NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Agenda
Reliability Issues Steering Committee

July 17, 2018 | 3:00–4:00 p.m. Eastern

Dial In: 1-415-655-0002 | Code: 732 244 850 | Join WebEx meeting

Introduction and Chair's Remarks

NERC Antitrust Compliance Guidelines and Public Announcement*

Agenda Items

1. **June 14 and April 9, 2018 Meeting Minutes* – Approve**
2. **RISC Resilience Report Draft Outline* – Review**
3. **2019 Reliability Leadership Summit Suggested Topics/Speakers/Panel Volunteers* – Review**
4. **FERC Technical Conference Comments* – Review**
5. **Measuring Emerging Risks*– Review**
6. **Future Meetings - Review Date Options for September Call – Review**

*Background materials included.

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Antitrust Compliance Guidelines

I. General

It is NERC's policy and practice to obey the antitrust laws and to avoid all conduct that unreasonably restrains competition. This policy requires the avoidance of any conduct that violates, or that might appear to violate, the antitrust laws. Among other things, the antitrust laws forbid any agreement between or among competitors regarding prices, availability of service, product design, terms of sale, division of markets, allocation of customers or any other activity that unreasonably restrains competition.

It is the responsibility of every NERC participant and employee who may in any way affect NERC's compliance with the antitrust laws to carry out this commitment.

Antitrust laws are complex and subject to court interpretation that can vary over time and from one court to another. The purpose of these guidelines is to alert NERC participants and employees to potential antitrust problems and to set forth policies to be followed with respect to activities that may involve antitrust considerations. In some instances, the NERC policy contained in these guidelines is stricter than the applicable antitrust laws. Any NERC participant or employee who is uncertain about the legal ramifications of a particular course of conduct or who has doubts or concerns about whether NERC's antitrust compliance policy is implicated in any situation should consult NERC's General Counsel immediately.

II. Prohibited Activities

Participants in NERC activities (including those of its committees and subgroups) should refrain from the following when acting in their capacity as participants in NERC activities (e.g., at NERC meetings, conference calls and in informal discussions):

- Discussions involving pricing information, especially margin (profit) and internal cost information and participants' expectations as to their future prices or internal costs.
- Discussions of a participant's marketing strategies.
- Discussions regarding how customers and geographical areas are to be divided among competitors.
- Discussions concerning the exclusion of competitors from markets.
- Discussions concerning boycotting or group refusals to deal with competitors, vendors or suppliers.

- Any other matters that do not clearly fall within these guidelines should be reviewed with NERC's General Counsel before being discussed.

III. Activities That Are Permitted

From time to time decisions or actions of NERC (including those of its committees and subgroups) may have a negative impact on particular entities and thus in that sense adversely impact competition. Decisions and actions by NERC (including its committees and subgroups) should only be undertaken for the purpose of promoting and maintaining the reliability and adequacy of the bulk power system. If you do not have a legitimate purpose consistent with this objective for discussing a matter, please refrain from discussing the matter during NERC meetings and in other NERC-related communications.

You should also ensure that NERC procedures, including those set forth in NERC's Certificate of Incorporation, Bylaws, and Rules of Procedure are followed in conducting NERC business.

In addition, all discussions in NERC meetings and other NERC-related communications should be within the scope of the mandate for or assignment to the particular NERC committee or subgroup, as well as within the scope of the published agenda for the meeting.

No decisions should be made nor any actions taken in NERC activities for the purpose of giving an industry participant or group of participants a competitive advantage over other participants. In particular, decisions with respect to setting, revising, or assessing compliance with NERC reliability standards should not be influenced by anti-competitive motivations.

Subject to the foregoing restrictions, participants in NERC activities may discuss:

- Reliability matters relating to the bulk power system, including operation and planning matters such as establishing or revising reliability standards, special operating procedures, operating transfer capabilities, and plans for new facilities.
- Matters relating to the impact of reliability standards for the bulk power system on electricity markets, and the impact of electricity market operations on the reliability of the bulk power system.
- Proposed filings or other communications with state or federal regulatory authorities or other governmental entities.
- Matters relating to the internal governance, management and operation of NERC, such as nominations for vacant committee positions, budgeting and assessments, and employment matters; and procedural matters such as planning and scheduling meetings.

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Draft Minutes
Reliability Issues Steering Committee

June 14, 2018 | 3:00–4:00 p.m. Eastern

Kristin Iwanechko took attendance and a quorum of the Reliability Issues Steering Committee (RISC) members was not reached. Members on the phone were: Peter Brandien, Chair, Mark Ahlstrom, Jeffrey Cook, Charles King, Mark McCulia, Chris Root, Chris Shepherd, Brian Allen Slocum, Donald Holdsworth, Chuck Abell, and David Zwergel. NERC staff attendees included Mark Lauby and Mike Walker.

Introduction and Chair's Remarks

Chair Brandien welcomed RISC members and observers and reviewed the agenda.

NERC Antitrust Compliance Guidelines and Public Announcement

Ms. Iwanechko called attention to the NERC antitrust guidelines in the agenda package.

Agenda Items

1. **April 9, 2018 Meeting Minutes**

   As quorum was not reached, the April 9, 2018 meeting minutes will be presented for approval during the July 17 meeting.

2. **Resilience Framework**

   a. Comments Submitted to FERC

   Chair Brandien provided an overview of the comments submitted to FERC stating he did not note anything in the comments overall that would suggest the Committee rethink the position shared with the NERC Board of Trustees at their May 2018 meeting (i.e., that RISC did not see any gaps). Chair Brandien shared the following takeaways from the comments:

   - Commenters generally supported their ISO/RTO filings (although some in the PJM footprint deviated slightly from PJM's comments).
   - Numerous comments stating a definition is needed, as well as metrics to gauge where we are with resilience.
   - Many non-market areas commented on not forgetting about the states.
   - Some comments on cost-benefits.
   - Numerous comments around fuel and what FERC should or should not do about gas, with few people saying we need to modify the criteria in the TPL standards.
   - More comments stating Reliability Standards currently cover resilience than those suggesting additional standards are needed.

- A number of commenters highlighted the need to include a focus on transmission and how it can play into resilience.

