Call to Order

NERC Antitrust Compliance Guidelines—Public Announcement

Consent Agenda - Approve

1. Minutes*
   a. December 14, 2016 Conference Call
   b. November 2, 2016 Meeting

2. Committee Membership and Charter Changes*
   a. Election and Appointment of NERC Officers
   b. Reliability Issues Steering Committee Membership
   c. Personnel Certification Governance Committee Membership
   d. Operating Committee Charter
   e. Critical Infrastructure Protection Committee Charter

Regular Agenda

3. Remarks and Reports
   a. Opening Remarks by Board Chair
   b. Remarks by Patricia Hoffman, Acting Assistant Secretary, DOE
   c. Remarks by Murray Doehler, Chair, CAMPUT
   e. President’s Report
   f. Board of Trustees Self-Assessment Results
4. Standards*
   a. Project 2016-01 Modifications to TOP and IRO Standards (IRO-002-5, TOP-001-4) – **Adopt**
   b. Project 2015-08 Emergency Operations (EOP-004-4, EOP-005-3, EOP-006-3, EOP-008-2) – **Adopt**
   c. Project 2016-02 Modifications to CIP Standards (CIP-003-7) – **Adopt**
   d. Texas RE Standards Development Process Revisions – **Approve**
   e. WECC Regional Reliability Standard VAR-501-WECC-3 – **Adopt**

5. Other Matters and Reports*
   a. Efficiency and Effectiveness Metric – **Approve**
   b. Distributed Energy Resources Task Force Final Report – **Accept**
   c. Proposed Amendments to the Bylaws of Texas RE – **Approve**
   d. FERC Data Access – **Update**
   e. U.S. Government Relations: New Administration Appointments – **Update**
   f. Western Interconnection Assurance Project – **Information**
   g. Mexico Update – **Update**
   h. E-ISAC Quarterly Update – **Information**

6. Committee Reports*
   a. Operating Committee
   b. Planning Committee
   c. Critical Infrastructure Protection Committee
      i. CIPC Strategic Plan 2015-2018 – **Approve**
   d. Member Representatives Committee
   e. Personnel Certification Governance Committee
   f. Standards Committee
      i. Standards Committee Strategic Work Plan 2017-2019 – **Approve**
   g. Reliability Issues Steering Committee
   h. Compliance and Certification Committee
      i. 2017 Work Plan – **Approve**
      i. Electricity Subsector Coordinating Council

7. Forum and Group Reports*

c. North American Generator Forum

8. Board Committee Reports

a. Corporate Governance and Human Resources
   i. 2017 Board Committee Assignments – Approve
   ii. 2016 Contribution to Savings and Investment Plan – Approve

b. Compliance

c. Finance and Audit
   i. NERC 2016 Unaudited Results—Actual to Budget Variance Analysis – Accept
   ii. Combined ERO Enterprise 2016 Unaudited Results—Actual to Budget Variance Analysis – Accept
   iii. Regional Entity 2016 Unaudited Results—Actual to Budget Variance Analysis – Accept

d. Enterprise-wide Risk

e. Standards Oversight and Technology

9. Adjournment

*Background materials included.*
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.
Call to Order and Chair's Remarks
Roy Thilly, Vice Chair and chair of the meeting, called to order the duly noticed open meeting of the Board of Trustees ("Board") of the North American Electric Reliability Corporation ("NERC") on December 14, 2016, at 11:00 a.m. Eastern Time, and a quorum was declared present. The agenda is attached as Exhibit A.

Present at the meeting were:

Board Members
Roy Thilly, Chair
Paul F. Barber
Gerald W. Cauley, President and Chief Executive Officer
Janice Case
Robert G. Clarke
Kenneth W. DeFontes
George Hawkins
Kenneth G. Peterson
Jan Schori
Roy Thilly

NERC Staff
Charles A. Berardesco, Senior Vice President, General Counsel, and Corporate Secretary
Tina Buzzard, Associate Director
David Calderon, Engineer
Thomas Coleman, Director of Reliability Assessment
Kristen Iwanechko, Associate Director of ERO Enterprise Operations and Strategic Planning
Mark G. Lauby, Senior Vice President and Chief Reliability Officer
John Moura, Director of Reliability Assessment and System Analysis
Janet Sena, Senior Vice President and Director of Policy and External Affairs

Mr. Thilly noted that Mr. Fred Gorbet, Chair of the Board, was not present due to a pre-existing conflict, and that Mr. Thilly as Vice Chair of the Board was acting as chair of the meeting.
NERC Antitrust Compliance Guidelines
Mr. Thilly directed the participants’ attention to the NERC Antitrust Compliance Guidelines included with the advance meeting materials, and directed that any questions regarding antitrust compliance or other related matters be directed to Mr. Berardesco.

2016 Long-Term Reliability Assessment
Mr. Thilly thanked the Trustees who had provided comments on the draft 2016 Long-Term Reliability Assessment report (“LTRA”) which had been included in the advance meeting materials, and also thanked ERO Enterprise staff and industry reviewers for all of their efforts. Mr. Moura introduced the LTRA and provided an overview of the report and key issues. Mr. Coleman reviewed the requirements for the LTRA in the NERC Rules of Procedure and the approach taken in developing the report. Mr. Calderon outlined the key findings, and Mr. Coleman reviewed the LTRA recommendations. The Board discussed the LTRA, including the executive summary, recommendations, and overall body of the report.

After discussion, and upon motion duly made and seconded, the Board accepted the LTRA, endorsed the recommendations contained therein, and authorized its publication.

Mr. Moura discussed the distribution of the LTRA, including congressional and regulatory outreach.

Adjournment
There being no further business, and upon motion duly made and seconded, the meeting was adjourned.

Submitted by,

Charles A. Berardesco
Corporate Secretary
Call to Order
Mr. Frederick W. Gorbet, Chair, called to order the duly noticed open meeting of the Board of Trustees (the “Board”) of the North American Electric Reliability Corporation (“NERC” or the “Corporation”) in Atlanta, Georgia, on November 2, 2016, at 9:00 a.m. Eastern, and a quorum was declared present. The agenda is attached as Exhibit A.

Present at the meeting were:

Board Members:
Frederick W. Gorbet, Chair
Paul F. Barber
Janice B. Case
Gerald W. Cauley, President and Chief Executive Officer
Robert G. Clarke
Kenneth W. DeFontes, Jr.
David Goulding
George S. Hawkins
Kenneth G. Peterson
Jan Schori
Roy Thilly

NERC Staff
Charles A. Berardesco, Senior Vice President, General Counsel, and Corporate Secretary
Tina Buzzard, Associate Director
Stan Hoptroff, Vice President and Chief Technology Officer
Scott Jones, Vice President of Finance and Treasurer
Mark G. Lauby, Senior Vice President and Chief Reliability Officer
Ken McIntyre, Vice President of Standards and Compliance
Sonia Mendonça, Vice President of Enforcement and Deputy General Counsel
James Merlo, Vice President of Reliability Risk Management
Timothy E. Roxey, Vice President and Chief E-ISAC Operations Officer
Marcus H. Sachs, Senior Vice President and Chief Security Officer
Janet Sena, Senior Vice President, Director of Policy and External Affairs
Michael Walker, Senior Vice President and Chief Financial and Administrative Officer
NERC Antitrust Compliance Guidelines
Mr. Berardesco noted the public nature of the meeting and directed the participants’ attention to the NERC Antitrust Compliance Guidelines, which had been included with the advance meeting materials.

Welcoming Remarks/Executive Session
Mr. Gorbet welcomed attendees to the meeting. He expressed his appreciation to Federal Energy Regulatory Commission Commissioner Colette Honorable for her attendance, as well as the attendance of Liz Dalton of the Department of Energy. Mr. Gorbet also recognized several FERC staff members in attendance, including David Ortiz and Joe McClelland.

Consent Agenda
Upon motion duly made and seconded, the Board approved the consent agenda as follows:

Minutes
The draft minutes for the August 11, 2016 meeting were approved as presented to the Board at this meeting.

Committee Membership Appointments and Charter Revisions

Compliance and Certification Committee Membership

RESOLVED, that the Board hereby approves the appointment of the following individuals as members of the Compliance and Certification Committee, each for a term of three years:

- Daniela Cismaru of Alberta Electric System Operator, representing the Canada Provincial sector

Planning Committee Membership

RESOLVED, that the Board hereby approves the appointment of the following individual to the Planning Committee for a term ending in June 2018:

- Bob Ramaekers of Tenaska, representing the Electricity Marketer sector

Regular Agenda

Remarks by Board Chair
Mr. Gorbet reported that before the open meeting, as is its custom, the Board met in closed session with NERC management, and subsequently in executive session without NERC management, to review NERC management activities. Mr. Gorbet referenced the discussions during the prior day’s meeting, noting the value of the policy input before the meetings, and referenced the panel discussion during the Member
Representatives Committee ("MRC") meeting on distributed energy resources and the importance of the issues that were discussed

**Remarks by Commissioner Colette Honorable, Federal Energy Regulatory Commission**
Ms. Honorable thanked the Board and NERC staff, particularly Mr. Cauley and Ms. Sena, for their warm welcome, and the recognition of the FERC staff in attendance. She noted the passion around the work being done at NERC and the engagement of all stakeholders. Ms. Honorable expressed appreciation for the way NERC works with FERC, as two independent entities that must and do work together well. She expressed an open invitation for stakeholders to visit with her, as trust and respect are key in the type of working being done by NERC and FERC. Ms. Honorable cited examples where NERC and FERC complement each other, using the work around gas/electric interdependence and reliability assessments as key examples, and thanked Mr. Lauby and John Moura for their efforts in these areas. She cited the work being done to integrate Mexico into the ERO and the cooperative efforts with FERC, NERC and DOE.

**Remarks by Liz Dalton, Department of Energy**
Ms. Dalton provided an update on DOE rulemakings and reports, including FAST Act emergency authority rulemaking, strategic transformer reserve strategy, U.S./Canada grid strategy, Mexico strategy, Alysso Canyon implications and the quadrennial review. She noted the upcoming elections and the new approach to administration transitions, and encouraged interaction with transition teams after the election.

**President’s Report**
Mr. Cauley welcomed the regulatory staff that was present. Following on FERC Chairman Norman Bay’s remarks in Halifax, he noted that NERC and stakeholders are making a positive impact on BPS reliability as evidenced in the data, referencing Mr. Merlo’s presentation the prior day. Mr. Cauley commented on the expertise of industry that is being utilized to address recent FERC directives on GMD and supply chain as examples of industry engagement. He noted the continued success in integrating ERO Enterprise leadership, referencing the dissolution of the separate Regional Entity Management Group. With respect to key challenges, he referenced the transition to risk based compliance and enforcement and the implementation of new IT infrastructure across the ERO Enterprise to drive efficiencies and help enable consistent implementation. On the strategic plan metrics, Mr. Cauley noted the move to a smaller set of metrics that are outcomes based, i.e., designed to determine if BPS reliability is improving. With respect to the evolving partnerships with Canada and Mexico, he noted that these are more important than ever, as there is a need to ensure security as cross-border transactions increase. Mr. Cauley focused on key efforts going forward, including addressing gas/electric interdependence, resiliency of the grid, and changing technology. Mr. Lane Lanford commenting on behalf of the Regional Entity chief executives, and referenced the work around the development of the Compliance Monitoring guide as an example of the evolving alignment across the ERO Enterprise.

**Report on Semiannual Meeting of NERC Trustees and Regional Entity Boards**
Mr. Gorbet reported on the joint meeting of the ERO Enterprise board leadership, noting that there are designed to ensure communications are open and facilitate alignment. The group addressed a range of
issues, included promoting industry excellence beyond writing standards and enforcement, an update on Mexico and Canada initiatives and alignment of strategic plans across the ERO Enterprise.

Standards

Mr. McIntyre presented on the following Reliability Standards projects and other matters. After discussion, and upon motions duly made and seconded, the Board approved the following resolutions:

2017-2019 Reliability Standards Development Plan

RESOLVED, that the Board hereby approves the proposed 2017-2019 Reliability Standards Development Plan, as presented to the Board at this meeting, together with such changes as are necessary to reflect Federal Energy Regulatory Commission directives relating to GMD and supply chain.

FURTHER RESOLVED, that NERC management is hereby authorized to make the appropriate filings with applicable regulatory authorities, and take such further actions and make such further filings as are necessary and appropriate to effectuate the intent of the foregoing resolutions.

Florida Reliability Coordinating Council Regional Reliability Standard Development Process Manual Revisions

RESOLVED, that the Board hereby approves the proposed Florida Reliability Coordinating Council Regional Reliability Standard Development Process Manual revisions, as presented to the Board at this meeting.

FURTHER RESOLVED, that NERC management is hereby authorized to make the appropriate filings with ERO governmental authorities and take such further actions and make such further filings as are necessary and appropriate to effectuate the intent of the foregoing resolutions.

Response to FERC Directive to Change VRFs of IRO-018-1 and TOP-010-1 to High

RESOLVED, that the Board hereby approves the proposed changes to the Violation Risk Factors for Reliability Standard IRO-018-1 Requirement R1 and Reliability Standard TOP-010-1 Requirements R1 and R2 from “medium” to “high.”

FURTHER RESOLVED, that NERC management is hereby authorized to make the appropriate filings with ERO governmental authorities and take such further actions and make such further filings as are necessary and appropriate to effectuate the intent of the foregoing resolutions.

Interpretation of CIP-002-5

RESOLVED, that the Board hereby adopts the proposed Interpretation of Reliability Standard CIP-002-5.1, as presented to the Board at this meeting.
FURTHER RESOLVED, that NERC management is hereby authorized to make the appropriate filings with ERO governmental authorities and take such further actions and make such further filings as are necessary and appropriate to effectuate the intent of the foregoing resolutions.

WECC Interpretation BAL-002-WECC-2a

RESOLVED, that the Board hereby adopts proposed Regional Reliability Standard Interpretation BAL-002-WECC-2a for Arizona Public Service Company, as presented to the Board at this meeting.

FURTHER RESOLVED, that the Board hereby approves the associated implementation plan, as presented to the Board at this meeting.

FURTHER RESOLVED, that the Board hereby approves the Violation Risk Factors and Violation Severity Levels for the proposed Reliability Standard, as presented to the Board at this meeting.

FURTHER RESOLVED, that NERC management is hereby authorized to make the appropriate filings with ERO governmental authorities and take such further actions and make such further filings as are necessary and appropriate to effectuate the intent of the foregoing resolutions.

BAL-004-2 – Time Error Correction

RESOLVED, that the Board hereby adopts proposed standard document Implementation Plan for Reliability Standard BAL-004-0, as presented to the Board at this meeting.

FURTHER RESOLVED, that the Board hereby approves the proposed retirement of Reliability Standard BAL-004-0, as presented to the Board at this meeting.

FURTHER RESOLVED, that NERC management is hereby authorized to make the appropriate filings with ERO governmental authorities and take such further actions and make such further filings as are necessary and appropriate to effectuate the intent of the foregoing resolution.

Other Matters and Reports

2016 ERO Reliability Risk Priorities: RISC Recommendations
Mr. Peter Brandien, chairman of the Reliability Issues Steering Committee (the “RISC”), presented the RISC report for Board acceptance. He expressed his appreciation for the support of NERC staff and stakeholder engagement. Mr. Cauley noted the policy input, and that much of it could be reflected in future reports. Mr. Barber expressed his concerns around the aging work force challenges and his view that future reports should highlight that risk. After discussion, and upon motion duly made and seconded, the following resolution was approved:
RESOLVED, that the Board of Trustees hereby accepts the 2016 ERO Reliability Risk Priorities: RISC Recommendations to the Board, as presented to the Board at this meeting.

2017-2020 ERO Strategic Plan and Metrics
Mr. Lauby presented the ERO Strategic Plan and reliability metrics for approval. It was agreed that a number of the policy input comments could be included in the final metrics. Upon motion duly made and seconded, the following resolution was approved:

RESOLVED that the Board hereby approves the proposed 2017-2020 ERO Enterprise Strategic Plan and related Reliability Metrics, in substantially the form as presented to the Board at this meeting, together with such changes as are approved by the Chief Executive Officer and reported to the Board.

NERC Rules of Procedure Amendments
Ms. Mendonca summarized the proposed revisions to the NERC Rules of Procedure to implement an optional consolidated hearing process, as set forth in the advance agenda materials. Upon motion duly made and seconded, the Board approved the following resolutions:

RESOLVED, that the Board hereby approves the proposed amendments to Section 400 and Appendices 2 and 4C to the NERC Rules of Procedure, as presented to the Board at this meeting.

FURTHER RESOLVED, that NERC management is hereby authorized to make the appropriate filings with ERO governmental authorities and take such further actions and make such further filings as are necessary and appropriate to effectuate the intent of the foregoing resolution.

E-ISAC Quarterly Update
Mr. Sachs Marc presented the quarterly E-ISAC update, referencing the materials included in the advance agenda package, including various statistics, advisories and reports, a technology update, and a staffing update. Ms. Dalton noted DOE’s strong support of the E-ISAC and expressed appreciation for its work with DOE.

Update on Mexico
Mr. Cauley provided an update on Mexico discussions to join the ERO, noting the statutory requirements for NERC to seek such an outcome. He referenced some of the key issues, including the standards approval process and the details of responsibilities for compliance monitoring and enforcement. Mr. Cauley noted that an agreement could be reached before year end, which could require a special Board meeting for approval. He noted that in terms of budgets, 2017 would likely be a transition year to a more comprehensive approach for 2018.

Committee Reports
Representatives of the Standing Committees provided reports to the Board highlighting items from their written reports, which had been included with the advance meeting materials.
Operating Committee
Jim Case, Committee Chair, referenced the written report and noted several items, including the use of the work plan, an upcoming joint OC/PC meeting, and sharing of operating lessons learned.

Planning Committee
Brian Evans-Mongeon, Committee Vice Chair, referenced the written report, and noted key activities since the last Board meeting, including implementing the revised Committee charter and improved processes.

Critical Infrastructure Protection Committee
Marc Child, Committee Chair, summarized and highlighted portions of the written report, including the upcoming strategic and work plans, work on industry mutual assistance and distribution of key lessons learned from the Ukraine and “Internet of Things” cyberattacks. He also noted a need for the Committee to be more nimble as issues arise.

Member Representatives Committee
Nabil Hitti, MRC Chair, summarized the issues that had been discussed at the MRC meeting on the previous day, including the election of new officers. He noted that the MRC budget working group support NERC on enhancement of the NERC metrics. Mr. Hitti expressed his appreciation to NERC staff for their work in developing policy input background materials.

Personnel Certification Governance Committee
Brett Hallborg, Committee Chair, referenced the written report, focusing on efforts to update exams.

Standards Committee
Brian Murphy, Committee chair, noted that the written report had been reviewed the prior day.

Reliability Issues Steering Committee
Peter Brandien, Committee Chair, thanked stakeholder for their feedback on the RISC report. He noted the need for RISC nominees, and that the 2017 leadership summit would be held in March, to facilitate an earlier RISC report issuance.

Compliance and Certification Committee
Patti Metro, Committee Chair, referenced the written report, noting that the Committee will be posting the results of the CMEP review and that it had formed a task force to work on consistency issues with ERO Enterprise staff.

Electricity Subsector Coordinating Council
Mr. Cauley noted that the ESCC meeting at end of the month in light of the upcoming administration transition.

Forum and Group Reports

North American Energy Standards Board
Michael Desselle, NAESB Chair, referenced the written report, noting coordination with NERC on time error correction and support of Mexico as it transitions its energy structure.

North American Transmission Forum
Tom Galloway, Forum CEO, referenced the written report and highlighted the excellent coordination with NERC.

North American Generator Forum
Allen Shriver, Forum COO, referenced the written report and expressed his thanks for NERC hosting the recent annual meeting.

