTF have reviewed comments received by the MRC
• Report submitted for approval on February 9, 2017 to NERC Board of Trustees
Next Steps: Coordination and Outreach

- NARUC and other State regulators
- Federal Energy Regulatory Commission
- Provincial regulators
- Department of Energy
- Inverter manufacturers, researchers
- Planning and Operating Committees
Questions and Answers
Update and Schedule of Near-Term Reliability Assessments

John Moura, Director, Reliability Assessment and System Analysis
Member Representatives Committee Meeting
February 8, 2017
• Identifies the strategic direction and priority risks that should be assessed by the ERO

• High and medium risks that should be assessed:
  ▪ Changing Resource Mix
  ▪ Bulk Power System Planning
  ▪ Resource Adequacy and Performance
  ▪ Extreme Natural Events
• Assess:
  - Essential Reliability Services and conduct interconnection-wide studies
  - Natural gas dependency and disruption risks
  - Distributed Energy Resources
  - Proposed regulatory rules or statutes impacting the resource mix
  - Resource adequacy using probabilistic-based approaches
## 2017 Reliability Assessments

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Scope</th>
<th>Planned Delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long-Term Reliability Assessment</td>
<td>10-Year Resource Assessment; Emerging Reliability Issues</td>
<td>December, 2017</td>
</tr>
<tr>
<td>Winter Assessment</td>
<td>Seasonal Resource Assessment</td>
<td>November, 2017</td>
</tr>
<tr>
<td>Summer Assessment</td>
<td>Seasonal Resource Assessment</td>
<td>May, 2017</td>
</tr>
<tr>
<td>Single Point of Disruption</td>
<td>Analysis of natural gas storage, LNG, and pipeline risks</td>
<td>May, 2017</td>
</tr>
<tr>
<td>Distributed Energy Resources (DER)</td>
<td>Analysis of potential effects of DER on BPS and recommendations</td>
<td>February, 2017</td>
</tr>
<tr>
<td>Essential Reliability Services (ERS)</td>
<td>Providing key statistics and benchmarks for ERS measures</td>
<td>TBD</td>
</tr>
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<td>May, 2018</td>
</tr>
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</table>
Special Assessment Topics for Consideration

- Increasing Variable Resource Curtailments
- Off-Peak/Shoulder Period Demand
- Accelerated Nuclear Retirements
- 2017/2024 Solar Eclipse
- Distributed Energy Resources
- Demand and Variable Resource Forecasting Performance
- Modeling Fidelity and Performance
- Evaluation of Resource Adequacy Approaches
- Capacity Value for Generation with Non-firm Fuel
Questions and Answers
• Federal Energy Regulatory Commission (FERC) Order initiates further actions to address geomagnetic disturbances (GMD)
  ▪ Implementation of GMD Vulnerability Assessments (TPL-007-1)
  ▪ Revisions to TPL-007-1
  ▪ Additional research
  ▪ Data collection
• Order No. 830 directs NERC to revise TPL-007 to address Commission concerns
  ▪ Modify the benchmark GMD event definition used for GMD assessments
  ▪ Require entities to collect GMD data
  ▪ Establish deadlines for Corrective Action Plans (CAPs) and mitigating actions to address identified GMD impacts

• Revisions must be filed by May 2018
• Standards drafting team appointed in December 2016
  ▪ Initial meeting January 2017
• Standards Authorization Request (SAR) posted for comment December 2016 – January 2017
• SDT is developing revisions and anticipates posting initial drafts by June 2017
• Revisions must be filed by May 2018
Three-Pronged Approach

Standard Revision Plan
- Standard Drafting Team

Research Plan
- GMDTF to develop
- Consultant to execute
- NERC Staff Project Manager

Data Collection and Sharing Plan
- GMDTF to develop
- NERC Technical Staff
- PMO for IT solution
Preliminary Research Plan Proposal