RISC members offered their thoughts on the overall comments, noting that regional differences and themes need to be considered and there may be a gap to address regarding communications for cyber security. Chair Brandien noted the RISC report should be reviewed to see if the recommendations cover this potential gap.

b. Standing Committee Suggestions for Additional Activities

Chair Brandien suggested including the recommendations for additional activities in the final resilience report discussed below to be presented to the NERC Board of Trustees at its November 2018 meeting. He asked that the Standing Committee Chairs review the additional activities documented thus far and provide any additions or revisions for review and inclusion in the final report.

c. RISC Recommendations to Board

Chair Brandien opened a discussion on how the RISC should close the RISC recommendations assignment and suggested developing a final report to the Board which would include how the resilience framework was developed, the RISC's recommendations, and the additional activities presented by the standing committees.

Mark Lauby added the report could also include a background on the need for the work assigned, a summary of NERC's filing, and the slide deck with the models that were presented to the MRC. Mr. Lauby offered to coordinate with NERC staff on an outline of the report to present for feedback at the next meeting of the RISC on July 17. A first draft of the report will be distributed to the RISC in August 2018 for review and comments, followed by a proposed final draft to the RISC in September for review and approval, with the final report submitted to the Board at its November 2018 meeting.

RISC members agreed with the approach presented by Chair Brandien and Mr. Lauby.

3. 2019 Reliability Leadership Summit

Chair Brandien and Mr. Lauby presented the draft 2019 Reliability Leadership Summit agenda which includes four recommended panels: **Panel 1** - Regulatory and Policymaking during Unprecedented Change, **Panel 2** - Identification and Mitigation of Significant Risks to Reliability: Existing and Emerging Landscape of Risks, **Panel 3** - Providing Assurance for the Availability of Adequate Fuel Delivery to Satisfy Energy Needs, and **Panel 4** - Open Discussion.

Feedback by RISC members included:

- Support for having four panels, with an open discussion as the last panel, similar to the previous Reliability Leadership Summit.
- Consider including a panel specifically on resilience or incorporating resilience into the current recommended panels.
- The timing of cyber and resilience for Panel 2 may be too short.

- Consider having Panel 2 focus on emerging issues like new models, communications, new threats and risks.
- Consider customer-driven use of our system as a potential topic.

At the conclusion of the discussion, Chair Brandien asked the members to further review the draft agenda and provide additional thoughts on topics, speakers, and willingness to moderate a panel to the RISC distribution list (risc@nerc.com).

4. Future Meeting Dates

Ms. Iwanechko noted the next meeting of the RISC is via conference call on July 17, 2018.

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Draft Minutes
Reliability Issues Steering Committee

April 9, 2018 | 3:00–4:00 p.m. Eastern

Kristin Iwanechko took attendance and verified a quorum with the following Reliability Issues Steering Committee (RISC) members on the phone: Mark Ahlstrom, Lisa Carrington, Carol Chinn, Jeff Cook, Tim Eckel, Brian Evans-Mongeon, Donald Holdsworth, Patti Metro, Dave Osburn, Katherine Prewitt, Chris Root, Mark Rothleder, Herb Schrayshuen, Brian Slocum, and Dave Zwergel. Additional stakeholder observers were in attendance as well. NERC staff attendees included Tina Buzzard, Mark Lauby, and Mike Walker.

Introduction and Chair's Remarks

Mr. Lauby chaired the meeting in Peter Brandien's absence. He welcomed RISC members and observers and reviewed the agenda.

NERC Antitrust Compliance Guidelines and Public Announcement

Ms. Iwanechko called attention to the NERC antitrust guidelines in the agenda package.

Agenda Items

1. **March 16, 2018 Meeting Minutes**

   The March 16, 2018, meeting minutes were approved on a motion by Mr. Ahlstrom and seconded by Mr. Schrayshuen.

2. **Resilience Framework**

   a. NERC Standing Committee Input

   Standing Committee representatives provided an overview of their comments submitted in response to the RISC's request for input on the resilience framework. Mr. Evans-Mongeon stated that the Planning Committee (PC) supports moving forward with the framework as presented. Mr. Zwergel reported that the Operating Committee (OC) identified current activities and categorized into the four constructs of the resilience framework. The OC also identified and suggested other activities that could be undertaken to enhance resilience even further. Ms. Carrington stated that the Critical Infrastructure Protection Committee (CIPC) evaluated the activities in their work plan and categorized them into the four constructs. She also noted that the CIPC suggested including detection in the definition of resourcefulness. Ms. Metro stated that for the Compliance and Certification Committee (CCC), most of the RISC recommendations are outside the CCC's purview and do not impact their work plan. She noted that the CCC discussed the adequate level of reliability and were supportive of the direction of the resilience framework. Guy Zito stated that the Standards Committee (SC) discussed the SC's processes and how they support the definition of resilience. The SC generally agreed that

the standards address many of the framework elements of resilience and identified some suggested process improvements. Mr. Zito noted that the SC is supportive of the direction of the resilience framework.

Mr. Lauby highlighted the following suggestions from the standing committee comments which RISC members agreed to make: (1) add detection to the description of resourcefulness; and (2) add "coordinated and controlled manner" in the description of rapid recovery.

b. Relationship Between Reliability and Resilience

Mr. Lauby reviewed the presentation that was included in the agenda package which outlines how the resilience framework relates to NERC's reliability construct. He stated that NERC's view of reliability has two fundamental concepts: adequacy and operating reliability. Mr. Lauby reviewed the definition of an adequate level of reliability noting that a system with an adequate level of reliability is resilient. He reviewed a chart showing that within a band which is deemed acceptable, at some point there will be an event that brings reliability down until rebounding to a recovered steady-state. He mapped the chart with the resilience framework and suggested the following resilience indicators: robustness, amplitude, degradation, recovery, and recovery state. Mr. Lauby added that the resilience definition proposed by FERC appears to not capture lessons learned by industry. RISC members were supportive of the concepts in the presentation and offered the following suggestions:

- Consider showing the robustness line between optimal and ALR-Nadir.
- Add something to reflect the time of recovery, acknowledging that at some point the recovery time is too long.
- Consider an additional line below ALR-Nadir to show a lower level of acceptable reliability during a major system upset.
- From a public safety point of view, consider how long is acceptable to live without critical infrastructure components.
- Consider whether the 'Improved' line should be moved down to the 'R Optimal' line.
- Replace "optimal" with "target".
- Capture improvement for detectable events prior to a disturbance.