Board Committee Reports

Corporate Governance and Human Resources Committee
Mr. Clarke, Committee Chair, summarized the Committee’s open and closed meetings that occurred prior to this meeting, noting the Committee recommendation that the Board accept the Action Plans arising out of the ERO Enterprise Effectiveness Survey, the approval of the Board assessment materials, reviews of metrics and HR matters (noting the much improved attrition levels), changes to the Company’s approach on employee life insurance and 401K enrollment, and continued work on metrics for incentive compensation. Upon motion duly made and seconded, the following resolution was approved:

RESOLVED, that the Board, upon recommendation of the Corporate Governance and Human Resources Committee, hereby accepts the ERO Enterprise Effectiveness Survey Report and Action Plans, as presented to the Board at this meeting.

Compliance Committee
Ms. Case, Committee Chair, summarized the recent sessions of the Committee, including approvals of notices of penalty, the CMEP quarterly report, and presentations on misoperations and compliance guidance.

Finance and Audit Committee
Ms. Schori, Committee Chair, reported on the Committee’s recent meetings. She noted the recent FERC approval of the 2017 budgets and expressed her congratulations to ERO Enterprise financial staff. She also noted the Committee recommendation of Board acceptance of the third quarter financials, review of the 2016 audit plan and approval of the 2016 audit fees. Upon motion duly made and seconded, the following resolution was approved:

RESOLVED, that the Board, upon recommendation of the Finance and Audit Committee, hereby accepts the NERC Third Quarter 2016 Unaudited Statement of Activities, as presented to the Board at this meeting.
Enterprise-wide Risk Committee
Mr. Goulding, Committee Chair, summarized the work of the Committee, including an update on work and audit plans, upcoming regional entity audits and oversight efforts and CCC activities.

Standards Oversight and Technology Committee
Mr. Peterson, Committee Chair, reported on the Committee’s open meeting, including recommendation of the Reliability Standards Development Plan, review of the cost effectiveness pilot, receipt of the quarterly standards report and the review of IT activities.

Nominating Committee
Mr. Peterson, Committee Chair, reported that the Committee will be interviewing four trustee candidates later in November.

Closing Remarks
In his closing remarks, Mr. Gorbet thanked all participants and expressed his appreciation for the policy input the leadership of MRC Chair Hitti. He also thanked NERC staff for their efforts, noting the continued improvement in the quality of presentations. Mr. Gorbet also referenced all of the efforts that occur prior to and during the meetings from an administrative perspective, and thanked all NERC staff engaged in those efforts.

Adjournment
There being no further business, and upon motion duly made and seconded, the meeting was adjourned.

Submitted by,

Charles A. Berardesco
Corporate Secretary
Reliability Issues Steering Committee Membership

**Action**
Approve

**Background**
As required by the Reliability Issues Steering Committee (RISC) charter, the RISC Nominating Committee (RISCNC) solicited a pool of candidates to fill open stakeholder-based positions (at-large and MRC) on the RISC. The RISCNC recommends that the Board of Trustees approve the appointment of the following representatives, for the terms listed.

<table>
<thead>
<tr>
<th>Name</th>
<th>Title and Company</th>
<th>Term Ending</th>
</tr>
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<tbody>
<tr>
<td>Peter Brandien, Chair</td>
<td>Vice President, System Operations, ISO New England</td>
<td>January 31, 2019</td>
</tr>
<tr>
<td>Mark McCulla, At-Large Member</td>
<td>Vice President of Transmission Operations, Entergy</td>
<td>January 31, 2019</td>
</tr>
<tr>
<td>Nelson Peeler, At-Large Member</td>
<td>Chief Transmission Officer, Duke Energy</td>
<td>January 31, 2019</td>
</tr>
<tr>
<td>Chris Root, At-Large Member</td>
<td>Chief Operating Officer, Vermont Electric Power Company</td>
<td>January 31, 2019</td>
</tr>
<tr>
<td>Tim Eckel, At-Large Member</td>
<td>Vice President of Transmission Services, SaskPower</td>
<td>January 31, 2019</td>
</tr>
<tr>
<td>Woody Rickerson, At-Large Member</td>
<td>Vice President of Grid Planning and Operations, ERCOT</td>
<td>January 31, 2019</td>
</tr>
<tr>
<td>Carol Chinn, MRC Member</td>
<td>Regulatory Compliance Officer, Florida Municipal Power Agency</td>
<td>January 31, 2019</td>
</tr>
<tr>
<td>John Pespisa, MRC Member</td>
<td>Director, NERC Compliance Program, Southern California Edison</td>
<td>January 31, 2019</td>
</tr>
<tr>
<td>Herb Schrayshuen, MRC Member</td>
<td>N/A (representing small electricity end-user)</td>
<td>January 31, 2018</td>
</tr>
</tbody>
</table>
Personnel Certification Governance Committee Membership

Action
Approve

Background
The Personnel Certification Governance Committee (PCGC) is recommending that the Board of Trustees approve the re-appointments of the following members to the PCGC for a two-year term ending on December 31, 2018:

- Don Urban, Principal Analyst, Reliability First
- Cory Danson, Tech Writer/Operation Compliance, Western Area Power Administration
- Mark Thomas, Manager, Training, Entergy
- Margaret Adams, Lead Functional Coordinator, Southwest Power Pool
- Misty Revenew, Strategic Business Analyst, Lower Colorado River Authority
Operating Committee Charter

Action
Approve

Background
The Operating Committee (OC) requests Board of Trustees (Board) approval of amendments to the current OC Charter, which was approved by the Board on November 7, 2013. The proposed revisions were approved by the OC on September 6, 2016.

The OC Strategic Plan Task Team (task team) was assigned with reviewing and revising the OC Charter. As part of this review, revisions to the Planning Committee (PC) Charter were also considered in an effort to align the two technical committee charters. Task team members were Todd Lucas, Keith Carman, Vice Chair Linke and Jerry Rust.

At the September OC meeting, the task team presented its conclusions of its review and made the following revisions to the OC Charter:

- Removed approval of Reliability Coordinator (RC) Reliability Plans and replaced with Review and approval of the OC Strategic Plan and Work Plan (See Section 2.4).
- Added documents to manage and coordinate (See Section 2.6).
- Added information regarding subgroup work plans (See Section 6.1)
- Renamed Appendix 3 from Approval Process” to “Approval Process for Deliverables”.
- Added review and approval of Reference Documents (see Appendix 3, Section 2)

There are also minor conforming and clarifications reflected in the attached redline.
# Table of Contents

**Section 2. General Overview and Functions**
1. General forum ........................................................................................................5
2. Advice and recommendations ..................................................................................5
3. Support for other NERC programs .........................................................................5
4. Review and approval of Reliability Coordinator Plans ............................................5
5. Review of foundational changes to interconnected operations ...............................6
6. Review, manage and coordinate the following documents ..................................6
7. Opinions and interpretations ..................................................................................6

**Section 3. Membership**
1. Goals ....................................................................................................................7
2. Expectations ..........................................................................................................7
3. Representation .......................................................................................................7
4. Selection ...............................................................................................................7
5. Terms ....................................................................................................................8
6. Resignations, Vacancies, and Nonparticipation .......................................................8
7. Proxies ..................................................................................................................8

**Section 4. Meetings**
1. Quorum ..............................................................................................................9
2. Voting ...................................................................................................................9
3. Antitrust Guidelines ............................................................................................9
4. Open Meetings ...................................................................................................9
5. Confidential Sessions ..........................................................................................9

**Section 5. Officers**
1. Terms and conditions ..........................................................................................10
2. Selection .............................................................................................................10

**Section 6. Subcommittees**
1. Appointing subgroups ..........................................................................................11
2. Nominating subcommittee ...................................................................................11

**Section 7. Executive Committee**
1. Authorization ......................................................................................................12
2. Membership .........................................................................................................12
3. Election Process ................................................................................................12
4. Terms .................................................................................................................12

**Section 8. Action Without A Meeting** ....................................................................13
Appendix 1 – Committee Members.......................................................................................................................................................... 14
Appendix 2 – Meeting Procedures......................................................................................................................................................... 17
1. Voting Procedures for Motions........................................................................................................................................................ 17
2. Minutes.............................................................................................................................................................................................. 17
3. Minority Opinions........................................................................................................................................................................... 17
4. Personal Statements......................................................................................................................................................................... 17
Appendix 3 – Reliability Guidelines Approval Process .......................................................................................................................... 18
1. Reliability Guidelines................................................................................................................................................................. 18
2. Approval of Reliability Guidelines.............................................................................................................................................. 18
3. Review of Approved Reliability Guidelines.................................................................................................................................. 18
Section 1. Purpose

The purpose of the Operating Committee (OC) is to promote North American Bulk-Power System operational reliability excellence.
Section 2. General Overview and Functions

1. General forum.
   Provides a general forum for aggregating ideas and interests regarding the operations of the interconnected Bulk-Power Systems in North America.

2. Advice and recommendations.
   Provides the electric reliability organization (ERO) (stakeholders, Board of Trustees, and staff) with advice, recommendations, and the collective and diverse opinions on matters related to interconnected operations to help the industry arrive at informed decisions.

3. Support for other NERC programs.
   Provide technical advice and subject matter expert support to each of the NERC program areas, and serve as a forum to integrate the outputs of each ERO program area, including:
   a. Reliability Assessments – Review reliability assessments, assure technical accuracy and completeness of results, and endorse approval of assessments to NERC’s Board of Trustees (Board).
   b. Emerging Issues and Reliability Concerns – Identify emerging issues within the electric industry, address issues in reliability assessments, and address other issues as assigned by the Board.
   c. Operational Analyses – Develop operational analyses, model validation, and key reliability areas, resulting in technically accurate and comprehensive reports addressing these areas (i.e., frequency response, intermittent generation, smart grid, etc.). Provide recommendations that facilitate addressing the reliability risks identified. Provide oversight, guidance, and direction to address key planning related issues.
   d. Standards Input – Provide technical expertise and feedback to Standard Authorization Requests (SARs) that have reliability-related impacts, provide foundational technical efforts that support the key reliability operational related standards development, coordinate effectively with the Standards Committee to maintain alignment on priorities of related OC efforts, develop and vet operational guidelines with industry stakeholders, and provide reliability risk information for prioritization of SARs and new Reliability Standards.
   e. Metrics – Provide direction, technical oversight, and feedback on the NERC Adequate Level of Reliability (ALR) metrics.
   f. Event Analysis – Review all event reports to determine lessons learned and good industry practices and promote the dissemination of information to the industry to enhance reliability.
   g. NERC Alerts – Participate in the review and development of requests for industry actions and informational responses.
   h. Reliability Guidelines and Technical Reports – Develop reliability guidelines, white papers, technical reports and reference documents to address emerging issues and industry concerns related to system operations.

4. Review and approval of the Operating Committee Strategic Plan and Work Plan.
   The Operating Committee will develop and maintain a strategic plan and associated work plan to address the functions of the Operating Committee. The strategic plan will be reviewed as needed to maintain alignment with the NERC Electric Reliability Organization (ERO) enterprise. The work plan will be updated as needed to track the progress of the Operating Committee and subcommittees.

Deleted: Reliability Coordinator Plans

Deleted: Comply with existing requirements for review and approval of Reliability Coordinator plans.
Section 2. General Overview and Functions

5. Review of foundational changes to interconnected operations.
   Review and provide constructive feedback regarding foundational changes to interconnected operations, such as changes to the footprints of reliability coordinators, balancing authorities, transmission operators, Interconnections, field tests and HVDC ties, etc.

6. Manage and coordinate documents such as.
   a. State of Reliability Report
   b. Technical content of the NERC Reliability Functional Model
   c. Reliability Guidelines (See Appendix 3)
   d. Reference documents (See Appendix 3)
   e. Other documents under the purview of the Operating Committee.

7. Opinions and interpretations.
   Provide technical opinions at the industry stakeholders’ request on operating reliability concepts, philosophies, and standards.
Section 3. Membership

1. Goals.

The OC provides for balanced decision making by bringing together a wide diversity of opinions from industry experts with outstanding technical knowledge and experience in the area of interconnected systems operation reliability.

2. Expectations.

OC voting members are expected to:

a. Bring subject matter expertise to the OC;

b. Be knowledgeable in reliable operations within their organization;

c. Attend and participate in all OC meetings;

d. Express their own opinions, as well as the opinions of the sector they represent, at committee meetings;

e. Complete committee assignments; and,

f. Inform the secretary of any changes in their status that may affect their eligibility for committee membership. Failure to do so in a timely manner may result in the member’s dismissal by the chair.

3. Representation.

See Appendix 1, “Committee Members”

a. Committee members may, but need not be, NERC members. A non-voting representative must meet the requirements defined in Appendix 1. Voting members, with the exception of sector 11 that appoints its members, may hold a position in any sector in which they would be eligible for NERC membership, even if they are a NERC member in another sector. Questions regarding eligibility for committee membership will be referred to the NERC general counsel for final determination of status.

b. To ensure adequate Canadian representation, the membership to the committee may be increased so that the number of Canadian voting members is equal to the percentage of the net energy for load (NEL) of Canada to the total NEL of the United States and Canada, times the total number of voting members on the committee, rounded to the next whole number.

4. Selection.

With the exception of sector 11, NERC sector members will annually elect voting committee members to committee sectors corresponding to their NERC sector under an election process that is open, inclusive, and fair. The selection process will be completed in time for the secretary to send the committee membership list to the Board for its approval at the Board’s August meeting so that new committee members may be seated at the September meeting.

a. Un-nominated voting member positions will remain vacant until the next annual or special election. If a vacancy in an elected sector is created by a resignation or other cause, a special election will be held unless it would coincide with the annual election process. Special elections shall follow the same procedure as the annual election.

b. Members may not represent more than one committee sector.

c. A particular organization, including its affiliates, may not have more than one member on the committee.
Section 3. Membership

d. If additional Canadian members are added, no more than one additional Canadian voting member shall be selected from a sector unless this limitation precludes the addition of the number of additional Canadian voting representatives required by Section 3.3.b. In this case, no more than two additional Canadian voting members may be selected from the same sector.

e. The secretary will monitor the committee selection process to ensure that membership specifications are met.

f. After the secretary announces the election results, the newly elected members will serve on the committee pending approval by the Board. The secretary will submit the newly elected members’ names to the Board for approval at the Board’s next regular meeting.

5. Terms.

Members’ terms are staggered, with one-half of the members’ terms expiring each year. Except for the cases described below, a member’s term is two years. Members may be re-elected for subsequent terms. Shorter terms may be required for several reasons:

a. If two members are simultaneously selected to a sector that did not have any existing members, in order to stagger their terms, one member will be assigned a one-year term and the second member will be assigned a two-year term using a fair and unbiased method.

b. If a member replaces a departed member between elections, the new member will assume the remaining term of the departed member.

c. If a member fills a vacant member position between elections, his/her term will end when the term for that vacant position ends.

6. Resignations, Vacancies, and Nonparticipation.

a. Members who resign will be replaced for the time remaining in the member’s term. Members will be replaced pursuant to Section 3.4, officers will be replaced pursuant to Section 5, and executive committee members will be replaced pursuant to Section 7.

b. Newly elected or appointed members will serve on the committee pending approval by the Board. The secretary will submit new members’ names to the Board for approval at the Board’s next regular meeting.

c. The committee chair will contact any member who has missed two consecutive meetings (even if the member has sent a proxy) to 1) seek a commitment to actively participate or 2) ask the member to resign from the committee.

d. The chair may remove any member who has missed two consecutive meetings (even with a proxy).

7. Proxies.

A member of the committee may give a proxy only to a person who:

a. Meets the member’s eligibility requirements (see Section 3.3a) and is not affiliated with the same organization as another committee member (see Section 3.4c), or

b. Is not another committee member, unless that committee member would represent the proxy’s sector instead of his/her own sector at the meeting.

To permit time to determine a proxy’s eligibility, proxies must be submitted to the secretary in writing at least one week prior to the meeting (electronic transmittal is acceptable). Any proxy submitted after that time will be accepted at the chair’s discretion, provided that the chair believes the proxy meets the eligibility requirements.
Section 4. Meetings

See Appendix 2, “Meeting Procedures.” In the absence of specific provisions in the Charter document, the OC will follow Roberts Rules of Order, Newly Revised.

1. Quorum.
   A quorum requires two-thirds of the voting members.

2. Voting.
   Except for sector 11, each voting member of the committee shall have one vote on any matter coming before the committee that requires a vote. Sector 11 voting is specified in Appendix 1. Actions by members of the committee shall be approved upon receipt of the affirmative vote of two-thirds of the voting members of the committee present and voting, in person or by proxy, at any meeting at which a quorum is present. The chair and vice chair may vote. Additional voting guidelines are in Appendix 2. Voting may take place during regularly scheduled in-person meetings or may take place via electronic mail, facsimile or conference call.

3. Antitrust Guidelines.
   All persons attending or otherwise participating in the committee meeting shall act in accordance with NERC's Antitrust Compliance Guidelines at all times during the meeting. A copy of the NERC antitrust statement shall be included with each meeting agenda.

4. Open Meetings.
   NERC committee meetings shall be open to the public, except as noted below under Confidential Sessions. Although meetings are open, only voting members may offer and act on motions.

5. Confidential Sessions.
   The chair of a committee may limit attendance at a meeting or portion of a meeting, based on confidentiality of the information to be disclosed at the meeting. Such limitations should be applied sparingly and on a non-discriminatory basis as needed to protect information that is sensitive to one or more parties. A preference, where possible, is to avoid the disclosure of sensitive or confidential information so that meetings may remain open at all times. Confidentiality agreements may also be applied as necessary to protect sensitive information.
Section 5. Officers

1. Terms and conditions.

   At its first June meeting and every two years thereafter, the committee shall select a chair and vice chair from among its voting members by majority vote of the members of the committee to serve as chair and vice chair of the committee from the end of that June meeting until the end of the June meeting two years later. The newly selected chair and vice chair shall not be representatives of the same sector.

   a. Pending approval by the Board, the newly elected officers will assume their duties as stated above. The secretary will submit the names of the elected officers to the chair of the Board for approval at the Board’s next regular meeting.

   b. The chair and vice chair, upon assuming such positions, shall cease to act as representatives of the sectors that elected them as representatives to the committee and shall thereafter be responsible for acting in the best interests of the members as a whole.

2. Selection.

   The committee selects officers using the following process. The chair is selected first, followed by the vice chair.

   a. The nominating subcommittee will present its recommended candidate.

   b. The chair opens the floor for nominations.

   c. After hearing no further nominations, the chair closes the nominating process.

   d. The committee will then vote on the candidate recommended by the nominating subcommittee, followed by the candidates nominated from the floor in the order in which they were nominated. The first candidate to garner the majority of the committee’s votes will be selected.

   e. If the committee nominates one person, that person is automatically selected as the next chair.

   f. If the committee nominates two or more persons, and none receive a majority of the committee’s votes, then the secretary will distribute paper ballots for the members to mark their preference.

   g. The secretary will collect the ballots. If the committee nominates three or more candidates, then the winner will be selected using the Instant Runoff Process. (Explained in Roberts Rules of Order)
Section 6. Subcommittees

1. Appointing subgroups.

The OC may appoint technical subcommittees, task forces, and working groups as needed. Once these subgroups have been appointed, a scope document will be developed to ensure alignment with the Operating Committee Charter and strategic plan. The OC will annually review the appropriateness of the ongoing subcommittee.

2. Nominating subcommittee.

At the first regular meeting following the selection of a new committee chair, the chair will nominate, for the committee’s approval, a slate of five committee members from different sectors to serve as a nominating subcommittee. The subcommittee will:

a. Recommend candidates for the committee’s chair and vice chair, and
b. Recommend candidates for the executive committee’s four “at large” members.
Section 7. Executive Committee

1. Authorization.

The executive committee of the OC is authorized by the OC to act on its behalf between regular meetings on matters where urgent actions are crucial and full committee discussions are not practical. Ultimate OC responsibility resides with its full membership whose decisions cannot be overturned by the executive committee, but retains the authority to ratify, modify, or annul executive committee actions.