- File research plan with FERC May 29, 2017
- Task 1: Spatial Averaging
- Task 3: Latitude Scaling
- Task 5: Improve Harmonics Analysis
- Task 2: Improve Earth Conductivity Models
- Task 4: Transformer Thermal Impact

Research Plan Begins: Planning and Project Management

May 2017

December 2017

December 2019

December 2020
NERC is seeking input on the research plan through:
  - GMD Task Force
  - Technical committees
  - Research organizations

GMDTF meeting at EPRI facility in February 2017 to finalize research work plan

Present research work plan at March 2017 Planning Committee (PC) meeting

Section 1600 data request goals
  - PC to approve data request for 45-day industry comment at June 2017 PC meeting, approve at September 2017 PC meeting
  - PC to submit data request to NERC Board of Trustees in Q4 2017 for final approval (depending on comments received)
Questions and Answers
Inverter Disconnects During Transmission Disturbances

James Merlo, Vice President, Reliability Risk Management
Member Representatives Committee Meeting
February 8, 2017
On August 16, 2016, the Blue Cut Fire caused thirteen 500 kV line faults and two 287 kV line faults.

All of these faults cleared normally, with roughly the same fault clearing time and magnitude.

Four of the faults caused a loss of photovoltaic (PV) generation.

No qualified events but Entities volunteered to work with the ERO to understand the occurrences.
### Blue Cut Fire Event #1

#### Maximum Generation Lost (MW)

<table>
<thead>
<tr>
<th>Event #</th>
<th>Time</th>
<th>Fault Type</th>
<th>Fault Duration (cycles)</th>
<th>North Western</th>
<th>North Eastern</th>
<th>Eastern</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>11:45</td>
<td>Line to Line</td>
<td>2.49</td>
<td>391.6</td>
<td>326.53</td>
<td>460.2</td>
<td>1178.33</td>
</tr>
</tbody>
</table>
Inverter Properties

- Widespread inverter reduction in power output as inverters perceived frequency outside acceptable bounds
- Inverters that use the zero crossing of a voltage signal as a reference to calculate frequency are susceptible to significant error if a phase shift is introduced (as may happen when a fault occurs)
- Zero crossing time of the voltage waveform shifted significantly during the event
• The calculated frequency exceeded 62 Hertz (Hz) at some locations and fell below 57 Hz at others
• This results in instantaneous reduction in power output from the inverters
• NERC Standards allow asynchronous generating units to trip due to instability in power conversion control equipment
• NERC does not provide guidance on how to calculate frequency
OFF NOMINAL FREQUENCY CAPABILITY CURVE

- Quebec
- Western
- Eastern
- ERCOT
- Eastern Interconnection
- No Trip Zone

Time (sec)
Frequency (Hz)

NERC
North American Electric Reliability Corporation
Current and Planned Production
Way Forward

- NERC task force to further investigate potential causes and solutions to the loss of PV generation as a result of power system faults
- Engage inverter manufacturers to share challenges associated with some of the existing frequency and voltage measurement techniques
- Develop guidance as information and solutions become available
Questions and Answers
Cyber Automated Information Sharing System

Marcus Sachs, Senior VP & Chief Security Officer
Member Representatives Committee
February 8, 2017
CAISS is a technology proof-of-concept project

- Based on STIX/TAXII technology
- Requested in 2015 ESCC recommendations
- Results of the pilot will be integrated into future platform
- Ten initial participants—more have joined since the beginning of 2017

NERC pays for back-end services

- Participants pay for any hardware or software needed at users' sites

Two complementary technologies:

- ThreatConnect – Front-end GUI for analysis and STIX package creation
- Soltra Edge – Back-end, machine-to-machine communications TAXII server
  (Soltra Edge was sold to NC4 in November 2016)

STIX = Structured Threat Information eXpression
TAXII = Trusted Automated Exchange of Indicator Information
• STIX is a standardized language for the representation of threat information

• Eight types of items that can be shared:
  - Observable (activity)
  - Indicator (what to watch)
  - Incident (where)
  - Tactics, techniques, procedures (how)
  - Exploit target (victim)
  - Campaign (why)
  - Threat actor (who)
  - Course of action (how to respond)
STIX - How it Works

Atomic

What threat activity are we seeing?