Mr. Lauby stated he would adjust the charts based on the feedback received and recirculate to the committee.

3. 2019 Reliability Leadership Summit

Mr. Lauby noted that NERC is working on confirming a date for the 2019 Reliability Leadership Summit and asked RISC members for thoughts on potential agenda topics. Members made the following suggestions:

- Distributed energy resources and batteries;

- Fuel security;
- Dynamic models with storage;
- Planning models; and
- Include regional and international perspectives on unique or common things that exist on certain topics.

4. Future Meeting Dates

Ms. Iwanechko will reach out to the committee to schedule the next call for June.

Agenda Item 2
RISC Meeting
July 17, 2018

Reliability Issues Steering Committee Report on Resilience

Next Steps:

- July 10 – Send the Reliability Issues Steering Committee ("RISC") Outline and Next Steps
- July 17 – RISC Meeting
- August 24 – Send RISC Draft Report
- September 10/11 – RISC Deadline for Comments on Draft Report
- September 19/20 – RISC Call to Discuss Comments
- September 28 – Send RISC Final Draft
- October 5 – RISC Call to Vote on Final Draft
- October 12 – Send Final Report for Board of Trustees ("Board") November Package
- November 6-7 – Present to the Board

Outline:

- National Academies of Sciences, Engineering, and Medicine report: Enhancing the Resilience of the Nation's Electricity System.
- Department of Energy ("DOE") *Staff Report to the Secretary on Electricity Markets and Reliability* ("DOE Grid Report").RISC Commitment to Evaluate Resilience:
  - Introduction regarding the RISC as an advisory committee for strategic issues affecting reliability of the Bulk Power System ("BPS").
  - Overview of the Board's directive that the RISC reexamine resilience in light of the DOE Grid Report
- RISC Resilience Framework (Exhibit 1 to Report)
  - Description of the RISC Resilience Framework and its connection with (i) the National Infrastructure Advisory Council ("NIAC") Framework for Establishing Critical Infrastructure Resilience; and (ii) NERC's definition of the Adequate Level of Reliability ("ALR").
  - Summarize stakeholder committee coordination and comments on the RISC Resilience Framework.
- Federal Energy Regulatory Commission ("FERC") Resilience Proceeding:
  - Introduction regarding FERC's January 8, 2018 order terminating the DOE's originally proposed grid pricing rule and initiating a new proceeding examining resilience.
  - Summary of initial comments in the proceeding.
  - Summary of reply comments in the proceeding.
  - Overview of NERC's reply comments in the proceeding to preface the RISC's conclusions in this report.
    - Reference to the RISC's evaluation of comments in the FERC proceeding as part of its efforts to analyze resilience pursuant to the Board's directive.

- Workshop on Gas Infrastructure Risk and Associated Recommendations:
  - Summarize the purpose of the workshop and any takeaways.
- Conclusions:
  - Resilience is an Existing Part of NERC's Mission: Provide the RISC's analysis of resilience as an existing part of NERC's mission, leveraging materials and discussion from (i) Mark Lauby's Testimony at FERC's 2018 Reliability Technical Conference; (ii) NERC's reply comments in the resilience proceeding; and (iii) the May 2018 Member Representatives Committee ("MRC") Presentation (Exhibit 2 to Report).
    - Underscore the connection between resilience and (i) NERC's statutory mission regarding Reliable Operation of the BPS; and (ii) NERC's definition of the ALR for the Bulk Electric System ("BES").
    - Highlight existing NERC activities in support of resilience.
    - Revisit the RISC Resilience Framework's mapping of NERC program areas and activities to an enhanced presentation of the four outcome based abilities of the NIAC framework.
  - Recommendations for Additional NERC Activities Supporting Resilience: Recommend further activities based on stakeholder committee feedback on the RISC Resilience Framework.
    - Incorporate resilience as an explicit part of risk elements driving ERO Enterprise compliance monitoring efforts.
    - Evaluate potential operational impacts associated with Distributed Energy Resources interconnected with the BES.
    - Evaluate fuel assurance as an aspect of resilience, consistent with the Workshop on Gas Infrastructure Risk and Associated Recommendations.
    - Consider application of more timely and precise Interconnection-wide transmission loading relief procedures to manage extreme events more effectively.
    - Consider adding an explicit list of resilience related questions to Standards templates to enhance consideration of resilience as part of Reliability Standards development.
    - Develop a guideline that provides insights into the quality of emergency preparedness, such as the characteristics of good "communications protocols," or "emergency plans."
    - Assess the application of new technologies to improve resilience.
    - [Others?]

RISC 2019 Reliability Leadership Summit

Name	Suggested Topics	Suggested Speakers/Panelists	Willing to Moderate a Panel
Patti Metro		I think it is important to include cooperative/public power entities as speakers for the Summit. I can facilitate the cooperative sector involvement likely asking one of the three cooperative CEOs on the MRC (Greg Ford, Jay Bartlett, Don Gulley) to participate	Yes
Dave Osburn		Agrees w/PP CEO for a speaker	
Michael Walker		Andy Bochman from INL might be a good panelist for Panel 2	
Chuck Abell	On the last call I thought the general consensus was to replace one of the existing agenda items with a "Resilience" topic		

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DRAFT Agenda
2019 Reliability Leadership Summit

March 14, 2019 | 8:30 a.m. – 4:30 p.m. Eastern

The Mayflower Hotel
1127 Connecticut Ave NW
Washington, DC 20036
Meeting Room: XXXX

Continental Breakfast **7:30 – 8:30 a.m.**

Welcome Remarks **8:30 – 9:00 a.m.**
Peter Brandien, *RISC Chair; Vice President, System Operations, ISO New England*
Mark Lauby, *Senior Vice President and Chief Reliability Officer, NERC*

Morning Speaker **9:00 – 9:30 a.m.**
Federal Energy Regulatory Commission (?)
Department of Energy (?)