2. Membership.

The committee will elect an executive committee of six members, all from different sectors, as follows:

a. Chair
b. Vice-chair
c. Four at-large members from different sectors nominated by the nominating subcommittee.

3. Election Process. The nominating subcommittee will present its slate of candidates for the four “at large” members.

a. The chair opens the floor for additional nominations.
b. If the Committee members nominate additional candidates, then the secretary will distribute paper ballots for the members to list their top four candidates.
c. The four candidates who receive the most votes will be elected, provided that no two candidates may be from the same sector.

4. Terms.

The executive committee will be replaced every two years, with the chair and vice chair replaced at a June meeting and the at-large members replaced at a September meeting.
**Section 8. Action Without A Meeting**

The OC may act by mail or electronic (facsimile or e-mail) ballot without a regularly scheduled meeting. Two-thirds of the members present and voting is required to approve any action. A quorum for actions without a meeting is two-thirds of the OC members. The OC chair or four members (each from different industry segments) may initiate the request for such action without a meeting. The secretary shall post a notice on the NERC website and shall provide OC members with a written notice (letter, facsimile, or e-mail) of the subject matter for action not less than five business days prior to the date on which the action is to be voted. The secretary shall distribute a written notice to the OC (letter, facsimile, or e-mail) of the results of such action within five business days following the vote and also post the notice on the NERC website. The secretary shall keep a record of all responses (e-mail, facsimiles, etc.) from the OC members with the OC minutes.
# Appendix 1 - Committee Members

<table>
<thead>
<tr>
<th>Name</th>
<th>Definition</th>
<th>Members</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voting Members</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Investor-owned utility</td>
<td>This sector includes any investor-owned entity with substantial business interest in ownership and/or operation in any of the asset categories of generation, transmission, or distribution. This sector also includes organizations that represent the interests of such entities.</td>
<td>2</td>
</tr>
<tr>
<td>2. State/municipal utility</td>
<td>This sector includes any entity owned by or subject to the governmental authority of a state or municipality, that is engaged in the generation, delivery, and/or sale of electric power to end-use customers primarily within the political boundaries of the state or municipality; and any entity, whose members are municipalities, formed under state law for the purpose of generating, transmitting, or purchasing electricity for sale at wholesale to their members. This sector also includes organizations that represent the interests of such entities.</td>
<td>2</td>
</tr>
<tr>
<td>3. Cooperative utility</td>
<td>This sector includes any non-governmental entity that is incorporated under the laws of the state in which it operates, is owned by and provides electric service to end-use customers at cost, and is governed by a board of directors that is elected by the membership of the entity; and any non-governmental entity owned by and which provides generation and/or transmission service to such entities. This sector also includes organizations that represent the interests of such entities.</td>
<td>2</td>
</tr>
<tr>
<td>4. Federal or provincial utility/Federal Power Marketing Administration</td>
<td>This sector includes any U.S. federal, Canadian provincial, or Mexican entity that owns and/or operates electric facilities in any of the asset categories of generation, transmission, or distribution; or that functions as a power marketer or power marketing administrator. This sector also includes organizations that represent the interests of such entities. One member will be a U.S. federal entity and one will be a Canadian provincial entity.</td>
<td>2</td>
</tr>
<tr>
<td>5. Transmission dependent utility</td>
<td>This sector includes any entity with a regulatory, contractual, or other legal obligation to serve wholesale aggregators or customers or end-use customers and that depends primarily on the transmission systems of third parties to provide this service. This sector also includes organizations that represent the interests of such entities.</td>
<td>2</td>
</tr>
<tr>
<td>Name</td>
<td>Definition</td>
<td>Members</td>
</tr>
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</tr>
<tr>
<td>Voting Members</td>
<td></td>
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</tr>
<tr>
<td>6. Merchant electricity generator</td>
<td>This sector includes any entity that owns or operates an electricity generating facility that is not included in an investor-owned utility’s rate base and that does not otherwise fall within any of sectors (i) through (v). This sector includes but is not limited to cogenerators, small power producers, and all other non-utility electricity producers such as exempt wholesale generators who sell electricity at wholesale. This sector also includes organizations that represent the interests of such entities.</td>
<td>2</td>
</tr>
<tr>
<td>7. Electricity marketer</td>
<td>This sector includes any entity that is engaged in the activity of buying and selling of wholesale electric power in North America on a physical or financial basis. This sector also includes organizations that represent the interests of such entities.</td>
<td>2</td>
</tr>
<tr>
<td>8. Large end-use electricity customer</td>
<td>This sector includes any entity in North America with at least one service delivery taken at 50 kV or higher (radial supply or facilities dedicated to serve customers) that is not purchased for resale; and any single end-use customer with an average aggregated service load (not purchased for resale) of at least 50,000 MWh annually, excluding cogeneration or other back feed to the serving utility. This sector also includes organizations that represent the interests of such entities.</td>
<td>2</td>
</tr>
<tr>
<td>9. Small end-use electricity customer</td>
<td>This sector includes any person or entity within North America that takes service below 50 kV; and any single end-use customer with an average aggregated service load (not purchased for resale) of less than 50,000 MWh annually, excluding cogeneration or other back feed to the serving utility. This sector also includes organizations (including state consumer advocates) that represent the interests of such entities.</td>
<td>2</td>
</tr>
<tr>
<td>10. Independent system operator/Regional transmission organization</td>
<td>This sector includes any entity authorized by the Commission to function as an independent transmission system operator, a Regional transmission organization, or a similar organization; comparable entities in Canada and Mexico; and the Electric Reliability Council of Texas or its successor. This sector also includes organizations that represent the interests of such entities.</td>
<td>2</td>
</tr>
<tr>
<td>11. Regional Entity</td>
<td>This sector includes any Regional Entity as defined in Article I, Section 1, of the Bylaws of the corporation. In aggregate, this sector will have voting strength equivalent to two members. The voting weight of each Regional member’s vote will be set such that the sum of the weight of all available Regional Entity members’ votes is two votes.</td>
<td>2</td>
</tr>
</tbody>
</table>
### Appendix 1 – Committee Members

<table>
<thead>
<tr>
<th>Name</th>
<th>Definition</th>
<th>Members</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Voting Members</strong></td>
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<tr>
<td>RE</td>
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<td>FRCC</td>
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<td>RFC</td>
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<td>TRE</td>
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<td>MRO</td>
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<td>NPCC</td>
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<td>SERC</td>
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<td>SPP</td>
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<tr>
<td>WECC</td>
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</tr>
<tr>
<td><strong>Number of Members</strong></td>
<td>Number of Members</td>
<td>Proportional Voting</td>
</tr>
<tr>
<td>RE</td>
<td>1</td>
<td>X</td>
</tr>
<tr>
<td>FRCC</td>
<td>1</td>
<td>X</td>
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<tr>
<td>RFC</td>
<td>1</td>
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<tr>
<td>TRE</td>
<td>1</td>
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<tr>
<td>MRO</td>
<td>1</td>
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</tr>
<tr>
<td>NPCC</td>
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<td>SERC</td>
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<tr>
<td>SPP</td>
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<td>X</td>
</tr>
<tr>
<td>WECC</td>
<td>1</td>
<td>X</td>
</tr>
<tr>
<td><strong>12. State government</strong></td>
<td>(See Government representatives below)</td>
<td>2</td>
</tr>
<tr>
<td><strong>Officers</strong></td>
<td>Chair and Vice Chair</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total Voting Members</strong></td>
<td></td>
<td>26</td>
</tr>
<tr>
<td><strong>Non-Voting Members</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Government representatives</td>
<td>This sector includes any federal, state, or provincial government department or agency in North America having a regulatory and/or policy interest in wholesale electricity. Entities with regulatory oversight over the Corporation or any Regional Entity, including U.S., Canadian, and Mexican federal agencies and any provincial entity in Canada having statutory oversight over the Corporation or a Regional Entity with respect to the approval and/or enforcement of Reliability Standards, may be non-voting members of this sector.</td>
<td></td>
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<tr>
<td>United States federal government</td>
<td>2</td>
<td></td>
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<tr>
<td>Canadian federal government</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Provincial government</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Secretary</td>
<td>The committee secretary will be seated at the committee table</td>
<td>1</td>
</tr>
<tr>
<td>Subcommittee Chairs</td>
<td>The chairs of the subcommittees will be seated at the committee table.</td>
<td></td>
</tr>
</tbody>
</table>

1. Industry associations and organizations and other government agencies in the U.S. and Canada may attend meetings as non-voting observers.
Appendix 2 - Meeting Procedures

   a. The default procedure is a voice vote.
   b. If the chair believes the voice vote is not conclusive, the chair may call for a show of hands.
   c. The chair will not specifically ask those who are abstaining to identify themselves when voting by voice or a show of hands.
   d. The committee may conduct a roll-call vote in those situations that need a record of each member’s vote.
      i. The committee must approve conducting a roll call vote for the motion.
      ii. The secretary will call each member’s name.
      iii. Members answer “yes,” “no,” or “present” if they wish to abstain from voting.

2. Minutes.
   a. Meeting minutes are a record of what the committee did, not what its members said.
   b. Minutes should list discussion points where appropriate, but should usually not attribute comments to individuals. It is acceptable to cite the chair’s directions, summaries, and assignments.
   c. Do not list the person who seconds a motion.
   d. Do not record (or even ask for) abstentions.

   All Committees members are afforded the opportunity to provide alternative views on an issue. The meeting minutes will provide an exhibit to record minority opinions. The chair shall report both the majority and any minority views in presenting results to the Board.

4. Personal Statements.
   The minutes will also provide an exhibit to record personal statements.
Appendix 3 – Approval Process for Deliverables

1. Reliability Guidelines.

   Reliability Guidelines are documents that suggest approaches or behavior in a given technical area for the purpose of improving reliability. Reliability guidelines are not binding norms or mandatory requirements. Reliability guidelines may be adopted by a responsible entity in accordance with its own facts and circumstances.

   a. Approval of Reliability Guidelines.

      Because reliability guidelines contain suggestions that may result in actions by responsible entities, those suggestions must be thoroughly vetted before a new or updated guideline receives approval by the OC. The process described below will be followed by the OC:

      i. New/updated draft guideline approved for industry posting. The OC approves for posting for industry comment the release of a new or updated draft guideline developed by one of its subgroups or the committee as a whole.

      ii. Post draft guideline for industry comment. The draft guideline is posted as “for industry-wide comment” for forty-five (45) days. If the draft guideline is an update, a redline version against the previous version must also be posted.

      iii. Post industry comments and responses. After the public comment period, the OC will post the comments received as well as its responses to the comments. The committee may delegate the preparation of responses to a committee subgroup.

      iv. New/updated guideline approval and posting. A new or updated guideline which considers the comments received, is approved by the OC and posted as “Approved” on the NERC website. Updates must include a revision history and a redline version against the previous version.

      v. Guideline updates. After posting a new or updated guideline, the OC will continue to accept comments from the industry via a web-based forum where commenters may post their comments.

         • Each quarter, the OC will review the comments received. At any time, the OC may decide to update the guideline based on the comments received or on changes in the industry that necessitate an update.

         • Updating an existing guideline will require that a draft updated guideline be approved by the OC in the above steps.

   b. Review of Approved Reliability Guidelines.

      Approved Reliability Guidelines shall be reviewed for continued applicability by the OC at a minimum of every third year since the last revision.

2. Reference Documents.

   Reference documents suggest approaches or behavior in a given technical area for the purpose of improving reliability. Reference documents are not binding norms or mandatory requirements.

   a. Approval of Reference Documents.

      Because reference documents contain suggestions that may result in actions by responsible entities, those suggestions must be thoroughly vetted by the committee before a new or updated reference document receives approval by the OC.
i. Reference document updates. After posting a new or updated reference document, the OC will continue to accept comments from the industry via a web-based forum where commenters may post their comments.

b. **Review of Approved Reference Documents**

Approved reference documents shall be reviewed for continued applicability by the OC at a minimum of every third year since the last revision.

---

2 Standards Committee authorization is required for a reliability guideline to become a supporting document that is posted with or referenced from a NERC Reliability Standard. See Appendix 3A in the NERC’s Rules of Procedure under “Supporting Documents.”
Critical Infrastructure Protection Committee Charter

Action
Approve

Summary
The Critical Infrastructure Protection Committee (CIPC) requests the Board of Trustees approve its revised Charter. The charter revisions include language that codifies desired technical qualifications of CIPC members and handling of vacancies. CIPC’s charter did not previously stipulate that all meetings are open unless declared confidential – which we changed to be consistent with the other technical committees. Lastly, we added a participation clause to ensure CIPC voting members are given first right of refusal when new subcommittee or working group opportunities arise.
# Table of Contents

Preface ................................................................................................................................. iv

Chapter 1 – Purpose .............................................................................................................. 1

Chapter 2 – General Functions of the CIPC ......................................................................... 2
  Advisory Panel to the NERC Board .................................................................................... 2
  Coordination and Communications .................................................................................. 2
  Information Sharing ......................................................................................................... 2
  Security Guidelines ......................................................................................................... 2
  NERC Reliability Standards .............................................................................................. 2
  Forums and Workshops ..................................................................................................... 2

Chapter 3 – Membership ..................................................................................................... 3
  Owners and Operators ..................................................................................................... 3
  Expectations and Requirements ..................................................................................... 3
  Terms ............................................................................................................................... 3
  Selection ........................................................................................................................ 3
  Alternates ....................................................................................................................... 4
  Executive Committee Review .......................................................................................... 4

Chapter 4 – Officers ............................................................................................................ 5
  Officer Positions .............................................................................................................. 5
  Terms ............................................................................................................................... 5
  Timing of Elections ....................................................................................................... 5
  Selection Process .......................................................................................................... 5
  Vacancies ........................................................................................................................ 5

Chapter 5 – Executive Committee ...................................................................................... 6
  Members .......................................................................................................................... 6
  Non-Voting Executive Committee Members ................................................................... 6
  Terms ............................................................................................................................... 6
  Duties ............................................................................................................................... 6
  Open Meetings ............................................................................................................... 7

Chapter 6 - Meetings ......................................................................................................... 8
  Quorum ........................................................................................................................... 8
  Voting .............................................................................................................................. 8
  Proxies ............................................................................................................................ 8
  Agenda ............................................................................................................................ 8
  Action without a Meeting .............................................................................................. 8
Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regular Meetings</td>
<td>8</td>
</tr>
<tr>
<td>Open Meetings</td>
<td>8</td>
</tr>
<tr>
<td>Antitrust Guidelines</td>
<td>8</td>
</tr>
<tr>
<td>Confidential Sessions</td>
<td>9</td>
</tr>
<tr>
<td>Confidential Matters</td>
<td>9</td>
</tr>
<tr>
<td>Parliamentary Procedures</td>
<td>9</td>
</tr>
<tr>
<td>Non-Voting Members</td>
<td>9</td>
</tr>
<tr>
<td>Chapter 7 - Subgroups</td>
<td>10</td>
</tr>
<tr>
<td>Appointing Subgroups</td>
<td>10</td>
</tr>
<tr>
<td>Nominating Subcommittee</td>
<td>10</td>
</tr>
<tr>
<td>Appendix 1 – Reliability Guidelines Approval Process</td>
<td>11</td>
</tr>
</tbody>
</table>
Preface

The North American Electric Reliability Corporation (NERC) is a not-for-profit international regulatory authority whose mission is to assure the reliability of the bulk power system (BPS) in North America. NERC develops and enforces Reliability Standards; annually assesses seasonal and long-term reliability; monitors the BPS through system awareness; and educates, trains, and certifies industry personnel. NERC’s area of responsibility spans the continental United States, Canada, and the northern portion of Baja California, Mexico. NERC is the electric reliability organization (ERO) for North America, subject to oversight by the Federal Energy Regulatory Commission (FERC) and governmental authorities in Canada. NERC’s jurisdiction includes users, owners, and operators of the BPS, which serves more than 334 million people.

The North American BPS is divided into several assessment areas within the eight Regional Entity (RE) boundaries, as shown in the map and corresponding table below.

The Regional boundaries in this map are approximate. The highlighted area between SPP and SERC denotes overlap as some load-serving entities participate in one Region while associated transmission owners/operators participate in another.

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FRCC</td>
<td>Florida Reliability Coordinating Council</td>
</tr>
<tr>
<td>MRO</td>
<td>Midwest Reliability Organization</td>
</tr>
<tr>
<td>NPCC</td>
<td>Northeast Power Coordinating Council</td>
</tr>
<tr>
<td>RF</td>
<td>ReliabilityFirst</td>
</tr>
<tr>
<td>SERC</td>
<td>SERC Reliability Corporation</td>
</tr>
<tr>
<td>SPP RE</td>
<td>Southwest Power Pool Regional Entity</td>
</tr>
<tr>
<td>Texas RE</td>
<td>Texas Reliability Entity</td>
</tr>
<tr>
<td>WECC</td>
<td>Western Electricity Coordinating Council</td>
</tr>
</tbody>
</table>
Chapter 1 - Purpose

The mission of the Critical Infrastructure Protection Committee (CIPC) is to advance the physical and cyber security of the critical electricity infrastructure of North America.
Chapter 2 - General Functions of the CIPC

Advisory Panel to the NERC Board
Serve as an expert advisory panel to the North American Electric Reliability Corporation (NERC) Board of Trustees (Board) and standing committees in the security areas for physical, cyber, operations, compliance and policy matters.

Coordination and Communications
1. Coordinate and communicate with those organizations responsible for both physical and cyber security in all electric industry segments, including but not limited to the Electricity Information Sharing and Analysis Center (E-ISAC), American Public Power Association (APPA), Canadian Electricity Association (CEA), Edison Electric Institute (EEI), Electric Power Research Institute (EPRI), Electric Power Supply Association (EPSA), ISO/RTO Council (IRC), National Rural Electric Cooperative Association (NRECA), North American Energy Standards Board (NAESB), the Nuclear Energy Institute (NEI), and the NERC Regional Entities (REs).
2. Coordinate and communicate with the other critical infrastructure sectors as appropriate.
3. Liaise with government agencies on critical infrastructure protection matters.
4. Coordinate with the other NERC committees and working groups to assure the highest degree of collaboration possible.

Information Sharing
Facilitate and advocate information sharing for critical infrastructure protection among industry segments and with governments.

CIPC actions, documents, and recommendations will be distributed to the NERC committees and working groups and posted for industry comments (assuming sensitivity permits), at the discretion of the CIPC. NERC committees, working groups, and industry comments will be considered by the CIPC prior to forwarding actions or documents to the NERC Board for approval if required.

Security Guidelines
Develop, periodically review, and revise security guidelines. Issue guidelines in accordance with the process described in Appendix 1.

NERC Reliability Standards
1. Assist in the development of guidance and implementation of NERC Reliability Standards.
   a. Assist the standards process by providing expert resources in support of the development of NERC Reliability Standard Authorization Requests and standards.
   b. Assist the standards process by providing a forum for education, sharing of views, and informed debate of NERC Reliability Standards.
   c. Facilitate the implementation of NERC Reliability Standards by developing guidance documents and performing other activities.

Forums and Workshops
Conduct training forums and educational workshops related to the CIPC purpose.
Chapter 3 - Membership

Owners and Operators
The majority of the members of CIPC will be representatives of the registered entities that own and/or operate the Bulk Electric System (BES) infrastructure of North America.