Tactical

What threats should I look for on my systems and why?

Operational

Where has this threat been seen?

What can I do about it?

What weaknesses does this threat exploit?

Strategic

Who is responsible for this threat?

Why do they do this?

What do they do?
• TAXII defines a set of services and message exchanges that enable sharing of actionable information

• Three sharing models:
  - Hub and spoke (central clearinghouse)
  - Source/subscriber (single source)
  - Peer-to-peer (multiple party sharing)
WELCOME TO THE E-ISAC COMMUNITY IN THREATCONNECT

ThreatConnect has teamed up with E-ISAC, the leading provider of security services to electricity service owners and operators in the USA, Canada, and portions of Mexico. The ThreatConnect platform supports E-ISAC through a continuous learning and collaboration environment. The platform allows E-ISAC member to share and collaborate with each other within and among their own threat intelligence and cybersecurity teams. ThreatConnect allows users to aggregate and normalize cyber threat information from a wide variety of government and private sources.
ThreatConnect Analysis

DNS Resolution History

<table>
<thead>
<tr>
<th>Resolved</th>
<th>Resolution</th>
<th>City</th>
<th>Country</th>
<th>Registering Org</th>
<th>ASN</th>
</tr>
</thead>
<tbody>
<tr>
<td>08-29-2016 17:59 BST</td>
<td>5.149.249.172</td>
<td>Amsterdam</td>
<td>nl</td>
<td>Fortunis Networks L.P.</td>
<td>59711</td>
</tr>
</tbody>
</table>

Passive DNS

<table>
<thead>
<tr>
<th>Host</th>
<th>First Seen Resolution</th>
<th>Last Seen Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>kdsdfoid9w54ygdjoi.akpartl.info.tr</td>
<td>Thu Mar 03 11:51:11 UTC 2016</td>
<td>Thu Mar 03 12:40:09 UTC 2016</td>
</tr>
</tbody>
</table>
Questions and Answers
Recent FERC Activity

Michael Bardee, Director
FERC Office of Electric Reliability
February 8, 2017
FAST Act/CEII Final Rule

- RM16–15/RM15–25, 11/17/16
- Implements provisions of FAST Act that require designation, protection and sharing of critical energy/electric infrastructure information (CEII)
- Prohibits unauthorized disclosure of CEII
- Sanctions for FERC employees and certain others who knowingly & willfully make unauthorized disclosure
- Info downloaded from non-public NERC database will be treated as non-public; CEII status will be evaluated upon a request or if FERC proposes to release
- Effective as of February 21, 2017
Primary Frequency Response

- NOPR, RM16-6, 11/17/16
- Proposes to amend pro forma large & small generator interconnection agreements to:
  - Require all new generating facilities to install, maintain and operate functioning governor or equivalent controls
  - Incorporate certain operating requirements including maximum droop and deadband parameters and sustained response provisions
- No proposal on headroom or compensation
- Comments closed January 24, 2017
Remedial Action Schemes

- NOPR, RM16–20, 1/19/17
- Proposal to approve PRC–012–2
- PRC–012–2 would require RCs to review new or modified RAS schemes; PCs must evaluate at least every 5 years; each RAS operation or misoperation also must be evaluated; RAS–entity must perform functional testing of each RAS
- NOPR proposes to clarify that PRC–012–2 will not supersede TPL–001–4
- Comments due 60 days after publication in Federal Register
RM16–7, 1/19/17

Approves BAL–002–2, Disturbance Control Standard—Contingency Reserve for Recovery from a Balancing Contingency Event

Directs modification: if BA will not restore ACE timely during EEA, BA must notify RC and provide recovery plan and target time period

Also directs NERC to collect & report data on MW losses & resets after Reportable BCEs; and to study & report on risks of MSSC exceedances that do not cause energy emergencies
Thank you!

Questions?