Panel 1 – Regulatory and Policymaking during Unprecedented Change **9:30 – 10:30 a.m.**

Panelists
National Energy Board of Canada
U.S. Department of Energy
SENER from Mexico
One State Policy Maker or Regulator
One Provincial Policy Maker or Regulator

Moderator
XXXX

The bulk power system (BPS) is experiencing transformational change, with a shift in fuel-mix and accelerated technology deployment. With this change, new reliability risks emerge that need to be identified, understood, and mitigated.

This panel will bring together regulators and policy makers to provide their views on the particular needs and challenges they face with this transformation. Opportunities for policy makers, industry, and other stakeholders to work together in addressing these challenges will be discussed as part of a collaborative effort to shape the energy landscape of the future.

Break **10:30 – 10:45 a.m.**

Panel 2 – Identification and Mitigation of Significant Risks to Reliability: Existing and Emerging Landscape of Risks **10:45 a.m. – 12:00 p.m.**

Panelists
4 Regionally Diverse Organizations

Moderator
XXXX

The nation's critical infrastructure serves as the backbone of our nation's economy, security, and health. Maintaining the security of our nation's critical infrastructure, both physical and cyber, and addressing reliability challenges from extreme natural events, will continue to be a high priority for industry, policy makers, and regulators. As the risk landscape evolves, efforts will be needed to further our understanding of the impacts from new potentially disruptive events which challenge the security and reliability of the BPS.

Do opportunities exist for industry to further strengthen BPS security, reliability, and resilience through careful planning so new technology integration supports reliability and organizational goals, while at the same time not increasing vulnerabilities? Beyond the current NERC Reliability Standards, how can industry include security perspectives alongside reliability and resilience of the BPS in its planning and operations? This panel will also discuss existing and emerging international, national, and regional BPS reliability risks. Potential mitigation approaches and next generation modeling requirements will also be discussed.

Lunch **12:00 – 12:45 p.m.**
Located in XXXX

Afternoon Speaker **12:45 – 1:15 p.m.**
A Luminary from our Industry

Panel 3 – Providing Assurance for the Availability of Adequate Fuel Delivery to Satisfy Energy Needs
1:15 – 2:30 p.m.

Panelists
4 panelists focused on assuring sufficient fuel infrastructure is available to support an adequate level of reliability.

Moderator
XXXX

As the system transforms to a future generation-mix that includes gas, wind, solar, and battery at higher levels than the current levels, the ability to assure sufficient energy is available to meet the needs of consumers is being emphasized. To assure resource adequacy and operational reliability, addressing this transition is crucial. How should industry, policy makers, and the ERO Enterprise work together to ensure

sufficient infrastructure is in place to assure that generation and necessary fuel resources are available to support the continued reliable operation of the BPS during this transition?

Break **2:30 – 2:45 p.m.**

Panel 4 – Open Discussion **2:45 – 4:15 p.m.**

Moderators
Two RISC Members

In this open-format discussion, Summit attendees will share thoughts and ideas on the priority and significance of BPS reliability risks. This discussion will concentrate on distilling the observations and themes discussed in the earlier panels, identifying potential blind spots or risks not revealed during the Summit panels or from general industry experience, and outlining strategic approaches for consideration by the ERO Enterprise, industry, policy makers, regulators, and other stakeholders in addressing significant emerging reliability risks. Discussion items can be, but are not limited to, practical BPS operations and planning, policy development at the FERC, NERC, or Regional Entity level (*e.g.*, standards and requirements), critical infrastructure protection, etc. *See* reference material: 2018 ERO Reliability Risk Priorities Report.

Closing Remarks **4:15 – 4:30 p.m.**
Jim Robb, *President and CEO, NERC*

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FERC Reliability Technical Conference
Panel II: Advancing Reliability and Resilience of the Grid

Remarks of Mark Lauby, Senior Vice President and Chief Reliability Officer
North American Electric Reliability Corporation
July 31, 2018

On behalf of the North American Electric Reliability Corporation (NERC), I appreciate the Commission's focus on advancing the reliability and resilience of the grid. As the Electric Reliability Organization (ERO), a highly reliable and secure grid is at the heart of our vision and the very foundation of the ERO Enterprise. NERC, and the Regional Entities which make up the ERO Enterprise, work with industry every day to identify risks to reliability, prioritize actions, and implement mitigation strategies. This panel is an opportunity to review the ERO Enterprise's leadership on advancing the reliability and resilience of the grid. NERC's response herein expands upon its filing outlining its comments to FERC's New Proceeding.

A bulk power system that provides an adequate level of reliability is a resilient one. NERC's activities, since its inception, have focused on the ability to withstand, manage event impacts, and respond to emerging issues and risks to ensure the Reliable Operation of the bulk power system. As the ERO, NERC must identify new and emerging risks to reliability. Resilience is a performance characteristic of the Reliable Operation of the bulk power system, and is a critical part of the ERO Enterprise's activities. Per its statutory mission, NERC has an essential leadership role in analyzing risks to reliability and resilience. Further, as a learning industry, NERC has supported sharing of lessons learned, and monitors system performance to identify existing and emerging risks. For over 50 years, as NERC's 50th anniversary was just celebrated in June 2018, "reliability" for the bulk power system has been defined to consist of two fundamental and aspirational concepts:

- ***Adequacy*** *is the ability of the electric system to supply the aggregate electric power and energy requirements of the electricity consumers* ***at all times****, taking into account scheduled and reasonably expected unscheduled outages of system components.*
- ***Operating reliability*** *is the ability of the electric system to* ***withstand sudden disturbances*** *such as electric short circuits or unanticipated loss of system components.*

While construction and operation of a system able to withstand impacts from all potential risks is a difficult and costly goal to realize, it is feasible and imperative to establish an adequate level of reliability. A balance is achieved by coupling the ability to withstand impacts to certain design levels, while incorporating resilience measures, all meant to mitigate impacts from risks to reliability and maintain the Reliable Operation of the bulk power system.