Expectations and Requirements
Voting members of the CIPC are expected to:

1. Bring subject matter expertise to the CIPC;
2. Be knowledgeable about physical and cyber security practices and challenges in the electricity sector;
3. Attend and participate in all CIPC meetings;
4. Express their own opinions at committee meetings, but also represent the interests of their Regions;
5. Discuss and debate interests rather than positions;
6. Chair or co-chair a CIPC Work Group or Task Force at least once within a two-year term
7. Complete assigned Committee, Task Force, and Working Group assignments; and
8. Maintain, at a minimum, a Secret Clearance, or to the extent not already obtained, apply for a Secret Clearance.

Terms
Terms are expected to be a minimum of two years.

Selection
1. There will be a minimum total of 30 voting members. The maximum will be 32, as described below.
2. Twenty-four selected from the eight NERC REs, each of which will appoint three members with expertise in three technical areas – physical security, cyber security, and operations as defined below:
   a. Physical Security – Members are primarily focused on protection of electricity sector facilities. Members should have a background in corporate or physical security at an asset owner utility, ISO or RTO.
   b. Cyber Security – Members are technical experts in one or more areas of control systems security, information security, or systems architecture and design that affect the reliable operation of the BES.
   c. Operations – Members are primarily focused on system operations. Members should have a background in supervisory control and data acquisition (SCADA), Energy Management System (EMS), substation or generating plant control equipment operation and administration.
3. A minimum of two (more if required as stated later in this paragraph) selected by CEA. The Committee shall contain the number of Canadian voting representatives equal to the percentage of the Net Energy for Load (NEL) of Canada to the total NEL of the United States and Canada, times the total number of voting members on the Committee, rounded up to the next whole number. The RE representatives can fulfill this requirement. If the Canadian RE representatives are not in sufficient numbers, then NERC will ask the CEA to select sufficient Canadian representatives to meet the requirement.
4. Four policy experts – defined as having had regulatory review responsibility, strategic planning or legislative development, review or advocacy experience positions in a NERC registered entity, or an industry trade association.
a. Two selected by APPA.

b. Two selected by NRECA.

**Alternates**

Appointing organizations may appoint non-voting alternates who will have a voice at meetings and can be named as proxies.

**Executive Committee Review**

The Executive Committee (EC) will annually review the membership to ensure sufficient expertise is represented on the CIPC and that the members are meeting the expectations and requirements listed above. The chair will contact any member who has missed two consecutive meetings (even if the member has sent a proxy) to seek a commitment to actively participate, or ask the member to resign from the committee. The chair may remove any member who has missed two consecutive meetings (even with a proxy).
Chapter 4 - Officers

Officer Positions
The Committee shall have a chair and two vice-chairs as selected from the voting membership.

Terms
The terms of all officer positions are for two years and shall begin on January 1 following their election and continue through December 31 of the second year following.

Timing of Elections
Elections for the chair and vice-chairs shall take place at the September meeting in odd-numbered years.

Selection Process
The Committee selects officers using the following process:

1. The nominating subcommittee will present its recommended candidate (or candidates if filling the vice chair positions).
2. The secretary will open the floor for nominations.
3. After hearing no further nominations, or upon approval of a motion to close nominations, the secretary will close the nominating process.
4. The committee will then vote on the slate of candidates recommended by the nominating subcommittee. If the slate is approved by a two-thirds majority, the slate shall be deemed elected and the election shall close.
5. If the slate fails, the secretary will distribute paper ballots containing the names of all of the candidates, listed in the order in which they were nominated, on which the committee members shall mark their preference(s).
6. The secretary shall collect and tabulate the ballots. Any ballot containing more votes than the number of open positions shall be deemed invalid. Any candidate(s) to garner a two-thirds majority of the Committee’s votes will be deemed elected.
7. If open positions remain at the conclusion of the balloting process, the chair may, at his/her discretion, open the floor for additional nominations. The secretary shall prepare new ballots listing the names of the remaining and any newly nominated candidates in the order the nominations were made, and the balloting process shall be repeated until all positions have been filled.
8. The elected leadership will be submitted to the NERC Board for approval.

Vacancies
If an officer is unable to complete their term, that person’s replacement will be selected by the EC to serve the remainder of that term.
Chapter 5 – Executive Committee

Members

1. The CIPC shall have an EC with the following membership:
   a. Chair
   b. Two vice-chairs
   c. Secretary (non-voting, NERC staff member)
   d. Four additional members elected by the CIPC, who are subject matter experts (SMEs) in one of the following areas: Physical Security, Cyber Security, Operations, and Policy.
      i. The SME members are selected at the December meeting in odd-numbered years, using the selection process defined in the Officers section above.
      ii. The terms of the SME member positions are for two years and shall begin on January 1 following their election and continue through December 31 of the second year following.
      iii. If an SME member is unable to complete their term, that person’s replacement will be selected by the EC to serve the remainder of that term.

Non-Voting Executive Committee Members

In addition, the EC includes, as non-voting participants, the immediate past CIPC Chair who may serve one year, and named representatives from APPA, CEA, EEI, EPSA, IRC and NRECA. Other recognized and well-established trade associations from the electricity sector that are involved in critical infrastructure protection issues will be considered for non-voting membership if they are not already represented. Representatives from NERC are encouraged to participate in and contribute to EC activities.

Additional non-voting members must be approved by the voting members of the EC.

Terms

Terms shall be for two years commencing on January 1 of the year following appointment.

Duties

EC duties:

1. Provide policy direction for the operation of the CIPC and manage task force and working group workload.
2. Review CIPC member candidates for expertise qualifications.
3. Respond to urgent matters by calling conference calls or special meetings.
4. Prepare meeting agendas.
5. Coordinate CIPC activities with other NERC standing committees and other entities.
6. Report to the NERC Board.
7. Coordinate and collaborate with the Electricity Sector Coordinating Council (ESCC) as needed or requested.
Open Meetings
EC meetings are open to CIPC members, alternates, proxies, and invited guests except as noted below under Chapter 6 - Confidential Sessions. Although meetings are open, only voting members may offer and act on motions.
Chapter 6 - Meetings

Quorum
A CIPC quorum requires two-thirds of the Committee voting members.

Voting
Voting may take place during regularly scheduled in-person meetings, web meetings, or may take place via email or conference call. All actions by the committee shall be approved upon receipt of the affirmative vote of two-thirds of the members present and voting at a meeting at which quorum is present.

Proxies
A member of the committee is authorized to designate a proxy. Proxy representatives may attend and vote at committee meetings provided the absent committee member notifies in writing (letter or email) the committee chair, vice chair or secretary along with the reason(s) for the proxy. The member shall name the proxy representative and their affiliation in the correspondence. No member of the committee can serve as a proxy for another member of the committee. It is expected that the proxy will adhere to the Voting Members’ Expectations and Requirements as described in Section 3 of this document.

Agenda
1. Agendas with materials to be voted on will be posted two weeks prior to the meeting.
2. Only a voting member can put forth a motion.

Action without a Meeting
The Committee may act by mail or email ballot without a regularly scheduled meeting. Two-thirds of the members present and voting is required to approve any action. A quorum for actions without a meeting is two-thirds of the Committee members. The committee chair or a majority of the EC may initiate the request for such action without a meeting. The secretary shall post a notice on the NERC website and shall provide committee members with a written notice (letter or email) of the subject matter for action not less than three business days prior to the date on which the action is to be voted. The secretary shall distribute a written notice to the Committee (letter or email) of the results of such action within five business days following the vote and also post the notice on the NERC website. The secretary shall keep a record of all responses from the committee members with the committee minutes.

Regular Meetings
CIPC meetings will be conducted at the discretion of the chair, generally once every three months.

Open Meetings
NERC committee meetings are open to the public, except as noted below under Confidential Sessions. Although meetings are open, only voting members may offer and act on motions.

Antitrust Guidelines
All persons attending or otherwise participating in the committee meeting shall act in accordance with NERC’s Antitrust Compliance Guidelines at all times during the meeting. A copy of the NERC antitrust statement shall be included with each meeting agenda.
Confidential Sessions
The chair of a committee may limit attendance at a meeting or portion of a meeting, based on confidentiality of the information to be disclosed at the meeting. Such limitations should be applied sparingly and on a non-discriminatory basis as needed to protect information that is sensitive to one or more parties. A preference, where possible, is to avoid the disclosure of sensitive or confidential information so that meetings may remain open at all times. Confidentiality agreements may also be applied as necessary to protect sensitive information. (See also the following paragraph on Confidential Matters.)

Confidential Matters
On occasion, the CIPC may be called upon to provide information or support in relation to a matter that requires confidentiality. Upon such an occasion and with the approval of the NERC President/CEO, the chair of the CIPC may convene a working group to provide such information or support without notice or approval of any other member or group. The existence of such a working group, its mission and results, will be shared with the members only to the degree and at the time deemed appropriate by the NERC President/CEO.

Parliamentary Procedures
In the absence of specific provisions in this scope document, the Committee shall conduct its meetings guided by the most recent edition of Robert’s Rules of Order, Newly Revised.

Non-Voting Members.
Non-voting members will have a voice at all open meetings.
Chapter 7 - Subgroups

Appointing Subgroups
The EC may appoint technical subgroups to address security-related issues as it deems fit or may assign such issues to its subcommittees, working groups and task forces. Working groups and task forces will take assignments from the EC and all work products will be presented to the CIPC for any further action. Subgroups will be reviewed annually by the EC to ensure that work plans are being accomplished, workload is equitably distributed, and the subgroup is still adding value to the Committee function.

Nominating Subcommittee

1. At the last regular meeting (normally the June meeting) before the selection of a new committee chair (normally the September meeting), the incumbent chair will nominate, for the committee’s approval, a chair of the nominating subcommittee. The subcommittee will recommend candidates for the committee’s chair, two vice-chairs, and four SME EC members. The nominating subcommittee may be formed upon the vacancies.

2. The subcommittee chair will then assemble five committee members which shall include the subcommittee chair and four additional members drawn from the larger committee.

3. The subcommittee will solicit nominations for the Officer and SME EC positions from the voting members of the committee.

4. The subcommittee will review the nominations received and develop a slate of seven candidates: one for the committee chair, two for the committee vice-chairs, and four SME members of the EC.

5. The subcommittee will present its slate of officers at the committee’s September meeting and SME EC members at the committee’s December meeting.
Appendix 1 – Reliability Guidelines Approval Process

1. Guidelines
Guidelines are documents that suggest approaches or behavior in a given technical area for the purpose of improving reliability. Reliability guidelines are not binding norms or mandatory requirements. Reliability guidelines may be adopted by a responsible entity in accordance with its own facts and circumstances.

2. Approval of Guidelines
Because guidelines contain suggestions that may result in actions by responsible entities, those suggestions must be thoroughly vetted before a new or updated guideline receives approval by a technical committee.

The process described below will be followed by the CIPC:

a. New/updated draft guideline approved for comment. The EC approves for comment request the release of a new or updated draft guideline developed by one of its subgroups or the committee as a whole. Alternately, the EC reserves the right to waive such posting.

b. Post draft guideline for comment if required. The draft guideline is posted for comment for forty-five (45) days (or a period specified by the EC). If the draft guideline is an update, a redline version against the previous version must also be posted.

c. Post comments and responses. After the comment period, the CIPC will post the comments received as well as its responses to the comments. The committee may delegate the preparation of responses to a committee subgroup.

d. New/updated guideline approval and posting. A new or updated guideline, which considers the comments, received, is approved by the CCIPC and posted as “Approved” on the NERC website. Updates must include a revision history and a redline version against the previous version.

e. Guideline updates. After posting a new or updated guideline, the CIPC will periodically assign a workgroup task to review the library of guidelines.

f. Standards Committee authorization is required for a reliability guideline to become a supporting document that is posted with or referenced from a NERC Reliability Standard. See Appendix 3A in the NERC’s Rules of Procedure under “Supporting Document.”

g. In order to receive ERO endorsement, the CIPC must follow the NERC approved process for development and publication of implementation guidance for documents that support a NERC Reliability Standard.
Project 2016-01 Modifications to TOP and IRO Standards (IRO-002-5, TOP-001-4)

Action
Adopt the following standard documents and authorize staff to file with applicable regulatory authorities:

- **Reliability Standards**
  - IRO-002-5 Reliability Coordination - Monitoring and Analysis
    [Clean] [Redline to last approved]
  - TOP-001-4 Transmission Operations
    [Clean] [Redline to last approved]

- **Violation Risk Factors (VRFs) and Violation Severity Levels (VSLs)**
  [VRFs and VSLs] for IRO-002-5 and TOP-001-4

- **Implementation Plan**
  [Implementation Plan] for IRO-002-5 and TOP-001-4

- **Definitions**
  None

- **Retirements**
  IRO-002-4 and TOP-001-3

Background
Proposed IRO-002-5 and TOP-001-4 contribute to reliable operations by: (i) establishing enhanced requirements for Transmission Operators (TOP) to monitor facilities necessary for reliability; and (ii) establishing requirements for Reliability Coordinators (RCs), Balancing Authorities (BAs), and TOPs to have and maintain redundant and diversely routed data exchange capabilities in primary control centers to support real-time operations. The standards address Federal Energy Regulatory Commission (FERC) Order No. 817 directives to modify the TOP and IRO standards to require:

- TOP monitoring of non-Bulk Electric System (non-BES) facilities as necessary for reliability (P 35);
- Redundancy and diverse routing of data exchange capabilities used by RCs, BAs, and TOPs (P 47); and
- Testing of redundant data exchange capabilities used in primary control centers (P 51).

Consistent with the body of TOP and IRO standards, IRO-002-5 contains requirements for RCs, while TOP-001-4 contains requirements applicable to TOPs and BAs.

Pertinent FERC Order No. 817 Directives
In approving revised TOP and IRO standards in Order No. 817, FERC directed NERC to file standards addressing the following directives by July 26, 2016. The standard drafting team (SDT) developed a Consideration of Directives document describing how the proposed modifications address the directives.
...revise Reliability Standard TOP-001-3, Requirement R10 to require real-time monitoring of non-BES facilities.

...modify Reliability Standards TOP-001-3, Requirements R19 and R20 to include the requirement that the data exchange capabilities of the transmission operators and balancing authorities require redundancy and diverse routing. In addition, [the Commission directs] NERC to clarify that “redundant infrastructure” for system monitoring in Reliability Standards IRO-002-4, Requirement R4 is equivalent to redundant and diversely routed data exchange capabilities.

...develop a modification to the TOP and IRO standards that addresses a data exchange capability testing framework for the data exchange capabilities used in the primary control centers to test the alternate or less frequently used data exchange capabilities of the reliability coordinator, transmission operator and balancing authority.

Standards Development Process
Both standards were balloted twice before final ballot, which concluded on December 12, 2016. IRO-002-5 and TOP-001-4 passed final ballot with weighted segment approval of 74.30 and 72.52 percent, respectively.

Minority Issue
A minority of stakeholders in the ballot pool did not support the proposed requirements for redundant and diversely routed data exchange capabilities as written. Some recommended developing defined terms or use of more prescriptive wording in the requirements to prevent misinterpretation during compliance audits. The SDT maintains that the results-based requirements and supporting explanation in the standards clearly describe the reliability objective for each requirement. Furthermore, the SDT's approach provides entities with flexibility to achieve the reliability objectives in a manner that is appropriate for their specific data exchange architecture and operational needs.

Additional Information
A link to the project history and files is included here for reference:

[Project 2016-01 Modifications to TOP and IRO Standards]
Project 2015-08 Emergency Operations (EOP-004-4, EOP-005-3, EOP-006-3, EOP-008-2)

**Action**
Adopt the following standards documents and authorize NERC staff to file with applicable regulatory authorities:

- **Reliability Standard EOP-004-4 – Event Reporting**
  [EOP-004-4]  [EOP-004-4 – Redline to last approved]

- **Violation Risk Factors (VRFs) and Violation Severity Levels (VSLs) for EOP-004-4**
  [VRFs and VSLs]

- **Implementation Plan for EOP-004-4**
  [EOP-004-4 Implementation Plan]

- **Retirements**
  EOP-004-3 – Event Reporting

- **Reliability Standard EOP-005-3 – System Restoration from Blackstart Resources**
  [EOP-005-3 - Clean]  [EOP-005-3 - Redline to last approved]

- **VRFs and VSLs for EOP-005-3**
  [VRFs and VSLs]

- **Retirements**
  EOP-005-2 – System Restoration from Blackstart Resources

- **Reliability Standard EOP-006-3 – System Restoration Coordination**
  [EOP-006-3 - Clean]  [EOP-006-3 - Redline to last approved]

- **VRFs and VSLs for EOP-006-3**
  [VRFs and VSLs]

- **Retirements**
  EOP-006-2 – System Restoration Coordination

- **Reliability Standard EOP-008-2 – Loss of Control Center Functionality**
  [EOP-008-2 - Clean]  [EOP-008-2 - Redline to last approved]

- **VRFs and VSLs for EOP-008-2**
  [VRFs and VSLs]

- **Retirements**
  EOP-008-1 – Loss of Control Center Functionality
Implementation Plan for EOP-005-3, EOP-006-3, and EOP-008-2

[Implementation Plan]

Background
The proposed EOP-004-4, EOP-005-3, EOP-006-3, and EOP-008-2 NERC Standards, resulting from Project 2015-08 Emergency Operations (EOP), implement the following: (1) recommendations of the Project 2015-02 Periodic Review Team (PRT), (2) recommendations from the Report on the FERC-NERC-Regional Entity Joint Review of Restoration and Recovery Plans (FERC-NERC Report), (3) industry input from comment periods following postings of the project Standard Authorization Request (SAR) and amendments to the proposed standards, and (4) collaborative efforts among NERC and the U.S. Department of Energy (DOE) to better align reporting requirements pursuant to EOP-004-3 and DOE Form OE-417. The proposed standards enhance the requirements for emergency operations, including the communication and coordination amongst reporting entities.

Pertinent FERC Order No. 749 Directives:

Paragraph 19
“NERC, in its comments about the term [unique tasks], states that it ‘could promote the development of a guideline to aid registered entities in complying with Requirement R11.’ The Commission notes that this Reliability Standard will not become effective for at least 24 months, during which time ambiguities in language or differences of opinion among affected entities may be resolved in practical ways. Once the Standard is effective, if industry determines that ambiguity with the term arises, it would be appropriate for NERC to consider its proposal to develop a guideline to aid entities in their compliance obligations.”

Recommendations from the FERC-NERC Report
- Clarify when system changes will trigger a requirement to update restoration plans.
- Examine when re-verification or testing of a system restoration plan is required.
- Examine system restoration training and drilling needs for transitioning from transmission operator island control to balancing authority control.

The revisions to EOP-005-2, based on the FERC directive and the recommendations from the Report on the FERC-NERC Report, are outlined in the project’s Consideration of Issues and Directives.

DOE Collaboration
The proposed EOP-004-4 standard attempts to harmonize reporting requirements between proposed EOP-004-4 and the currently-effective DOE Form OE-417. To the extent that any Reportable Events are not covered by a version of the DOE Form OE-417, entities are still required to report under proposed EOP-004-4.

1 For reference, the Report on the FERC-NERC-Regional Entity Joint Review of Restoration and Recovery Plans is available at FERC-NERC Report.
**Summary**

EOP-004-4 was posted for an initial comment period and ballot that ended September 8, 2016 and achieved an 80.32 percent approval rate. Due to substantive changes made by the standard drafting team in response to industry comments, EOP-004-4 posted for an additional comment period and ballot that ended on January 6, 2017 and achieved 93.55 percent approval rate. Results from the final ballot were not available when these materials were prepared, and they will be reported during the February 9, 2017 NERC Board of Trustees meeting.

EOP-005-3 was posted for an initial comment period and ballot that ended September 15, 2016 and achieved a 52.9 percent approval rate. EOP-005-3 posted for an additional comment period and ballot that ended on December 9, 2016 and achieved a 76.93 percent approval rate. Final ballot concluded January 6, 2017 and achieved an 83.65 percent approval rate.

EOP-006-3 was posted for an initial comment period and ballot that ended September 15, 2016 and achieved a 66.87 percent approval rate. EOP-006-3 posted for an additional comment period and ballot that ended on December 9, 2016 and achieved a 77.17 percent approval rate. Final ballot concluded January 6, 2017 and achieved an 80.56 percent approval rate.

EOP-008-2 was posted for an initial comment period and ballot that ended September 15, 2016 and achieved an 84.13 percent approval rate. Final ballot concluded December 9, 2016 and achieved a 93.17 percent approval rate.

**Additional Information**

A link to the project history and files is included here for reference:

[Project 2015-08 Emergency Operations]
Agenda Item 4c
Board of Trustees Meeting
February 9, 2017

Project 2016-02 Modifications to CIP Standards (CIP-003-7)
-Version A-

Action
Adopt the following standard documents and authorize NERC staff to file with applicable regulatory authorities:

- **CIP-003-7 - Cyber Security – Security Management Controls**
  [CIP-003-7 - Clean]
- **Violation Risk Factors (VRFs) and Violation Severity Levels (VSLs) for CIP-003-7**
  [CIP-003-7 VRFs and VSLs]
- **Implementation Plan for CIP-003-7**
  [CIP-003-7 Implementation Plan]
- **Retirements**
  - Reliability Standard CIP-003-6 - Cyber Security – Security Management Controls
  - Definition Low Impact BES Cyber System Electronic Access Point (LEAP)
  - Definition of Low Impact External Routable Connectivity (LERC)

Background
On January 21, 2016, the Federal Energy Regulatory Commission (FERC or the Commission) issued **Order No. 822, Revised Critical Infrastructure Protection Reliability Standards**, approving seven Critical Infrastructure Protection (CIP) Reliability Standards and new or modified definitions. In addition to approving the seven CIP Reliability Standards, the Commission, among other things, directed NERC to modify the definition of LERC in the Glossary of Terms Used in NERC Reliability Standards (NERC Glossary) by removing the word “direct” to clarify the electronic access controls for low impact BES Cyber System(s). The Commission directed NERC to file the modification within one year of the effective date of Order No. 822.

The Project 2016-02 standard drafting team (SDT) addressed the directive by revising the requirement for electronic access controls for asset(s) containing low impact BES Cyber Systems and incorporating the concepts of the definition of LERC into CIP-003-7. Specifically, the SDT modified Section 3, Part 3.1 of Attachment 1 to CIP-003-7 to require the Responsible Entity to implement electronic access controls to “permit only necessary inbound and outbound electronic access as determined by the Responsible Entity for any communications” using a routable protocol between low impact BES Cyber System(s) and a Cyber Asset(s) outside the asset containing low impact BES Cyber system(s), unless that communication meets the exclusion language that was previously in the definition of LERC. By incorporating the LERC concepts into the requirement language, the SDT eliminated the need for the term LERC in the NERC Glossary of Terms Used in Reliability Standards. Additionally, the defined term Low Impact BES Cyber System Electronic Access Point (LEAP) is no longer necessary because the SDT changed the requirement from requiring a LEAP to requiring electronic access controls. Consequently, the terms LERC and LEAP are proposed for retirement.
Pertinent FERC Directives
Order No. 822

“73. Based on the comments received in response to the NOPR, the Commission concludes that a modification to the Low Impact External Routable Connectivity definition to reflect the commentary in the Guidelines and Technical Basis section of CIP-003-6 is necessary to provide needed clarity to the definition and eliminate ambiguity surrounding the term “direct” as it is used in the proposed definition. Therefore, pursuant to section 215(d)(5) of the FPA, we direct NERC to develop a modification to provide the needed clarity, within one year of the effective date of this Final Rule. We agree with NERC and other commenters that a suitable means to address our concern is to modify the Low Impact External Routable Connectivity definition consistent with the commentary in the Guidelines and Technical Basis section of CIP-003-6.”

Standard Development Process
CIP-003-7 was posted for two industry comment and ballot periods. The second additional ballot ended on December 5, 2016 and resulted in an approval rating of 85.56 percent. The standard was posted for final ballot November 23–December 5, 2016, and achieved an approval rating of 87.95 percent.

Minority Issues
A minority of stakeholders disagreed with the drafting team’s approach to addressing the FERC directive and thought that the revisions to Section 3 of Attachment 1 (CIP-003-7) increased the compliance burden by requiring the Responsible Entity to implement electronic access controls for any communication(s) that uses a routable protocol when entering or leaving an asset containing a low impact BES Cyber System(s). The SDT stated that the revisions did not broaden the existing scope but instead provided the clarity that FERC desired around the term “direct” as used in the definition of LERC. Additionally, the SDT explained that for electronic access controls to be required and implemented, the communication(s) must meet all of the three criteria of Section 3, Part 3.1. Those criteria (i, ii, iii) were derived from the existing definition of LERC.

Additional Information
Links to the project history and RSAW are included here for reference:

- Project Page
  [Project 2016-02 Modifications to CIP Standards]

- Reliability Standard Audit Worksheet (RSAW)
  [CIP-003-7 Draft RSAW]
Project 2016-02 Modifications to CIP Standards (CIP-003-7) (Version B)

Action
Adopt the following standard documents and authorize NERC staff to file with applicable regulatory authorities:

- **CIP-003-7 - Cyber Security – Security Management Controls**
  [CIP-003-7 - Clean]
- **Violation Risk Factors (VRFs) and Violation Severity Levels (VSLs) for CIP-003-7(i)**
  [CIP-003-7 VRFs and VSLs]
- **Implementation Plan for CIP-003-7(i)**
  [CIP-003-7 Implementation Plan]
- **Definition of Transient Cyber Asset (TCA)**
  [Definition of Transient Cyber Asset]
- **Definition of Removable Media**
  [Definition of Removable Media]

Retirements

- Reliability Standard CIP-003-6 - Cyber Security – Security Management Controls
- Definition Low Impact BES Cyber System Electronic Access Point (LEAP)
- Definition of Low Impact External Routable Connectivity (LERC)
- Existing definition of Transient Cyber Asset (TCA)
- Existing definition of Removable Media

Background
On January 21, 2016, the Federal Energy Regulatory Commission (FERC or the Commission) issued Order No. 822, Revised Critical Infrastructure Protection Reliability Standards, approving seven Critical Infrastructure Protection (CIP) Reliability Standards and new or modified definitions, and directed NERC to, among other things: (1) modify the definition of LERC by removing the word “direct” to clarify the electronic access controls for low impact BES Cyber System(s); and (2) “develop modifications to the CIP Reliability Standards to provide mandatory protection for transient devices used at Low Impact BES Cyber Systems.” The Commission directed NERC to file the modification related to LERC within one year of the effective date of Order No. 822. No deadline was set for filing modifications to address the directive related to transient devices.

The Project 2016-02 standard drafting team (SDT) addressed the directive by revising the requirement for electronic access controls for asset(s) containing low impact BES Cyber Systems and incorporating the concepts of the definition of LERC into CIP-003-7. Specifically, the SDT
modified Section 3, Part 3.1 of Attachment 1 to CIP-003-6 to require the Responsible Entity to implement electronic access controls to “permit only necessary inbound and outbound electronic access as determined by the Responsible Entity for any communications” using a routable protocol between low impact BES Cyber System(s) and a Cyber Asset(s) outside the asset containing low impact BES Cyber system(s), unless that communication meets the exclusion language that was previously in the definition of LERC. By incorporating the LERC concepts into the requirement language, the SDT eliminated the need for the term LERC in the NERC Glossary of Terms Used in Reliability Standards. Additionally, the defined term Low Impact BES Cyber System Electronic Access Point (LEAP) is no longer necessary because Section 2 of Attachment 1 was modified from requiring a LEAP to requiring electronic access controls. Consequently, the terms LERC and LEAP are proposed for retirement.

In response to the directive related to transient devices, NERC proposed additional revisions to Attachment 1, CIP-003-6 to require entities to take steps to mitigate the risk to the Bulk Electric System (BES) of malware propagation through the use of transient devices at low impact BES Cyber Systems. Attachment 1 contains and outlines the required sections of a Responsible Entity’s cyber security plan(s) for its low impact BES Cyber Systems per Requirement R2. Under the existing version of CIP-003 (CIP-003-6), cyber security plan(s) are required to address four subject matter areas: (1) cyber security awareness; (2) physical security controls; (3) electronic access controls; and (4) Cyber Security Incident response. In CIP-003-7, Attachment 1 is expanded to include a fifth area: “Transient Cyber Asset and Removable Media Malicious Code Risk Mitigation.

As proposed, Section 5 of Attachment 1 of CIP-003-7 mandates Responsible Entities have malware protection for Transient Cyber Asset (TCA) (both entity and vendor-managed) and Removable Media. Additionally, NERC modified the definitions of TCA and Removable Media to ensure the applicability of security controls, provide clarity, and accommodate the use of the terms for all impact levels: high, medium and low. The revised definitions will allow entities to deploy one program to manage TCAs and Removable Media across multiple impact levels.

During development, Version B of CIP-003-7 herein requested for approval was balloted as CIP-003-7(i). Romanette i was included in the version numbering to differentiate it from an earlier ballot of CIP-003-7 that only addressed the directive related to LERC (Version A). Due to the filing deadline associated with the LERC directive, NERC staff and the SDT first developed and balloted modifications associated with the LERC directive independently. Following a successful ballot of the LERC-only modifications, NERC staff and the SDT then developed and balloted further changes to CIP-003-7 (balloted as CIP-003-7(ii)) to address the transient device directive. This approach ensured that even if the modifications related to the transient device directive did not pass ballot, NERC could fulfil its regulatory deadline with respect to the LERC directive by presenting Version A to the Board of Trustees for adoption.

During the ballot of CIP-003-7(i), the RSAW was modified and reposted to clarify that entities must document their determination of necessary inbound and outbound electronic access and provide justification of the business need for such access. Once this determination has been made and documented, the audit team’s professional judgement should not override the determination made by the entity.
32. After consideration of the comments received on this issue, we conclude that the adoption of controls for transient devices used at Low Impact BES Cyber Systems, including Low Impact Control Centers, will provide an important enhancement to the security posture of the bulk electric system by reinforcing the defense-in-depth nature of the CIP Reliability Standards at all impact levels. Accordingly, we direct that NERC, pursuant to section 215(d)(5) of the FPA, develop modifications to the CIP Reliability Standards to provide mandatory protection for transient devices used at Low Impact BES Cyber Systems based on the risk posed to bulk electric system reliability. While NERC has flexibility in the manner in which it addresses the Commission’s concerns, the proposed modifications should be designed to effectively address the risks posed by transient devices to Low Impact BES Cyber Systems in a manner that is consistent with the risk-based approach reflected in the CIP version 5 Standards.

73. Based on the comments received in response to the NOPR, the Commission concludes that a modification to the Low Impact External Routable Connectivity definition to reflect the commentary in the Guidelines and Technical Basis section of CIP-003-6 is necessary to provide needed clarity to the definition and eliminate ambiguity surrounding the term “direct” as it is used in the proposed definition. Therefore, pursuant to section 215(d)(5) of the FPA, we direct NERC to develop a modification to provide the needed clarity, within one year of the effective date of this Final Rule. We agree with NERC and other commenters that a suitable means to address our concern is to modify the Low Impact External Routable Connectivity definition consistent with the commentary in the Guidelines and Technical Basis section of CIP-003-6.

**Standard Development Process**
CIP-003-7(i) was posted for informal comment in November 2016, then posted for an initial comment and ballot that ended on January 25, 2017. The results of the initial ballot and subsequent final ballot were not available when these materials were prepared and will be reported during the February 9, 2016 Board of Trustees meeting.

**Minority Issues**
A minority of stakeholders disagreed with the drafting team’s approach to addressing the LERC directive and thought that the revisions to Section 3 of Attachment 1 to CIP-003-7(i) increased the compliance burden by requiring the Responsible Entity to implement electronic access controls for any communication(s) that uses a routable protocol when entering or leaving an asset containing a low impact BES Cyber System(s). The SDT stated that the revisions did not broaden the existing scope but instead provided the clarity that FERC desired around the term “direct” as used in the definition of LERC. Additionally, the SDT explained that for electronic access controls to be required and implemented, the communication(s) must meet all of the three criteria of Section 3, Part 3.1. Those criteria (i, ii, iii) were derived from the existing definition of LERC.
Because this document was prepared prior to the end of the comment and ballot period, no stakeholder comments had been received. NERC will report minority issues on the transient aspects at the Board of Trustees February 9, 2017 meeting.

Additional Information
Links to the project history and RSAW are included here for reference:

- **Project page**
  [Project 2016-02 Modifications to CIP Standards]

- **Reliability Standard Audit Worksheet (RSAW)**
  [CIP-003-7(i) Draft RSAW]
**Texas RE Standards Development Process Revisions**

**Action**
Approve the following standard documents and authorize staff to file with applicable regulatory authorities:

- Texas Reliability Entity (Texas RE) Standards Development Process
  [Texas RE Standards Development Process - Clean]
  [Texas RE Standards Development Process - Redline]

**Background**
Texas RE has revised its regional Standards Development Process (SDP). The purpose of these revisions is to reflect amendments to the Texas RE Bylaws (see Agenda Item 5c) that eliminate the Texas RE Reliability Standards Committee (RSC) and transfer its duties to the Texas RE Member Representatives Committee (MRC). In addition, the document reflects several minor revisions to clarify and update language.

**Summary**
A summary of the changes to the Texas RE SDP is provided below:

- Throughout document: replaced references to “Reliability Standards Committee” with “Member Representatives Committee” and “RSC” with “MRC”.

- Section IV, Roles in the Texas RE Regional Standards Development Process: (i) added definition of “Member Representatives Committee,” based on how it is defined in the Texas RE Bylaws and adding portions of the definition of the Reliability Standards Committee; (ii) deleted “Reliability Standards Committee”; (iii) deleted “Interchange Authority” from Texas RE Standards Development Sectors, as it is no longer a NERC registered function; (iv) added language to “Cooperative or Utility” to conform with Texas RE Bylaws regarding registration; and (v) revised definition of “Load Serving and Marketing” to conform with Texas RE Bylaws.

- Section V.B, Step 6B: revised “membership” to “Registered Ballot Pool” to correct an apparent typo.

- Appendix A, Section I: revised to reflect transfer of duties from Texas RE RSC to Texas RE MRC. Added language from Texas RE Bylaws regarding requirements for an MRC quorum.

- Appendix A, Section III: added language to clarify that the Registered Ballot Body is comprised of representatives from the Texas RE Standards Development Sectors.

- Appendix B, Section III: added “or other corporate governance changes” regarding changes to the Texas RE regional standards development process since the Texas RE Bylaws are no longer part of the Regional Delegation Agreement.

- Appendix C: deleted “Interchange Authority,” “Purchasing and Selling Entity,” and “Load Serving Entity” from the regional standard authorization request form as those are no longer NERC registered functions.
As required by Section 311 of the NERC Rules of Procedure, NERC staff reviewed Texas RE’s SDP and concluded the document met all of the evaluation criteria. The revised Texas RE SDP was approved by the Texas RE RSC on November 14, 2016 and was subsequently approved by the Texas RE Board of Directors on December 7, 2016. The Texas RE SDP was posted on the NERC website for industry stakeholder comment from December 9, 2016 through January 23, 2017. Any comments received during the posting period will be reviewed at the February 9, 2017 NERC Board of Trustees meeting.
WECC Regional Reliability Standard VAR-501-WECC-3

Action
Adopt the Regional Reliability Standard VAR-501-WECC-3 – Power System Stabilizer (PSS) and authorize NERC staff to file with applicable regulatory authorities.

- Regional Reliability Standard VAR-501-WECC-3
  [VAR-501-WECC-3 – Clean]
  [VAR-501-WECC-3 – Redline]

Background
On February 11, 2014, the Western Electricity Coordinating Council (WECC) received a Standard Authorization Request requesting modification of VAR-501-WECC-2 to ensure that the Western Interconnection is operated in a coordinated manner under normal and abnormal conditions by establishing the performance criteria for WECC PSSs. The current associated policies and procedures are voluntary and are not consistently implemented.

Summary
As proposed, the VAR-501-WECC-3 Regional Reliability Standard would require an applicable entity to:

1. Provide written Operating Procedures or other document(s) describing those known circumstances during which a Generator Owner’s PSS will not provide an active signal to the Automatic Voltage Regulator;
2. Have its PSS in service while synchronized, except during specified circumstances;
3. Tune its PSS to specific criteria;
4. Install and complete start-up testing of a PSS under specified circumstances; and
5. Repair or replace its PSS within 24 months of that PSS becoming incapable of meeting the tuning specifications stated in the Standard.

VAR-501-WECC-3 passed the WECC final ballot on April 28, 2016 and was approved by the WECC Standards Committee on June 14, 2016. On September 21, 2016 the WECC Board of Directors approved sending the proposed standard to NERC for adoption and subsequent filing with applicable regulatory authorities. NERC staff supports the Regional Reliability Standard, which was posted for a 45-day public comment period from December 12, 2016 through January 25, 2017. Any adverse comments or minority opinions received during the comment period will be reviewed at the February 9, 2017 Board of Trustees meeting.

Pertinent FERC Order No. 693 Directives
None

Additional Information
A link to the project history and files is included here for reference:
[WECC-0107 PSS Design and Performance (VAR-501-WECC-3)]
Revisions to Regional Reliability Standard BAL-001-TRE-1
Attachment 2 – Primary Frequency Response Reference Document

Action
Information

Background
Texas Reliability Entity (Texas RE) has revised Attachment 2, Primary Frequency Response Reference Document to regional Reliability Standard BAL-001-TRE-1 - Primary Frequency Response in the ERCOT Region. The purpose of these revisions is to reflect amendments to the Texas RE Bylaws and the Texas RE Standards Development Process that eliminate the Texas RE Reliability Standards Committee (RSC) and transfer its duties to the Texas RE Member Representatives Committee (MRC).

The revisions were approved by the Texas RE Board of Directors on December 7, 2016. In accordance with the revision process set forth in Attachment 2 to BAL-001-TRE-1, these revisions are provided to the NERC Board of Trustees and FERC for informational purposes only.

Summary
A summary of the changes to regional Reliability Standard BAL-001-TRE-1 is provided below:

- BAL-001-TRE-1, Section E.2.b, Associated Documents, Attachment 2: Replaced “Reliability Standards Committee” with “Member Representatives Committee” and “RSC” with “MRC.”
- BAL-001-TRE-1, Attachment 2 – Primary Frequency Response Reference Document: Replaced “Reliability Standards Committee” with “Member Representatives Committee” and “RSC” with “MRC.” Deleted reference to RSC procedures.

Additional Information
The revised documents are included here for reference:

[Texas RE – Revisions to BAL-001-TRE-1 Attachment 2 – clean]

[Texas RE – Revisions to BAL-001-TRE-1 Attachment 2 – redline]
Efficiency and Effectiveness Metric

Action
Approve

Background
An initial draft of metrics focused on measuring NERC’s efficiency and effectiveness (formerly referred to as NERC performance metrics) was shared during the November 2016 Member Representatives Committee (MRC) and Board of Trustees (Board) meetings. Since the November meetings, NERC has worked with the MRC Business Plan and Budget Input Group, as well as the Regional Executives, to gather additional feedback for improvements. Using this input, these metrics were revised to be a single metric, with four supporting measures. The measures and their thresholds and targets will be adjusted annually as needed. In 2017, NERC and the Regional Entities will explore evolving this metric to measure the efficiency and effectiveness of the ERO Enterprise.

The attached Efficiency and Effectiveness Metric is submitted to the Board for approval at its February 9, 2017, meeting. Once approved, this metric will be added as a seventh metric to the ERO Enterprise Strategic Plan and Metrics 2017–2020 (see Appendix 1).