In August, 2017, the United States Department of Energy (DOE) issued a Staff Report to the Secretary on Electricity Markets and Reliability. A recommendation made in the report requested NERC consider resilience in its mission. Namely:

> *NERC should consider adding resilience components to its mission statement and develop a program to work with its member utilities to broaden their use of emerging ways to better incorporate resilience.*

After review of the aforementioned DOE report and its recommendations, NERC's Board of Trustees (Board) took action to advance NERC's existing leadership in resilience. The Board directed the Reliability Issues Steering Committee (RISC) to reexamine resilience and its definition, propose a resilience framework, review NERC's ongoing activities and their contributions to resilience, and make recommendations for any additional actions. The initial results of this work appeared in NERC's comments to FERC's New Proceeding, and will be further documented in a RISC report to the Board.

Resilience is part of the Reliable Operation of the Bulk Power System

As called for in section 215 of the Federal Power Act, NERC develops Reliability Standards based on what is necessary to achieve an adequate level of reliability for Reliable Operations. When the Commission certified NERC as the ERO, they ordered that a definition of the adequate level of reliability be submitted to FERC.

NERC developed, filed, and later updated a definition of the adequate level of reliability along with a technical report to guide Reliability Standards development, Reliability Assessments, and technical committee work. In particular, the adequate level of reliability is defined as the state that design, planning, and operation of the bulk electric system will achieve when five performance objectives are met. The adequate level of reliability Performance Objectives are as follows:

1) The bulk electric system does not experience instability, uncontrolled separation, Cascading, or voltage collapse under normal operating conditions and when subject to predefined Disturbances.
2) Bulk electric system frequency is maintained within defined parameters under normal operating conditions and when subject to predefined Disturbances.
3) Bulk electric system voltage is maintained within defined parameters under normal operating conditions and when subject to predefined Disturbances.
4) Adverse Reliability Impacts on the bulk electric system following low probability Disturbances (e.g., multiple contingences, unplanned and uncontrolled equipment outages, cyber security events, and malicious acts) are managed.
5) Restoration of the bulk electric system after major system Disturbances that result in blackouts and widespread outages of bulk electric system elements is performed in a coordinated and controlled manner.

The adequate level of reliability also lists two assessment objectives for purposes of assessing risks to reliability:

1) Bulk electric system transmission capability is assessed to determine availability to meet anticipated bulk electric system demands during normal operating conditions and when subject to predefined Disturbances.
2) Resource capability is assessed to determine availability to the bulk electric system to meet anticipated bulk electric system demands during normal operating conditions and when subject to predefined Disturbances.

Each objective addresses Reliable Operation of the bulk electric system over four time frames:

1) **Steady state:** the period before a disturbance and after restoration has achieved normal operating conditions
2) **Transient:** the transitional period after a disturbance and during high-speed automatic actions in response
3) **Operations response:** the period after the disturbance where some automatic actions occur and operators act to respond
4) **Recovery and system restoration:** the time period after a widespread outage through initial restoration to a sustainable operating state and recovery to a new steady state

These periods of time correspond to the four outcome-based abilities of both the National Infrastructure Advisory Council (NIAC) resilience framework and the Commission's proposed definition of resilience outlined in its New Proceeding on "Grid Resilience in Regional Transmission Organizations and Independent System Operators": (1) robustness; (2) resourcefulness; (3) rapid recovery; and (4) adaptability/lessons learned. Hence, resilience is part of the Reliability Operation of the bulk power system, pertaining to reliability before, during, immediately after, and in the longer-term after an event.

By defining specific performance and assessment objectives for the bulk power system that include elements of resilience, the adequate level of reliability as defined by NERC supports a highly reliable and secure grid. Namely, as indicated in the NIAC framework and FERC's proposed definition, industry has designed a reliable bulk power system that is robust to absorb disturbances, resourcefully operated, and rapidly recovers in a coordinated and controlled manner after an event. Lessons learned are actively considered during and after any events for potential structural and non-structural improvements.

The RISC recommended resilience framework is based on the adequate level of reliability and the NIAC Framework for Establishing Critical Infrastructure Goals (relied upon by the Commission for its proposed definition of resilience). The RISC suggested two enhancements to the NIAC proposed outcome-based abilities, shown in red:

- **Robustness**—The ability to continue operations in the face of disaster. In some cases, it translates into designing structures or systems to be strong enough to take a foreseeable punch. In others, robustness requires devising substitute or redundant systems that can be brought to bear should something important break or stop working. Robustness also entails investing in and maintaining

elements of critical infrastructure so that they can withstand low probability but high consequence events.

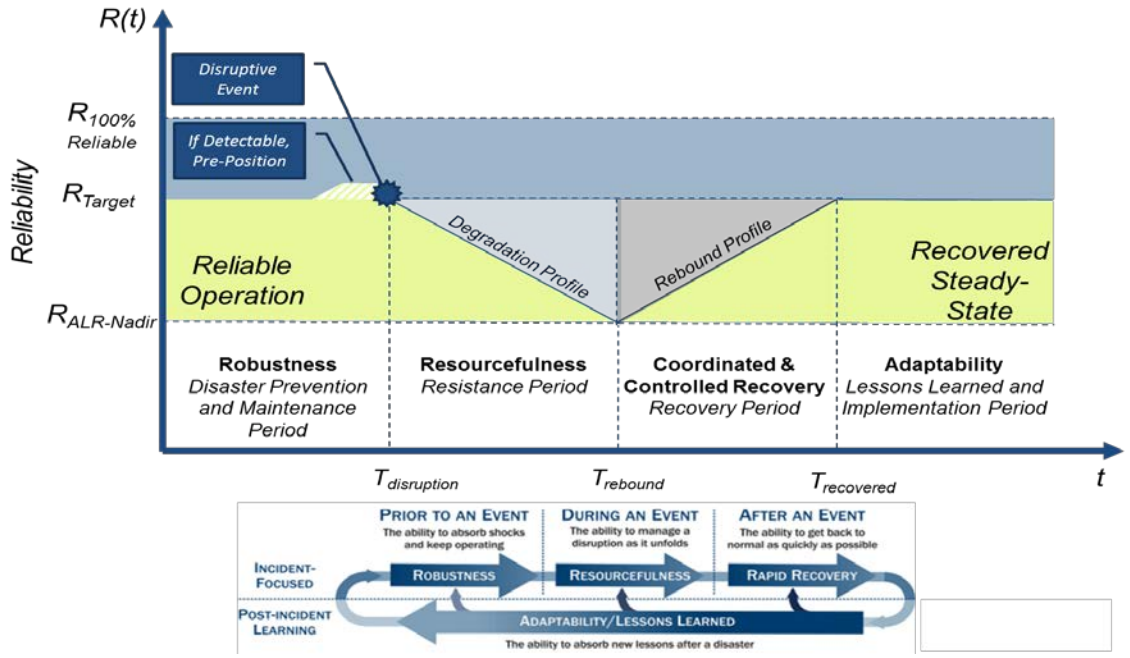
- **Resourcefulness**—The ability to skillfully detect and manage a disaster as it unfolds. It includes identifying options, prioritizing what should be done both to control damage and to begin mitigating it, and communicating decisions to the people who will implement them. Resourcefulness depends primarily on people, not technology.
- **Rapid recovery**—The capacity to get things back to normal as quickly as possible after a disaster in a coordinated and controlled manner. Carefully drafted contingency plans, competent emergency operations, and the means to get the right people and resources to the right places are crucial.
- **Adaptability**—The means to absorb new lessons that can be drawn from a catastrophe. It involves revising plans, modifying procedures, and introducing new tools and technologies needed to improve robustness, resourcefulness, and recovery capabilities before the next crisis.