Attachments
1. NERC’s Efficiency and Effectiveness Metric
## NERC’s Efficiency and Effectiveness Metric

<table>
<thead>
<tr>
<th>Measure of success</th>
<th>Threshold</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Execution of Business Plan and Budget</td>
<td>• NERC will be at or under budget for expenses and fixed assets exclusive of the authorized use of operating reserves</td>
<td>• NERC will be at or under budget for expenses and fixed assets inclusive of the authorized use of operating reserves with the exception of authorized reserve expenditures resulting from a FERC directive which was not in existence at the time the final 2017 BP&amp;B was provided to the Board for approval</td>
</tr>
<tr>
<td>Implementation of ERO Enterprise technology solutions</td>
<td></td>
<td>• Complete ERO Enterprise IT projects for Entity Registration, Enterprise Reporting Phase 4 (data for event analysis, misoperations, or TADS), and NERC’s public-facing website on time, on budget, and with expected functionality</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Develop a method to measure and track the cost benefit of ERO Enterprise IT projects</td>
</tr>
<tr>
<td>Implementation of the Regional Entity oversight plans and NERC adherence to the Rules of Procedure</td>
<td>• Implement the recommendations and schedule from audit findings identified in 2016 by the CCC and NERC’s internal audit department</td>
<td>• No significant new noncompliance findings in NERC’s implementation of the Regional Entity oversight plans or adherence to the Rules of Procedure</td>
</tr>
<tr>
<td>Implementation of action plans in response to ERO Enterprise Effectiveness Survey results</td>
<td></td>
<td>• Implement the 2017 milestones identified in the action plans as accepted by the Board of Trustees in 2016</td>
</tr>
</tbody>
</table>
Distributed Energy Resources Task Force Final Report

Action
Accept the report, endorse the recommendations, and approve for publication.

Background
The Distributed Energy Resources Task Force (DERTF) was established in response to recommendations from the Essential Reliability Services Task Force (ERSTF) Measures Framework Report. The DERTF has developed a report which is being distributed to the Member Representatives Committee (MRC). The report is focused on operational and planning impacts of Distributed Energy Resources (DER) and examining the potential implications to bulk power system (BPS) reliability. This report explores existing policies and requirements oriented to support the reliable integration of DER with respect to BPS reliability. In developing this report, the task force reviewed the NERC Functional Model, existing NERC Reliability Standards, and coordinated with IEEE-1547-related efforts. Additionally, the task force reviewed definitions for Behind-the-Meter Generation (BTMG), Distributed Generation (DG), and other related terms to provide clear distinctions between each category.

Next Steps and Actions
The final report recommends action in several areas, including:

- Reliability Guidelines
- Data Sharing
- System Modeling
- DER Models
- Definitions
- Industry Collaboration

NERC has identified several actions that should be prioritized including enhancements to NERC Reliability Standards, guideline development by the technical committees, model improvements, and increased attention in assessments, monitoring, and reliability studies.
# Table of Contents

Preface....................................................................................................................................................................... iii

Executive Summary ................................................................................................................................................... iv

Introduction............................................................................................................................................................... vi

Chapter 1: Definition of Distributed Energy Resources .............................................................................................1

Chapter 2: Reliability Considerations for DER ............................................................................................................3
  DER and Potential Risks to Reliability .....................................................................................................................4

Chapter 3: Data and Modeling for DER ......................................................................................................................6
  Data Requirements and Information Sharing at the T-D Interface ........................................................................6
  DER Modeling for Bulk Power System Planning and Operations ...........................................................................6
    Steady-State Studies ...........................................................................................................................................9
    Dynamic Studies ............................................................................................................................................... 11

Chapter 4: Characteristics of Nonsynchronous DER ............................................................................................... 16
  Background .......................................................................................................................................................... 16
    Voltage Ride-Through (VRT) and Frequency Ride-Through (FRT) Characteristics and Consequences .......... 16
    California Rules for DER ....................................................................................................................................... 20

Chapter 5: Previous Work of the NERC IVGTF Task Force ....................................................................................... 23

Chapter 6: NERC Reliability Standards .................................................................................................................... 25
  Background .......................................................................................................................................................... 25
  Review of Existing NERC Standards ..................................................................................................................... 25

Chapter 7: Recommendations......................................................................................................................................... 27

Appendix A: Typical Connection of DER .................................................................................................................. 28

Appendix B: Operations and Long-Term Planning ................................................................................................... 32

Appendix C: Review of Existing NERC Standards ................................................................................................... 36

Appendix D: Transmission-Distribution Interface ................................................................................................... 38

Task Force Membership .......................................................................................................................................... 39

References............................................................................................................................................................... 40
Preface

The North American Electric Reliability Corporation (NERC) is a not-for-profit international regulatory authority whose mission is to assure the reliability and security of the bulk power system (BPS) in North America. NERC develops and enforces Reliability Standards; annually assesses seasonal and long-term reliability; monitors the BPS through system awareness; and educates, trains, and certifies industry personnel. NERC’s area of responsibility spans the continental United States, Canada, and the northern portion of Baja California, Mexico. NERC is the Electric Reliability Organization (ERO) for North America, subject to oversight by the Federal Energy Regulatory Commission (FERC) and governmental authorities in Canada. NERC’s jurisdiction includes users, owners, and operators of the BPS, which serves more than 334 million people.

The North American BPS is divided into eight Regional Entity (RE) boundaries as shown in the map and corresponding table below.

The North American BPS is divided into eight RE boundaries. The highlighted areas denote overlap as some load-serving entities participate in one Region while associated transmission owners/operators participate in another.

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Name</th>
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<tbody>
<tr>
<td>FRCC</td>
<td>Florida Reliability Coordinating Council</td>
</tr>
<tr>
<td>MRO</td>
<td>Midwest Reliability Organization</td>
</tr>
<tr>
<td>NPCC</td>
<td>Northeast Power Coordinating Council</td>
</tr>
<tr>
<td>RF</td>
<td>ReliabilityFirst</td>
</tr>
<tr>
<td>SERC</td>
<td>SERC Reliability Corporation</td>
</tr>
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<td>Southwest Power Pool Regional Entity</td>
</tr>
<tr>
<td>Texas RE</td>
<td>Texas Reliability Entity</td>
</tr>
<tr>
<td>WECC</td>
<td>Western Electricity Coordinating Council</td>
</tr>
</tbody>
</table>
Executive Summary

The North American electric power system is transforming to a resource mix that relies less on coal and nuclear while integrating more natural gas, wind, solar, distributed generation, and demand response resources. The NERC Essential Reliability Services Working Group (ERSWG) is studying this transformation in the broader context of monitoring grid reliability and resiliency. Additionally, as noted in the ERS Framework Report\(^1\) in 2015, Distributed Energy Resources (DER) are a rapidly growing part of this transformation. This report discusses the potential reliability risks and mitigation approaches for increased levels of DER on the BPS.

At the distribution level, the potential impacts of DER are fairly well understood in the industry, but the translation of these impacts to the BPS has been studied less. This report discusses the challenges as well as the steps forward for reliably integrating higher DER penetrations.

In certain areas, DER are numerous and embedded within a distribution system that has traditionally been viewed as a relatively passive load resource on the BPS, but this will no longer be a valid assumption with the integration of more DER on the electric system. In addition, newer DER technologies are capable of providing advanced support services that will be needed as the transition from conventional synchronous resources to nonsynchronous inverter-based resources continues. It is paramount that NERC and the industry understand DER functionality and develop a set of guidelines to assist in modeling and assessments such that owners/operators of the BPS can evaluate and model DER in the electric system. Data requirements and information sharing across the transmission-distribution (T-D) interface should also be further evaluated to allow for adequate assessment of future DER deployments.

This report does not make an assessment of the capability of DER versus conventional resources; it is only meant to help entities, regulators, and policy makers better understand the differences between DER and conventional generation and how DER affect the BPS. DER will increasingly have state-of-the-art capabilities for active power control and reliability services. However, there are differences in how DER are deployed within the grid and the characteristics of the services and responses that they provide, so these differences must be understood and modeled appropriately. As a result, this report explains how practices for modeling and operating the BPS may be enhanced to reflect future system characteristics. Simultaneous efforts to improve DER interconnection standards, such as proposed changes to the Institute of Electrical and Electronics Engineers IEEE 1547\(^2\), will assist in establishing criteria and requirements for interconnection of DER to electric power systems.

The ability to accurately model the power system is important given the highly complex and interconnected nature of the power grid. System modeling is critical for power grid operations and planning for both normal operations and disturbances to ensure reliable operation of the BPS. All components of the system must be represented in the models, either directly or in an aggregated way, with sufficient fidelity to enable the model to provide meaningful and accurate simulations of actual system performance. A modular approach to represent DER in BPS studies, with some level of data validation, may ensure accurate representation of the resources for the specific BPS study type. While dynamic models for different DER technologies are available, limited existing knowledge and experience of modeling DER in system planning studies and operating with higher penetration DER levels will require future collaborative research, knowledge exchange, and learning.

Even though load and DER reside “behind-the-meter” the modeling for each of these respective network elements requires a different set of data. As the penetration level of DER increases, the classical transmission model of distribution system load (netted generation and load) is not valid; the unique characteristics of DER must be modeled separately. This is distinct from tariff and ratemaking issues (e.g., net metering, time-of-use rates, value

\(^1\) NERC Essential Reliability Services Task Force Measures Framework Report; November 2015
\(^2\) IEEE 1547 Standard for Interconnecting Distributed Resources with Electric Power Systems
of solar methods, etc.). Data for DER modeling and verification purposes must be collected, and the industry should determine the level of granularity which corresponds to the future BPS modeling needs.

The ERSWG has also discussed the importance of continuously maintaining the balance between demand and generation for balancing areas. These ramping and balancing activities may become more challenging for regions with high levels of DER as these activities will require resources located on the BPS as well as the distribution system, and the distribution system may not be visible to or controlled by the BPS operator.

A coordinated effort by transmission and distribution entities is needed to determine the appropriate use of future DER capabilities. Some DER have the capability to ride through disturbances, contribute reliability services, and follow dispatch signals. These capabilities are starting to be used either directly or through aggregators for a number of emerging services (e.g., demand response, micro-grids, virtual power plants, etc.). Dispatch of DER for system operations are not explicitly discussed in this report. As the capabilities of DER evolve to include advanced controls (e.g. active power control) and monitoring, the transmission and distribution utilities will need to expand their coordination activities in order to maintain BPS reliability.
Introduction

In 2015, the Essential Reliability Services Task Force (ERSTF) recognized that the North America’s electric power system generation resource mix is changing from the use of larger synchronous sources to the use of a more diverse fleet of smaller sized resources with varying generation characteristics. As this transformation continues, there is a fundamental shift in the operational characteristics of the power system as a whole and hence potential reliability implications\(^3\). The ERSTF final report provides directional measures to help the industry understand and policy makers prepare for the on-going transition. The measures provide insight to key technical considerations that may not have represented challenges with a conventional generation fleet, but may pose risks to BPS reliability under a changing generation fleet.\(^4\)

The growing interest in a more decentralized electric grid and new types of distributed resources further increase the variety of stakeholders and technologies. Both new and conventional stakeholders are building or planning to build distributed solar photovoltaic systems, energy management systems, micro-grids, demand services, aggregated generation behind the retail meter, and many other types of distributed generation. Many of these stakeholders have considerable experience with installing such systems on the distribution network for the benefits of industrial or residential customers; however, they may have less familiarity with the BPS and the coordinated activities that ensure system reliability during both normal operation and in response to disturbances. While this report examines reliability considerations from the viewpoint of the BPS, it will also help DER providers understand the reliability considerations for the power system as a whole.

Increasing amounts of DER can change how the distribution system interacts with the BPS and will transform the distribution system into an active source for energy and ERS. Attention must be paid to potential reliability impacts, the time frame required to address reliability concerns, coordination of ERS and system protection considerations for both the transmission and distribution system, and the growing importance of information sharing across the transmission-distribution (T-D) interface.

Today, the effect of aggregated DER is not fully represented in BPS models and operating tools. This could result in unanticipated power flows and increased demand forecast errors. An unexpected loss of aggregated DER could also cause frequency and voltage instability at sufficient DER penetrations. Variable output from DER can contribute to ramping and system balancing challenges for system operators whom typically do not have control or observability of the DER within the BPS.

These issues present challenges for both the operational and planning functions of the BPS. In certain areas, DER are being connected on the distribution system at a rapid pace, sometimes with limited coordination between distribution utilities and BPS planning activities. With the rapid rate of DER installations on distribution systems, it will be necessary for the BPS planning functions to incorporate future DER projections in BPS models. These changes will affect not just the flow of power but also the behavior of the system during disturbances. It is important to coordinate the planning, installation, and operation of DER with the BPS.

In this report the formal definition for DER is provided first, followed by BPS reliability considerations, modeling, and DER ride-through response given an event grid disturbance. Subsequently, the report provides a list of NERC reports and standards that address or may be affected by DER, followed by the recommendations and summary. Supplemental appendices are provided and an appendix will discuss operational considerations of DER.

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\(^3\) December 2015 – Essential Reliability Services Abstract Report

\(^4\) 2015 Essential Reliability Services Task Force Framework: Measure 10
The transformation of the distribution utility has become a major topic of discussion in the industry. It will be important for NERC’s ERS effort to follow this transformation and consider the implications and responsibilities for ensuring reliability with higher DER penetrations.
Chapter 1: Definition of Distributed Energy Resources

NERC recognizes that various definitions have been used within the industry; however, it is important to establish a working definition to create the context for the discussions within this report. Here, DER is defined as:

A Distributed Energy Resource (DER) is any resource on the distribution system that produces electricity and is not otherwise included in the formal NERC definition of the Bulk Electric System (BES).

As developed by NERC and approved by FERC, the BES definition includes all the larger elements and facilities that are necessary for the reliable operation and planning of the interconnected bulk power system (BPS). With the growing prevalence of DER, some areas are recognizing that the locations and characteristics of the DER devices must be correctly represented in planning, operating, and stability models to achieve accurate results. Understanding DER is therefore becoming an important consideration for BPS reliability.

There are various types of DER, a list of selected DER types and their respective definitions are provided below. The definitions do not provide a comprehensive review of industry terms, however they represent a framework for moving forward with an improved understanding of the role of DER in the context of BPS reliability.

DER include any non-BES resource (e.g. generating unit, multiple generating units at a single location, energy storage facility, micro-grid, etc.) located solely within the boundary of any distribution utility, Distribution Provider, or Distribution Provider-UFLS Only, including the following:

- **Distribution Generation (DG):** Any non-BES generating unit or multiple generating units at a single location owned and/or operated by 1) the distribution utility, or 2) a merchant entity.

- **Behind The Meter Generation (BTMG):** A generating unit or multiple generating units at a single location (regardless of ownership), of any nameplate size, on the customer's side of the retail meter that serve all or part of the customer’s retail load with electric energy. All electrical equipment from and including the generation set up to the metering point is considered to be behind the meter. This definition does not include BTMG resources that are directly interconnected to BES transmission.

- **Energy Storage Facility (ES):** An energy storage device or multiple devices at a single location (regardless of ownership), on either the utility side or the customer’s side of the retail meter. May be any of various technology types, including electric vehicle (EV) charging stations.

- **DER aggregation (DERA):** A virtual resource formed by aggregating multiple DG, BTMG, or ES devices at different points of interconnection on the distribution system. The BES may model a DERA as a single resource at its “virtual” point of interconnection at a particular T-D interface even though individual DER comprising the DERA may be located at multiple T-D interfaces.

- **Micro-grid (MG):** An aggregation of multiple DER types behind the customer meter at a single point of interconnection that has the capability to island. May range in size and complexity from a single “smart” building to a larger system such as a university campus or industrial/commercial park.

- **Cogeneration:** Production of electricity from steam, heat, or other forms of energy produced as a by-product of another process.

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5 NERC Glossary of Terms
- **Emergency, Stand-by, or Back-Up generation (BUG):** A generating unit, regardless of size, that serves in times of emergency at locations and by providing the customer or distribution system needs. This definition only applies to resources on the utility side of the customer retail meter.

While defining DER is an important first step, to fully understand the potential interaction of these resources with the BPS, it is essential to recognize how these resources are interconnected to the power grid. DER, as defined above, are generally interconnected to a distribution provider’s electric system at the primary voltage (≤ 100 kV but > 1 kV) and/or secondary voltage (≤ 1 kV). As such, the effect of aggregated DER is not fully represented in BPS models and operating tools. A discussion and examples of the types of interconnections between DER and the BPS are provided in Appendix A. Understanding how these resources are defined by NERC and how they are interconnected to the BPS allows for further exploratory discussions on how to model DER and their current operating characteristics.

For the purposes of this report, DER are defined as resources that produce electricity. Demand side management (DSM) resources which do not produce electricity are not included in the definition and is outside the framework of this report. As shown in Appendix D, while DSM activities may not have the same characteristics or behaviors as resources that produce electricity, DSM activities can have impacts at the T-D interface that overlap and interact with those of DER. As such, the task force recommends future consideration of DSM in the DER definition and how the recommendations of this report may be applied to DER and DSM resources in a unified way.
In certain areas, North America is experiencing a growing interest in a more decentralized electric grid with increasing penetrations of DER. Greater levels of these interconnected resources reinforce the need to ensure the reliability of the BPS during both normal operation and in response to disturbances. Increasing amounts of DER can change how the distribution system interacts with the BPS and may transform distribution utilities into active sources for both energy and ERS. These dramatic changes for the distribution system, which can alter not just the flow of power but also the responses to various types of disturbances, must be understood and represented in the planning and operation of the grid. This can be accomplished through coordinated activities that ensure effective communication is occurring between those operating the BPS and the distribution provider.

The following is an overview of the key areas of focus on which the DERTF has collaborated:

- **Modeling**: DER are typically netted with load at the distribution bus for operations and planning. The challenge is to understand their variability and interactions with other resources. The electric industry has studied and incorporated the characteristics of conventional resources into the models that are used for planning and operations. To support the reliable integration of DER at higher levels, appropriate modeling methods will be necessary.

- **Ramping and Variability**: Certain types of DER create significant ramps, such as morning and evening solar ramps that are different than historically experienced by the distribution system and the BPS. Coordination between BPS and distribution system for planning, installation, and operation of DER resources is a continuing need as the generation resource mix evolves on both transmission and distribution systems.

- **Reactive Power**: Currently, most DER are not required to provide reactive support to help control local voltage levels. Modern technologies, including inverters for new rooftop solar PV installations, should have the capability to support voltage and ride-through voltage excursions. Use of these capabilities will be increasingly important to support the reliability of both the transmission and distribution systems.

- **Frequency Ride-Through**: DER are not coordinated with the voltage and frequency ride-through requirements of NERC Standard PRC-024-2. As DER are added to the system, frequency and voltage ride-through capabilities become important and must be considered both locally and for the BPS.

- **System Protection**: DER are not coordinated with UFLS programs nor are they used to calculate the most severe single contingency and contingency reserve requirements. High levels of DER with inverters can also result in a decline in short circuit current, which can make it more difficult for protection devices to detect and clear system faults. Hence, the implications of DER as part of system protection must be taken into consideration while planning the BPS and distribution systems.

- **Visibility and Control**: Many DER are passive in that they do not follow to a dispatch signal and are generally not visible to the system operator. The lack of visibility and control is not only a challenge for operations, but must also be accounted for in the planning of the BPS. At higher penetration levels, DER capabilities related to visibility and control may become increasingly important.

- **Load and Generation Forecasting**: Currently, DER are modeled as load modifiers for most load forecasting tools. However, given the number of DER installation applications and projections of future growth, it may become important to have sufficient information to support forecasting of DER power production separately from load, as well as to consider future DER deployment scenarios in the planning of both the distribution systems and the load/generation forecasting systems.

- **Interconnection Requirements**: Interconnection requirements are evolving with increasing DER penetrations, and as a consequence of this, a number of DER classes with very different dynamic behaviors...
will exist in the BPS. It will be important to know this information, at least in an aggregate way, so that the dynamic characteristics can be modeled correctly for BPS planning.

- **Reliability Standards**: NERC and industry must consider the existing standards, functional model, and related equipment standards in terms of accommodating the growing integration of DER while ensuring prudent planning and reliable operation of the BPS.

### DER and Potential Risks to Reliability

At low penetration levels, the effects of DER may not present a risk to BPS reliability; however, as penetrations increase, the effect of these resources can present certain reliability challenges that require attention. This leads to areas where further consideration is needed to better understand the impacts and how those effects can be included in planning and operations of the BPS.

The data on installed and projected DER units is needed for reliability modeling purposes. Important data for modeling include information on the location, type, size, configuration, interconnection characteristics, disturbance response characteristics, and date of operation of the equipment. DER generation profiles would also improve the fidelity of modeling results rather than forcing models to assume worst-case scenarios. It is particularly important that both data and models be available down to the elements of interest to the models (e.g., separating the DER generation from the load).

Maintaining the balance between demand and generation for a BA is required. If balance is not maintained, then there is not enough supply of generation to meet the load demand. Additionally, ramping is a concern for a BA because ramping may cause the BA to rely on its neighbors for capacity resources when there is a sudden large increase or decrease in generation. Ramping and balancing activities may become more challenging for regions with high levels of DER and variable energy resources (VER). Utility-scale VER (e.g., solar and wind) are now required to ride through disturbances, to provide reliability services, and to have active power management capability to respond to dispatch or automatic generation control (AGC) signals. Many DER will also have such capabilities, and these capabilities may be used either directly or through aggregators for numerous emerging services (e.g., demand response, micro-grids, virtual power plants, etc.).

System operators require sufficient levels of ERS, from on-line resources, for the reliable operation of the BPS. It is not necessary that all resources provide all services at all times, but if conventional resources are off-line or replaced by DER, it may be increasingly important to use DER for active power control and ERS. The DER task force is not suggesting that DER be dispatched like conventional generators or utility-scale VER power plants, but methods to obtain active power control and reliability services from some portion of DER are likely to be important in the future.

Current work on enhancements to the IEEE 1547 interconnection requirements and how capabilities of DER are used will present opportunities for improving BPS reliability. Technology advances have the potential to alter DER from a passive “do no harm” resource to an active “support reliability” resource. From a technological perspective, modern DER units will be capable of providing ERS and supporting BPS reliability. These technologies are likely to become more widely available in the near future, and they present an opportunity to enhance BPS performance when applied in a thoughtful and practical manner. For example:

- When viewed in aggregate, multiple DER units can scale up to become a very large resource. For example, in 2016, California Independent System Operator (CAISO) stated there are 4,900 MW of DER in its Balancing Authority. This was its largest single resource when aggregated. If DER could provide frequency response on a 5% droop characteristic, it could provide 163 MW / -0.10 Hz of frequency response to CAISO. This is a significant benefit.
• With respect to voltage support, active voltage control on a feeder circuit could significantly lower the risk of fault induced delayed voltage recovery (FIDVR) events for multiphase faults on the transmission system. By reducing net load on the feeder and providing voltage support, these events related to locked rotor current of single-phase compressors following a fault would have a reduced effect on the distribution voltage and BPS voltage levels.

• With the possible aggregation of DER capabilities, it becomes feasible to “dispatch” DER for system balancing, demand response, operating and contingency reserves, or to mitigate ramp rate concerns in the morning and evening.

The capabilities of VER are evolving rapidly, so there are a number of emerging topics that are not within the scope of this report. For example, protection settings are a future step in the modeling efforts that are discussed in Chapter 3, and IEEE 1547 proposals currently deal with reenergizing but not with DER capabilities for use as a black start resource. NERC should continue to monitor and participate in the ongoing evolution of capabilities and how such capabilities should be incorporated into future planning and operating of the BPS.
Chapter 3: Data and Modeling for DER

The increasing amount of DER connected to the distribution system requires consideration of DER resources in the planning and operations of the BPS. A key takeaway for both planning and operating considerations is the collection and sharing of data across the transmission-distribution (T-D) interface.

The scope of this chapter covers the recommended data requirements followed by the details around appropriate modeling for 1) steady-state power flow and short-circuit studies, and 2) dynamic disturbance ride-through and transient stability studies for BPS planning. Distribution system aspects (e.g., distribution protection and planning), BPS small-signal stability, and BPS operational aspects which include flexibility and ramping are out of the scope of this document.

Data Requirements and Information Sharing at the T-D Interface

With DER being connected at the distribution level but having potential impact at the BPS level, the following data and information sharing recommendations, across the T-D interface, are important to support adequate modeling and assessment of BPS reliability issues:

- Each substation with aggregated DER data represents the mix of DER and their capabilities. Examples of DER data categories include the following:
  - DER type (i.e., PV, wind, cogeneration, etc.)
  - DER MVA rating
  - Relevant energy production characteristics (i.e., active tracking, fixed tilt, energy storage characteristics, etc.)
  - DER operating power factor and/or reactive and real power control functionality
    - DER point of common coupling (PCC) voltage
  - DER location: behind the meter/in front of the meter
  - Date that DER went into operation

- A set of default equivalent impedances for various distribution grid types that can be used to choose adequate parameters (e.g., WECC’s PVD1 model for distributed PV systems)

- Relevant interconnection performance requirements based on national or regional standards

- DER stability models and their voltage and frequency trip parameters. In particular the regionally specific parameters Vt0, Vt1, Vt2, and Vt3 of WECC’s distributed PV model (PVD1) [41]

The recommended data requirements should be considered by the regional committees and specified in regional criterion such as WECC’s “Steady State and Dynamic Data Requirements MOD-(11 and 13)-WECC-CRT-1 Regional Criterion” [5] and others.

DER Modeling for Bulk Power System Planning and Operations

While it may be desirable to model DER in all planning studies and in full detail, the additional effort of doing so may only be justified if DER are expected to have significant impact on the modeling results. An assessment of the expected impact will have to be scenario-based, and the time horizon of interest may vary between study types. For long-term planning studies, expected DER deployment levels looking 5–10 years ahead may reasonably be considered. Whether DER are modeled in BPS studies or not, it is recommended that the minimum data collection of DER interconnections be established in order to adequately assess future DER deployments.
Modeling modern bulk systems with a detailed representation of a large number of DER and distribution feeders can increase the complexity, dimension, and handling of the system models beyond practical limits in terms of computational time, operability, and data availability. Therefore, a certain degree of simplification may be needed either by model aggregation (i.e., clustering of models with similar performance), by derivation of equivalent models (i.e., reduced-order representation), or by a combination of the two. Netting of DER with loads at the substation level is not recommended for high-DER penetration scenarios because the resulting models will misrepresent potential aggregate impacts of DER on BPS power flows and dynamic performance.

A modular approach to represent DER in BPS studies as illustrated in Figure 3.1: Modular Representation of DER in BPS Steady-State and Dynamic Studies [1, 2]. Figure 3.1 is recommended to ensure accurate representation of the resources for the specific BPS study type. The hierarchy of the clustering of DER for model aggregation could consider:

- Differentiation of DER per resource type to derive meaningful dispatch scenarios rather than worst-case dispatches for BPS planning studies.
- Differentiation of DER per interconnection requirements performance (i.e., the adhering interconnection standard requirements) to represent the fundamentally different steady-state and dynamic behavior among future and legacy DER.
- Differentiation of DER per technology-type (e.g., inverter-coupled versus directly-coupled synchronous generator DER) to accurately represent the technology-specific dynamic behavior.
Defining the appropriate balance between model accuracy and simplicity of steady-state and dynamic equivalent models for DER is a major objective of ongoing research efforts. However, certain guidelines for DER modeling have been published. The following includes a synopsis of the industry guidelines issued by the Western Electricity Coordinating Council (WECC). Aggregated and/or equivalent modeling of DER is discussed for four types of bulk power system planning studies:

- Steady-state power flow studies
- Steady-state short-circuit studies
- Dynamic disturbance ride-through studies
- Dynamic transient stability studies

Data requirements were summarized at the start of this chapter. The limited existing knowledge and experience on modeling DER in BPS planning studies will require ongoing research, knowledge exchange, and learning.
Steady-State Studies

Steady-state studies aim at:

- Power flow calculation to determine BPS real and reactive power flows for network expansion planning, voltage stability studies and coordination of voltage controls at the T-D interface
- Short-circuit calculations to determine short-circuit power levels for equipment rating and voltage sag propagation analysis

Modeling of DER in these studies would consider the real-power injection at distribution system level and the reactive power that may be supported or required by DER. A power flow case is needed to initialize the state variables of a dynamic BPS model for a dynamic stability study.

Steady-State DER Models

Appropriate DER models are required and may differ between steady-state analyses:

- Steady-state power flow calculations may only require a standard generator or simplistic voltage or current source models with voltage control loops appropriate for steady-state analysis under normal conditions of voltage and frequency.
- Steady-state short-circuit studies require appropriate DER models that would adequately represent the short-circuit contribution from DER. Inverter-based DER are current and power limited sources. A current-limited Norton equivalent with control loops that adequately model the response under abnormal conditions of voltage is required. The short-circuit contribution of DER depends significantly on the performance specified by interconnection requirements, such as trip and ride-through requirements. Traditional steady-state short-circuit analysis algorithms are not suitable for inverter-based DER. New algorithms that iteratively calculate the current-limited short-circuit contributions from inverter-based DER may be needed.

Aggregated Modeling and Netting of DER with Load

In most existing BPS planning studies, the distribution system load is aggregated at the transmission buses and netted with generation on the distribution system (DER generation is treated as negative load). In study cases and grid areas where DER levels are expected to significantly impact power flows between the transmission and distribution system to the point that they may conflict with NERC system performance criteria (e.g., NERC TPL-001-4 [3]), DER should not be netted with load but modeled in an aggregated and/or equivalent way to reflect their dynamic characteristics and steady-state output. Exceptions for permissive netting of DER (not explicitly modeling DER but reducing load by DER generation based on explicitly available DER data) may be acceptable in steady-state studies for those DER that inject real power only at unity power factor without the ability of providing static voltage support at low DER penetration levels.

Depending on the study region, the aggregate DER penetration at substation level, regional level, or interconnection-wide level may give indication towards the expected impact of DER on the system performance; however, the decision to aggregate DER must always be system-dependent. This assessment should be irrespective of whether it is behind-the-meter DER or before-the-meter (utility-scale) merchant DER.

Future modeling may require DER to be modeled distinctively from the load. Thresholds for aggregating DER or distinctly modeling DER may be determined by an area’s specific needs. An example of a modeling threshold in order to limit overall BPS model complexity is provided by the WECC manual [4, 5]. The WECC manual [4, 5] requires:

- Modeling of any single DER with a capacity of greater than or equal to 10 MVA explicitly, and
Chapter 3: Data and Modeling for DER

- Modeling of multiple DER at any load bus where their aggregated capacity at the 66/69 kV substation level is greater than or equal to 20 MVA with a single-unit behind a single equivalent (distribution) impedance model as shown in Figure 3.2 based on WECC’s “PV Power Plant Dynamic Modeling Guide” [6].

The threshold above which DER are not netted with loads is system-specific and may depend on the study specifications, DER penetration level, and load composition. For example, in the regional case of WECC, earlier versions of the WECC Data Preparation Manual stated that a maximum amount of five percent netted generation of an area’s total generation is recommended, but this statement was removed in the new version of the manual for use in 2017 [4]. In general, netting of DER with loads should be avoided.

Minimum data collection for DER modeling should be established to enable adequate assessment of future DER deployments. Related data requirements are outlined in WECC’s “Steady State and Dynamic Data Requirements MOD-(11 and 13)-WECC-CRT-1 Regional Criterion” [5].

Figure 3.2: WECC Recommended Power Flow Representation for Study of High-Penetration PV Scenarios. Source: EPRI Figure Based on [6]

More Detailed Representation in Special Cases
The objective of modeling of DER for power flow studies is to capture the effect of reactive power support as well as the voltage dependent characteristics of DER in steady-state and dynamic simulations, particularly for voltage stability studies. The aggregation of DER behind a single equivalent distribution impedance may be insufficient for steady-state studies in special cases.

The following special conditions may require detailed representation of the distribution system, either through considering the multiple equivalent impedances of High Voltage to sub-transmission lines as well as Medium Voltage to primary and Low Voltage to secondary feeders separately [2] or through equivalent voltage control blocks in the equivalent DER generator model:

- Impactful penetrations of DER generation that operate at power factors other than unity and/or implement other real or reactive power functionality dependent on system voltages or power flows.
- Impactful DER penetrations in terms of their percentage of instantaneous interconnection-wide load.
- A significant amount of reverse power flows from distribution substation to BPS level.
- Substantial amounts of DER connected at different voltage levels in a region.
Depending on the particular characteristics of the distribution systems and their level of uniformity in the study case, regionally-specific equivalent impedances and equivalent voltage control blocks in the equivalent DER generator model may be used (e.g., for urban, sub-urban and rural feeders) to accurately model the voltage at the equivalent DER model terminals.

In grid regions where DER performance requirements are changing (i.e., have been changed or are expected to change substantially in the future), multiple equivalent generators may be used for each DER generation in order to appropriately reflect the DER performance. Existing DER units (i.e., legacy DER) are typically not upgraded to meet the latest performance requirements.

**Dynamic Studies**
Dynamic simulation studies aim at:

- Disturbance ride-through analysis to determine BPS frequency and voltage stability following normally-cleared or delayed-cleared transmission faults with consideration of the amount of DER power that may be tripped off-line during the disturbance due to under-voltage, over-voltage, under-frequency, and/or over-frequency protection.

- Transient stability analysis to determine BPS transient stability during and following normally-cleared or delayed-cleared transmission faults with consideration of fast reactive support from DER that may improve the transient response of the overall system.

Modeling of DER in dynamic BPS studies requires a solid understanding of DER performance based on both interconnection requirements and technology-specific DER performance and control systems.

**Interconnection Requirements**
Interconnection requirements (also known as performance requirements) are differentiated by DER rated capacity in North America and by DER connection voltage level in Europe. For BPS stability studies, interconnection requirements determine a performance framework for the network fault response of individual DER units depending on their commissioning period, connection level or size, and sometimes technology type.

With regard to disturbance ride-through requirements, IEEE Std. 1547-2003 [7], FERC’s SGIP/SGIA [8, 9], and the former CA Rule 21 [10] for North America and California in particular, have focused on distribution-level protection and safety centric requirements meant to quickly trip DER off-line as to not interfere with legacy distribution-level protection equipment and to avoid the formation of utility islands. These standards, procedures and state rules have been or are currently being revised for voltage and frequency ride-through [11, 12, 13, 14] with a focus on providing BPS level ride-through support. Additional dynamic performance requirements for DER, such as dynamic voltage support during and/or following network faults, may evolve in the future similar to the requirements for an additional reactive current injection during faults for Germany [15, 16].

**Dynamic DER Models**
With respect to wind and PV generation connected to the BPS (i.e., typically wind and PV power plants of 10 MVA or larger), the following state-of-the-art generic dynamic models exist:

- **Wind:** The WECC generic wind turbine generator model (primarily for use with BPS connected wind turbine generators, but could be used for DER where detailed distribution models are developed) are documented [17]. The IEC models are documented in IEC Standard 61400-27-1 [18]. It is noteworthy that differences do exist between the generic wind turbine generator models specified in the IEC standard and the WECC modeling guidelines. The IEC models include a more detailed representation of the dynamic performance of wind turbine generators during the fault period than the WECC models [19, 20, 21] and, therefore, seem to be more suitable for transient stability studies.
• Photovoltaic (PV): The first generation of generic models for PV plants, developed by the WECC Renewable Energy Modeling Task Force (REMTF), has been approved under the WECC Modeling and Validation Working Group [6, 22, 23]. These models can potentially be used for modeling DER for situations where explicit detailed modeling of DER is warranted. For the purposes of BPS studies, much of the distribution system and the DER are represented as aggregated models. WECC has initiated and developed some aggregated, and simplified, DER models for representing devices such as distributed PV [6]; however, discussions continue within the WECC REMTF to improve these models. Currently, there is no IEC standard on PV modeling.

• Synchronous Generator DER: Modeling of large-scale directly-coupled synchronous generator (SG) and their excitation systems in power system stability studies is well established and widely accepted recommendations exist [24, 25]. Modeling of medium- to small-scale, low-inertia, distributed combined heat and power (CHP) plants is a less investigated field, although some older publications exist [26, 27, 28]. A relevant publication from recent years models the network fault response of a medium-scale diesel-driven synchronous generator [29].

• Other Electronically-Connected Resources: Other nonsynchronous resources, such as battery storage or voltage converter HVDC, may initially be represented by a generic inverter model if more specific models are not available.

Aggregated Modeling and Determining Dynamic Equivalence
Modeling of DER in dynamic BPS planning studies may require a certain degree of simplification to limit the data and computational requirements as well as the general handling of the BPS model. Model reduction could either be achieved by model aggregation (i.e., clustering of models with similar performance), by derivation of equivalent models (i.e., reduced-order representation), or by a combination of the two. However, equivalent models for DER should have sufficient fidelity to accurately consider the following two main challenges:

- Non-uniform model parameters of the controllers of the various DER in a distribution feeder, and;
- Considerable diversity of the terminal voltages of DER connected at different locations of a distribution feeder.

With regard to spreading model parameters, the modeling should distinguish the DER performance mandated by interconnection requirements. This could either be achieved by using separate classes of DER models with each representing the amount of DER that went into operation when certain requirements were in place, or by equivalent modeling of a mixed population of “legacy” and “modern” DER with a “partial tripping” design parameter as it has been considered in WECC’s distributed PV (PVD1) model [6]. Consideration should also be given to regional under frequency load shedding (UFLS) and under voltage load shedding (UVLS) programs that may trip distribution feeders at the substation level and thereby supersede DER ride-through or trip settings.

Consideration for the diversity of the terminal voltages of DER connected at different locations of a distribution feeder will be important to accurately model the dynamic response of DER in the periphery region (annulus) of a voltage sag as illustrated in Figure 3.3 [2]. This is the area where the modeling accuracy of DER may have a large impact on the simulation results in very high DER penetration studies because of the following:

- The annulus of the voltage sag can have a very large geographic extent.
- The number of DER units in this part of the system can become a significant part of the total number of regionally located DER units.
- Depending on the real and reactive power injection of DER during fault ride-through operation based on the interconnection requirements, DER can significantly influence the distribution system voltage and therefore the behavior of other DER, legacy and otherwise.
As illustrated in Figure 3.3 the post-fault real power imbalance due to under-voltage tripping of DER will be larger in the case shown in diagram (a) than in the case shown in diagram (b). The change in the area Figure 3.3 is an example of how accurately modeling DER generation may change what resources trip during a disturbance.

![Figure 3.3: Illustration of the Area Where Modeling Accuracy of DER is Critical][2]

Until a few years ago, very little research has been published on stability models' dynamic equivalence for active distribution systems (ADS) that comprise significant amounts of DER [30]. Publication [31] summarizes the state-of-the-art for the application of dynamic equivalencing methods to derive aggregated models of ADS.

Recently, a consensus is evolving that grey box modeling is recommended for equivalent modeling of ADS when sufficient physical knowledge is available. A grey box modeling approach is based on physical understanding of the structure and composition of the distribution system for which equivalent is being developed. System identification techniques are then used to identify model parameters based on measurements at the point of common coupling with the BPS (the boundary bus between the studied system and the system for which the equivalent is being developed). The computational challenges are reduced and these composite models can be easily integrated in dynamic simulation tools.