"Detect" was added to "resourcefulness," specifically focused on the ability to "detect" a cyber or physical attack enabling industry response. Further, "coordinated and controlled manner" added to "rapid recovery" to represent the actions industry employs to ensure that the system restoration is done in a thoughtful and deliberate manner in harmony with all other impacted registered entities. Though these proposed enhancements do not significantly alter the direction of NIAC's defined abilities, it provides an update and clarification.

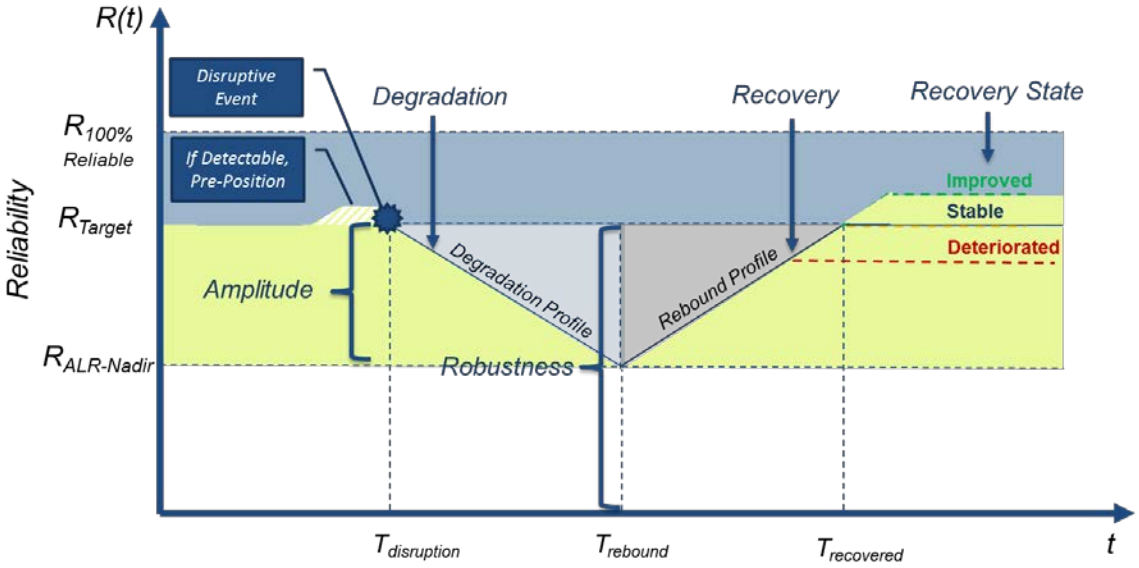
A Model for Reliable Operation of the Bulk Power System

Using the NIAC resilience framework, the RISC created a model that illustrates and enables measurement of system performance, or resilience, and provides an understanding of the elements needed to support the Reliable Operation of the bulk power system. The RISC resilience framework underscores NERC's longstanding focus on aspects of resilience and emphasis on reexamining the issue in the face of the changing resource mix.

The RISC resilience framework reflects the realization that reliable operation varies and is a function of time. Recognizing that the bulk power system cannot withstand all potential events, an adequate level of reliability must be provided so that the system can be reliably operated even with degradation in reliability due to an event. Further the system must have the ability to rebound or recover when repairs are made, or system conditions alleviated. The Figure below provides a graphic of the model.



Measuring the profile represented in this model provides relative characteristics of system performance, identifies areas where improvements may be desired, and post events, measure the success from system improvements. Some of the key areas that lend themselves for measurement are robustness, amplitude, degradation, recovery, and recovery state. The Figure below provides representation of these potential performance measures.



These performance measures are defined as:

- **Robustness:** the measured ability to withstand certain threats;
- **Amplitude:** a measure of the impact on bulk power system performance;
- **Degradation:** a measure of a change in system response with respect to an impact of varying amplitude;
- **Recovery:** a measure of the rate at which the system returns (rebounds) to a normal or stable state after the disruptive event, including any preparation time; and
- **Recovery state:** the state of bulk power system performance following the recovery period.
  - Stable
  - Improved
  - Deteriorated

These performance measures can be used for projected simulations as well as post events. Developing consistent measurement approaches will support relative comparisons towards achievable goals.

As an enhanced yardstick of reliability, resilience is reflected throughout NERC's programs. For instance, NERC's definition of adequate level of reliability includes a performance outcome providing for expeditious recovery from major system disturbances. NERC's activities focused on resilience encompass reliability standards, reliability assessments and performance analysis, and security.

Reliability Standards, Reliability Assessments and Performance Analysis, and Situational Awareness and Information Sharing Support Resilience

1) **NERC Reliability Standards** work together to establish a portfolio of performance-based outcome, risk reduction, and capability standards applicable to entities within NERC's jurisdiction and designed to support Reliable Operations. Most standards deal with fundamental parameters required to sustain reliability of the bulk power system under normal conditions: no instability, uncontrolled separation, cascading, or voltage collapse, with frequency and voltage held within defined parameters. NERC has a family of emergency preparedness and operations standards covering such topics as blackstart capability, system restoration coordination, and geomagnetic disturbance operations. Several Reliability Standards relate to the bulk power system's capability to withstand disturbances in anticipation of potential events, manage the system after an event, and/or prepare to restore or rebound after an event. In addition, certain Reliability Standards codify obligations to implement lessons-learned and thereby adapt after an event. NERC also has collaborated with FERC and Regional Entities on industry's response and recovery plans called for in NERC's Reliability Standards to assess their quality and make recommendations, with the results documented in a joint report.

2) **NERC Reliability Assessment and Performance Analysis, and the Events Analysis program** activities address resilience in multiple timeframes:

   a. **Reliability Assessments** in and of itself is a component of resilience, as it serves as a credible source of information for policy makers and stakeholders. NERC has a statutory responsibility to independently assess the reliability and adequacy of the bulk power system. Each year, NERC publishes the 10-year outlook for reliability and seasonal reports examining adequacy for the summer and winter seasons. NERC also conducts special assessments evaluating the reliability implications of major topics and trends. Collectively, these annual and special assessments form the technical foundation upon which NERC identifies emerging risks, providing actionable information for NERC, industry stakeholders, and policymakers. At a high level, Reliability Assessments evaluate the: 1) adequacy of resources to meet demand and energy requirements; 2) sufficiency of essential reliability services; 3) capability of the transmission system to accommodate projected resources and demand; 4) vulnerabilities to fuel supply, transportation, and delivery; and 5) ability to manage extreme conditions. NERC also published a report on resilience to events that result in severe impacts, and recently published a report specifically evaluating bulk power system reliability impacts as a result of disruptions to the natural gas system.

   b. **Performance Analysis** assesses the current trends based on historical performance of the bulk power system. This is annually documented **in** the State of Reliability Report which provides additional detail on how NERC uses reliability indicators to tie the performance of the bulk electric system to the reliability performance objectives in the adequate level of reliability.

   c. **Event Analysis** activities also serve an integral component of NERC's resilience efforts by supporting continuous improvement and learning from past events. Through these efforts, NERC evaluates bulk power system events by undertaking appropriate levels of analysis to determine the causes of the events, promptly assuring tracking of corrective actions designed to prevent recurrence, and providing lessons learned to the industry.

3) **Situational Awareness and Information Sharing** activities as part of the E-ISAC and Bulk Power System Awareness (BPSA) also contribute to resilience, and are carried forward by two complementary activities:

   a. The E-ISAC serves as the primary security communications channel for the electricity industry and enhances industry readiness and ability to respond to security threats, vulnerabilities, and incidents that could affect the bulk power system. The E-ISAC's Cybersecurity Risk Information Sharing Program (CRISP) also provides a voluntary program to facilitate real-time, computer-to-computer data exchange involving potential security threats identified through monitoring participating utility networks. Further, the E-ISAC holds a biannual GridEx conference to allow participants the opportunity to self-assess their emergency response and recovery plans through simulated security exercises featuring stresses on the system.

   b. The NERC BPSA collects and analyzes information on system disturbances and other incidents that affect the bulk power system. The BPSA then disseminates this information to internal departments, registered entities, regional organizations, and governmental agencies as

necessary. In addition, the BPSA monitors ongoing storms, natural disasters, and geopolitical events that may affect or are currently affecting the bulk power system. The BPSA issues alerts to NERC registered entities and the electricity sector upon discovering, identifying or receiving information that is critical to ensuring the reliability of the bulk power system. These activities by the E-ISAC and BPSA help support a bulk power system better able to anticipate, withstand, respond to, recover from, and learn from events.

Addressing Reliability Risks

As stated throughout, resilience is a performance characteristic of reliability. Therefore, improved reliability is completed through improvements to robustness, reliability degradation management, and system rebound and return to suitable state. A key inflection point in the model of the Reliable Operation of the bulk power system is the point where a disruption to reliability occurs. This disruption can occur due to the usual known risks, or if there is an appearance of a new emerging risk that can disrupt the system, such as a changing resource mix. Therefore, this risk landscape needs to be continually monitored to comprehend substantive changes. Doing so supports risk identification and an evaluation of the adequacy of NERC's reliability toolkit. Based on data collection, statistical analysis and simulations of projected systems, emerging risks can be identified. Once they are understood, the ERO Enterprise and industry can prioritize the risks and work together to mitigate them.

NERC's assessments of the changing resource mix identified significant emerging risks for reliability. For example, the past few winters have shown the potential impacts from increased reliance on natural gas and oil during cold weather conditions. These experiences underscore the importance of recommendations in NERC's recent assessments. In fact, four of NERC's assessment areas now meet their peak electric demand with greater than 50 percent of that sourced from natural-gas-fired electric generation.

To maintain reliability for the future, it is important to continue learning from events caused by cold weather, while monitoring current trends. For example, forced outage rates and unit unavailability due to lack of fuel for gas-fired power units is increasing. These incidents tend to occur during winter months, however they are also experienced during the summer when pipelines are under maintenance or storage facilities need to be topped off. Units made unavailable due to lack of fuel is becoming a more frequent occurrence and must be managed during normal operations.

Studies by planners on the one- to five-year time horizon are needed to determine the impacts on the bulk power system from the loss of fuel during periods when gas is diverted to firm customers, or when maintenance takes gas pipelines out-of-service for extended periods of time. Because natural gas provides "just-in-time" fuel and is not stored on site, improved fuel assurance should be considered to reduce the risk from fuel interruption that might result from common-mode failures causing widespread fuel delivery impacts. If the impacts are significant and risks increasing, Corrective Action Plan(s) may be needed to assure sufficient fuel is available to maintain the continued Reliable Operation of the bulk power system.

Many risks are local in nature. Consider how hurricanes impact some parts of North America, while icing impacts others areas. For this reason, NERC's standards activities focus on being performance based,

enabling local solutions to provide the performance desired. In fact, this is the strength of the ERO Enterprise's regional model which enables local solutions, and, if required, Reliability Standards to address local risks. Coupled with the ability to address broad performance objectives, NERC's continent-wide standards complement and provide flexibility toward addressing high level risks, such as critical infrastructure protection overall interconnection requirements such as frequency response. Standards and requirements are reviewed, updated and in some cases retired, adapting to the lessons learned and the needs of a changing system.

Further, as discussed previously, the ERO Enterprise's reliability toolkit encompasses reliability assessments and performance analysis enabling continued monitoring of risks, and reliability/resilience improvement through Reliability Standards, guidelines, assessments, Alerts, and industry outreach. Being vigilant and monitoring the changing risk landscape and matching the reliability tools to manage and mitigate impacts are a critical part of the ERO Enterprise's activities.

Engagement with the States

State government is a member of NERC's stakeholder body, and the Commission asks an important question concerning our engagement with the states. Changes that are rapidly taking place at the distribution level can impact bulk power system reliability. NERC's insights into reliability risk and security can help support the states in exercising their responsibilities. Accordingly, state public service commissions are widely represented in NERC's governance structure and technical committees. For example, two state commissioners participate actively on the Member Representatives Committee which advises NERC's Board and approves Trustee appointments. Two staff members of state commissions serve on the Operating, Planning, and Standards committees, and one staff member serves on the Compliance and Certification Committee.

In addition to these activities, NERC regularly engages with the National Association of Regulatory Utility Commissioners (NARUC) in disseminating reliability assessment findings and technical guidance. The Regional Entities also work directly with individual commissions and NARUC. On the security front, NERC's E-ISAC has increased engagement with the states in promoting participation by Governors and emergency management officials in the GridEx exercise.

Conclusion

A bulk power system that provides an adequate level of reliability is a resilient one. Resilience is a performance characteristic of the Reliable Operation of the bulk power system, and is a critical part of the ERO Enterprise's activities. As the ERO, NERC has a responsibility, working with industry experts and other stakeholders, to identify new and emerging risks to reliability. One of our paramount goals is to avoid the potential for large-scale disruptions to the bulk power system. Further, if and when these disruptions occur, an adequate level of reliability must be sustained. By leveraging industry expertise, informed by sound technical analysis, and support by the ERO Enterprise, NERC's activities support a learning environment to identify risks and mitigate them in pursuit of improved reliability performance.

The ERO Enterprise's leadership role is essential to maintaining a focus on conventional risk, while anticipating emerging risks that are less understood during a period of revolutionary change in the electricity sector. By placing a spot-light on known and emerging risks, the ERO Enterprise, working with industry and all stakeholders, strives to ensure a highly reliable and secure bulk power system.

NERC will continue to assess whether further activities are appropriate to support a resilient grid, consistent with the overarching scope of the adequate level of reliability, the RISC resilience framework, and any applicable Commission orders.

						Management's Risk Mitigation Activities					
Risk ID	**Primary Contact(s)**	**Risk Name**	**Description of Risk**	Impact	Likelihood	**Internal Control Description (Include any shared internal controls)**	**Control Owner(s)** *(Director or higher)*	**Internal Control Effectiveness Impact *(Scale 1-10 See Risk Criteria)***	**Internal Control Effectiveness Likelihood *(Scale 1-10 See Risk Criteria)***	Residual Risk Factor Impact (RRF) **FORMULA**	Residual Risk Factor Likelihood (RRF) **FORMULA**
1		**Changing Resource Mix**	1. The intensity and pace of change (penetration rates of certain resources) and the types of change (the specific resources) are influenced by policy and economic factors in addition to state, provincial, and federal initiatives, which sometimes influence one region, province, or state in a certain direction more than another. Since the BPS is interconnected, these effects cannot be isolated to stay within political boundaries. Over time, regulatory initiatives, along with expected lower production costs and aging generation infrastructure, will likely alter the nature, investment needs, and dispatch of generation considering the replacement of large rotating synchronous central-station generators with natural-gas-fired generation, renewable forms of asynchronous generation, demand response, storage, smart- and micro-grids, and other technologies. Planners and operators may be challenged to integrate these inputs and make necessary changes. 2. The ability of regulators and industry to foresee and address reliability issues associated with these changes to the resource mix is complicated by: a. Ancillary services, such as the ERS (e.g., voltage control and reactive support, frequency response, ramping/balancing, blackstart) on the BPS that could be further eroded by the retirement of many large rotating synchronous central station generating units. b. The integration of large amounts of new resource technologies, DER, and behind-the-meter resources; the lack of low-voltage ride through; inaccurate load data to accurately			Near-term (1–2 year time frame): 1. The ERO Enterprise and industry need to provide more effective guidance to evaluate and improve controllable device settings10 and how the interaction between these devices can affect BPS reliability, particularly during transient conditions. 2. The ERO Enterprise should augment new systems being developed to gather data and insights into DER (i.e., customer, distribution, or otherwise), and Reliability Coordinators should formulate plans to achieve the appropriate level of transparency and control such that implications to the BPS can be better understood. 3. Expand the collaboration, through the technical committees, with the RTOs/ISOs Council, Balancing Authorities in non-RTO/ISO market areas, other registered entities, and regulators on ERS recommendations for effective implementation as they emerge. 4. Based on assessments on the reliability impacts of the changing resource mix, policymakers should promote and engage in high-level collaboration among market operators (RTOs/ISOs), balancing authorities					

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			forecast anticipated demand; and the inability to observe and control DER. c. The need for data and information about the character of resources in the planning, operational planning, and operating time horizons so the system can be planned and operated while accounting for the contributions and implications to reliability of all resources, regardless of their location or configuration. d. The interaction and performance of control systems during transient events that may result in new common-mode failures that may not have been anticipated, (e.g., the inverter performance as demonstrated during the Blue Cut fire event).			in non-RTO/ISO market areas, and provinces and states to establish long-term strategies for aligning policies with reliability needs. 5. NERC should ensure that the IRPTF completes its scope of work on schedule and implements the recommendations needed to maintain reliability. The recommendations should include addressing any gaps in NERC Reliability Standards					