Notable former publications include NREL’s analytical method of equivalencing the collector system of large wind power plants for steady-state studies [32], a generic dynamic model of an active distribution system for BPS stability studies [33, 34], and WECC’s dynamic reduced-order stability model of DER in distribution systems considering partial loss of DER in-feed described below [6, 35].

WECC’s simplified distributed PV model (PVD1 [6, 36]) is currently not widely applied and may require further refinement. However, WECC’s proposed simplified equivalent model for distributed PV systems (PVD1) behind a single equivalent distribution feeder impedance (Figure 3.4) can currently be regarded as the “best-in-class” reduced-order modeling approach for practical power system studies. This model is described in WECC’s “PV Power Plant Dynamic Modeling Guide” [6] and is similar to the model described in [35] for the first time.

**WECC’s Simplified Equivalent Model for Distributed PV (PVD1)**

WECC’s simplified equivalent model for distributed PV systems (PVD1) is a highly reduced, almost algebraic, model to represent distributed PV systems in BPS stability studies. It includes active power control, reactive power control, and protective functions [36] and can account for partial tripping of distribution connected PV systems without the need to represent the distribution feeders explicitly; it can also consider the evolving mix of DER with...
and without ride-through capabilities, hence beyond default settings in IEEE Std. 1547-2003 [7]. The model structure of PVD1 is shown in Figure 3.4.

An indicative verification and analysis of the accuracy of the PVD1 model has been conducted by Electric Power Research Institute (EPRI) [38], including a comparison of modeling results with a more detailed DER aggregation technique that was proposed [2]. It was shown that the PVD1 model accurately represents the amount of tripped DER power in the post-fault period as long as “dynamic voltage support” from soon-to-be connected DER is neglected. The PVD1 model simplifies the DER dynamics that occur during the fault period significantly by assuming “momentary cessation” (a pause at zero power, but remaining on-line) of DER that ride through faults; this could potentially overestimate the amount of partial DER tripping. Neither does the PVD1 model represent the delay of the protection functions. Overall, the PVD1 model tends to produce conservative results because it tends to suggest a greater loss of DER generation than would likely be seen in the real system being simulated.

With the current limitations of WECC’s PVD1 model to represent dynamics during the fault period, the PVD1 model may not be suitable for this type of study. The use of detailed generic DER models used for utility-scale DER (larger than 10 MVA) is recommended.

**WECC’s Composite Load Model with Distributed PV (CMPLDWG)**

Besides modeling of DER, proper representation of load is important, especially in terms of voltage dependency [39]. Figure 3.5 illustrates WECC’s Composite Load Model (named CMPLDWG) [40] with distributed PV. The PVD1 model is currently integrated into this model in a fixed way that limits the flexible use of the model. However, a modular approach will become available in the near future.
A study of the combined WECC Composite Load model (CMPLDWG) and PVD1 models was undertaken by NREL [42] and included a comparison of the combined models results and detailed distribution-level analysis of various substation-level voltage sags in order to determine the amount of DER that would trip off-line if interconnected under the IEEE 1547-2003 standard. Tuning the CMPLDWG and PVD1 model parameters resulted in close agreement of the amounts of DER that would trip off-line for a given voltage sag magnitude. However, the tuned model parameters did not match expected physical model parameters for the distribution circuit models and the functionality of the modeled PV systems (i.e. agreement between models and analysis was poor when the CMPLDWG and PVD1 models were populated with expected physical model parameters). This study indicated that either the voltage diversity of a distribution circuit cannot be sufficiently modeled using the CMPLDWG and PVD1 models or some modifications to the expected model inputs, currently based on physical/functional parameters, is required for tuning the combined models.
Chapter 4: Characteristics of Nonsynchronous DER

Background
To determine how DER may interact with the power grid, it is necessary to understand how these resources operate. DER operating characteristics are determined by the generating technology employed. Synchronous machines operate as conventional generators from a performance perspective, and these characteristics are well understood by the industry. Nonsynchronous generation technologies, such as solar photovoltaic or fuel cell resources, rely on their direct current (DC) to alternating current (AC) inverter technology to deliver energy to an AC system. DC to AC inverter electrical performance requirements are designed to protect the user (public) and the inverter equipment from electrical hazards as well as to offer capabilities necessary for the reliable operation of the power grid to which the nonsynchronous generators are connected. The commonly adopted governing requirements today are Underwriters Laboratory (UL) 1741 (2010) and (IEEE)’s 1547-2003.

UL 1741 is a product safety standard and primarily covers the hazard component of the inverter function. UL standards generally address electrical, fire, and mechanical hazards in addition to verification of electrical ratings. Additionally, UL 1741 reflects the interconnection performance requirements of IEEE 1547.1.

IEEE 1547-2003 is a standard for interconnecting DER with the power grid, and the associated requirements apply to the point of common coupling (PCC) between the grid and the DER. These requirements address technical specifications and performance requirements for the inverter including voltage and frequency ride-through, voltage regulation, response to abnormal conditions, reclosing coordination, power quality, and islanding, among other issues. IEEE 1547-2003 specifically prohibits the DER from regulating voltage at the PCC. In addition, compliant devices do not regulate frequency at the PCC, and they cannot energize the local grid when islanded.

An amendment to IEEE 1547-2003 was made denoted as IEEE 1547a [43]. This amendment specifically allowed voltage regulation at the PCC and widened voltage and frequency operation ranges to accommodate voltage and frequency ride-through requirements desired by some utilities. The ongoing full revision of IEEE 1547 will “set the stage” for DER to provide additional reliability services. Equipment meeting these proposed specifications will have capabilities beyond isolation detection and will become active power controllers that can provide reliability services. These reliability services may include voltage support, voltage regulation, and frequency regulation.

In addition, the California Public Utilities Commission (CPUC) regulates the largest rollout of DER in North America in the California ISO balancing area and sets the technical and commercial standards for DER interconnection and operation according to CPUC Rule 21. The CPUC has implemented new technical standards for the DER systems that are intended to go beyond safety and hazard issues and “establish programmable functions” that DER systems will perform to support power system operations. However, the majority of existing fleet of DER conforms to IEEE 1547-2003. Therefore, the performance of the existing DER fleet is unlikely to change until normal equipment replacements occur. Nevertheless, the performance of the installed fleet could change rapidly with the rapid growth of new PV that complies with new interconnection standards.

Voltage Ride-Through (VRT) and Frequency Ride-Through (FRT) Characteristics and Consequences
The voltage and frequency performance of DER is currently not coordinated with BPS requirements. DER resources are not explicitly modeled as generating resources in operating and planning analysis tools either in real-time or off-line studies. Therefore, an event that causes a large amount of DER to isolate from the power grid could result in unpredicted BPS behavior. The most likely event is low voltages over a wide geographic and electrical area caused by a fault on the sub-transmission (<230kV) systems connected to load and DER. Fault clearing times are often dictated by relay coordination issues, which can lead to longer fault clearing times, particularly at lower voltages.
However, faults on the sub-transmission system can result in low voltage at the DER resulting in the isolation of that resource. Consequences of this isolation could be more severe fault induced voltage recovery (FIDVR) or a significant increase in perceptible BPS load until the DER resources reconnect to the power grid. To date, in most areas, these problems have not become very noticeable. However, system performance at 5 percent DER penetration will differ from that where DER are at 25 percent penetration. Loss of a large amount of DER during a fault could result in system performance similar to the loss of a BPS generator. If the potential separation of DER approaches a Balancing Authority’s Most Severe Single Contingency (MSSC), care must be taken to ensure that adequate contingency reserves are available for such an event.

Similar issues apply for frequency ride-through. In WECC, the largest credible generation contingency is the outage of two nuclear units at the Palo Verde plant. This could result in a loss of 2,740 MW with a resulting frequency decline of 0.29 Hz, or a 59.71 Hz nadir (BAL-003-1 interconnection frequency response obligation (IFRO) calculation for WECC). This is above the IEEE 1547 separation point of 59.3 Hz. However, the WECC Off-Nominal Frequency Plan begins tripping at 59.5 Hz and continues tripping down to 58.3 Hz. If UFLS event occurred, DER are likely to trip off-line at 59.3 Hz, dramatically increasing perceptible load on the BPS and further depressing frequency. It is important to recall that IEEE 1547 specifies minimum performance requirements: DER equipment manufactures may exceed 1547 trip requirements resulting in DER tripping before 59.3 Hz is reached. This implies that significant DER separation could occur at frequencies higher than 59.3 Hz, but all separation would occur by 59.3 Hz.

With respect to the BPS, voltage and frequency ride-through are key to system performance. Today, DER resources are typically netted with distribution load when measured and modeled. Consequently, the operator of the power grid is not aware of the total load and total interconnected DER. If a system event occurs, be it a voltage or frequency excursion, and that excursion exceeds the inverter isolation settings, it is likely that a significant amount of DER may automatically disconnect. This can instantaneously and significantly increase net load during such an event, thereby exacerbating the underlying disturbance that caused the voltage or frequency excursion. The impact of the change in net load is proportional to the amount of DER that isolates from the power grid. As DER penetration increases, the effects of this sudden load surge on the BPS increase.

The existing IEEE 1547-2003 performance requirements for voltage and frequency ride-through are documented below. These requirements have been overlaid with NERC’s frequency and voltage requirements (PRC-024 Attachment 1 and 2, respectively) and illustrate areas of concern where large penetrations of DER could adversely impact reliability. DER must isolate when these conditions are met as shown in Table 4.1 and Figure 4.1 for voltage ride-through and in Table 4.2 and Figure 4.2 for frequency.

<table>
<thead>
<tr>
<th>Table 4.1: Voltage Ride-Through Conditions (DER must isolate when these conditions are met)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DER Size</td>
</tr>
<tr>
<td>----------</td>
</tr>
<tr>
<td>≤ 30 kW</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>&gt; 30 kW</td>
</tr>
</tbody>
</table>
**Figure 4.1: NERC PRC-024-2 and IEEE 1547-2003 Voltage Ride-Through**

<table>
<thead>
<tr>
<th>DER Size</th>
<th>Frequency Range (Hz)</th>
<th>Clearing Times (sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 30 kW</td>
<td>&gt; 60.5</td>
<td>0.16</td>
</tr>
<tr>
<td></td>
<td>&lt; 59.3</td>
<td>0.16</td>
</tr>
<tr>
<td></td>
<td>&gt; 60.5</td>
<td>0.16</td>
</tr>
<tr>
<td>&gt; 30 kW</td>
<td>&lt; 59.8 – 57.0 adjustable</td>
<td>0.16 – 300 adjustable</td>
</tr>
<tr>
<td></td>
<td>&lt; 57.0</td>
<td>0.16</td>
</tr>
</tbody>
</table>
PRC-024-2 frequency ride-through requirements are designed such that UFLS schemes will operate before generators begin to disconnect from the BPS. Smaller DER installations, under 30 kW, can begin disconnecting from the BPS without respect to coordination with the area UFLS. When DER disconnect, BPS net load will increase. This will further depress frequency, potentially leading to premature system instability.

IEEE 1547-2003 currently prohibits energizing the DER if the area is de-energized/islanded, which precludes independent operation of DER. This is done largely for safety considerations so that islanding does not result in energized lines. In broad terms, DER can be considered “passive” resources in the sense that they do not directly regulate voltage or frequency. From the point of energy balance, DER operate as a “negative load.”

IEEE 1547 is currently being updated to include frequency and voltage ride-through capability that can better support BPS reliability. Other topics of discussion for updates within the IEEE 1547 standard include voltage and frequency regulation capabilities and communications. These efforts are ongoing, but will not affect DER that is installed before the revisions become effective. The DERTF supports the concepts being proposed to IEEE 1547 that allow for situational awareness.
California Rules for DER

The California Public Utilities Commission (CPUC) regulates the largest rollout of DER in North America in the California ISO balancing area. It also sets the technical and commercial standards for DER interconnection and operation according to its Rule 21. Rule 21 primarily follows the IEEE 1547 parallel operation DER interconnection standard where generation is operating in parallel (synchronously connected) with the system rather than in an islanded or isolated mode. CPUC is in the process of implementing new technical standards for the DER systems that are intended to go beyond safely and hazard issues and “establish programmable functions” that DER systems will perform to support power system operations. A report prepared by the CPUC Smart Inverter Working Group notes: 6

“[An] increasing number of DER systems can impact the stability, reliability, and efficiency of power grid operations. First, DER systems are usually located for the convenience of the DER owner, not the utility, and therefore may be in less-than-optimal locations from the perspective of grid operators. Second, DER systems are of widely varying sizes and purposes (e.g., as secondary to offsetting customers’ loads and/or their power production). Third, without coordination with the distribution equipment on the grid, DER systems could actually cause voltage oscillations, create reverse power flows on circuits not designed for two-way flows, and cause other power system impacts that could actually increase the frequency and durations of outages.”

The CPUC report not only covers the new standards for DER systems but also notes how utilities will be able to monitor and control these systems and their functions. Most notably:

“DER systems can respond to commands to override or modify their autonomous actions by utilities and/or retail energy providers. In some cases, DER systems, just like bulk power generation, may be directly monitored and controlled by utilities in real-time. In other cases, these ICT [Information and Communications Technology] capabilities may issue emergency commands, or may support normally autonomous operations by updating software settings, providing demand response pricing signals, establishing schedules for energy and ancillary services, adjusting the curves for active and reactive power, and other types of utility-DER interactions.”

Per CPUC plans, the following autonomous inverter functionalities will be added to the technical operating standards in Rule 21 by the end of 2017:

1. Support anti-islanding to trip off under extended anomalous conditions;
2. Provide ride-through of low/high voltage excursions beyond normal limits;
3. Provide ride-through of low/high frequency excursions beyond normal limits;
4. Provide volt/VAR control through dynamic reactive power injection through autonomous responses to local voltage measurements;
5. Define default and emergency ramp rates as well as high and low limits;
6. Provide reactive power by a fixed power factor; and
7. Reconnect by “soft-start” methods.

The implementation road map, as recommended by the CPUC Smart Inverter Working Group, consists of the following:

1. A nationally recognized testing laboratory or laboratories have made an accepted revised ANSI/UL 1741 testing procedure available to test the added autonomous inverter functionalities noted above;

2. Immediate modification of Rule 21 to allow the installation of certified inverters that include the proposed autonomous inverter functionalities applying for interconnection under Rule 21;

3. Consideration of an 18-month transitional permissive period during which the investor-owned utility distribution provider and the DER system installer may, by mutual agreement during the interconnection process, activate one or more of the autonomous functionalities for the purposes of conducting pilot operations, analysis, and publishing the results of any analysis;

4. Following the transitional permissive period and based on operational data collected and published during that period as well as any other relevant factors, CPUC would mandate the autonomous smart inverter functionalities for inverter-based distributed energy systems applying for interconnection under Rule 21; and

5. Upon further recommendations and future proposals by the CPUC Smart Inverter Working Group, CPUC would consider communications capabilities and advanced inverter functionalities for inverter-based distributed energy systems in California.

In addition to the autonomous inverter functionalities noted above, CPUC is evaluating the implementation of the following advanced communication functionalities for inverter based DER systems:

- Provide capability for including and/or adding communications modules for different media interfaces;
- Provide the TCP/IP internet protocols;
- Use the international standard IEC 61850 as the information model for defining data exchanges;
- Support the mapping of the IEC 61850 information model to one or more communications protocols;
- Provide cybersecurity at the transport and application layers; and
- Provide cybersecurity for user and device authentication.

Finally and beyond the autonomous inverter and communication functionalities noted above, CPUC will consider the following advanced functionalities for the DER systems in the future:

- Provide emergency alarms and information;
- Provide status and measurements on current energy and ancillary services;
- Limit maximum real power output at the Point of Common Coupling (PCC) upon a direct command from the utility;
- Support direct command to disconnect or reconnect;
- Provide operational characteristics at initial interconnection and upon changes;
- Test DER systems software patching and updates;
- Counteract frequency excursions beyond normal limits by decreasing or increasing real power;
- Counteract voltage excursions beyond normal limits by providing dynamic current support;
- Limit maximum real power output at the Electrical Connection Point (ECP) or optionally at the PCC to a preset value;
- Modify real power output autonomously in response to local voltage variations;
- Set actual real power output at the point of common coupling (PCC);
• Schedule actual or maximum real power output at specific times;
• Smooth minor frequency deviations by rapidly modifying real power output to these deviations;
• Follow schedules for energy and ancillary service outputs; and
• Set or schedule the storage of energy for later delivery, indicating time to start charging, charging rate and/or “charge-by” time.
NERC has taken a detailed look at the potential impacts of DER on the BPS in the form of solar photovoltaic systems (PVs) on the distribution system. This work was documented in the NERC Integrating Variable Generation Task Force Task 1-7 report entitled *Performance of Distributed Energy Resources During and After System Disturbance: Voltage and Frequency Ride-Through Requirements* that was issued in December 2013.

This earlier NERC task force stated that a large amount of distribution-connected generation may have significant effect on the reliability of the BPS. Of particular concern was the lack of disturbance tolerance, which entails voltage ride through (VRT) and frequency ride through (FRT) capability. Other than CPUC Rule 21, which was recently implemented, there are currently no North American VRT or FRT DER requirements in place today.

The Integration of Variable Generation Task Force (IVGTF) made the following general recommendations in its report:

- In the short-term, NERC should engage in current efforts to revise DER interconnection standards by providing information, raising awareness and encouraging the adoption of VRT and FRT for DER. The initial focus should be on identifying the need for adopting minimum tolerance thresholds for VRT and FRT in the IEEE Standard 1547 and, then, establish those minimums.

- In the longer-term, NERC should establish a coordination mechanism with IEEE Standard 1547 to ensure that BPS reliability needs are factored into future DER interconnection standards revision efforts. To date, BPS stakeholders have participated only sporadically in the IEEE Standard 1547 process. As a result, VRT and FRT concepts receive limited consideration and may have been outweighed by distribution system protection concerns. This liaison process would be too late for the P1547a amendment, but it would be timely for the full revision to begin in December 2013.

The IVGTF offered the following general guidelines on voltage ride-through (VRT) and frequency ride-through (FRT) specifications for distributed VER and other DER, for consideration in the IEEE Standard 1547 revision. It is assumed that VRT and FRT requirements would have to co-exist with revised “must trip” provisions needed to address safety and protection/coordination issues in distribution systems.

1. The revised IEEE Standard 1547 should allow for different methods of meeting the functional requirements of fault detection (clause 4.2.1), reclosing coordination (clause 4.2.2), and unintended islanding detection (clause 4.4.1). At present, DER meeting those functional requirements would still have to trip on voltage (clause 4.2.3) and frequency (clause 4.2.4) excursions. Removing those linkages would help pave the way for VRT and FRT requirements. The IVGTF recognized that these alternative methods are more expensive, require more engineering effort, and in some cases require further technical development. However, the increasing level of DER and the potential impact on the BPS justifies the effort.

2. The revised IEEE Standard 1547 should include explicit low and high VRT requirements. Likewise, the revised IEEE Standard 1547 should include explicit low and high FRT requirements. These requirements should be expressed as voltage versus cumulative time and frequency versus cumulative time.

3. Must-trip voltage thresholds in the existing IEEE Standard 1547 should be extended to accommodate an effective VRT envelope without overlap (Figure 5.1).
   a. As an example, Figure 5.1 shows a possible approach for low voltage ride-through down to 50 percent voltage for 10 cycles (160 milliseconds), within the existing IEEE Standard 1547 framework.
   b. Zero voltage ride-through is not required for BPS reliability. A ride-through level down to approximately 50 percent voltage would provide adequate tolerance during transmission faults.

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*Performance of Distributed Energy Resources During and After System Disturbance: Voltage and Frequency Ride-Through Requirements*
c. A ride-through period longer than shown in Figure 5.1—possibly greater than 10 seconds—at higher voltage level (e.g., down to 70 percent voltage) may be needed to avoid compounding fault-induced delayed voltage recovery (FIDVR).

![Figure 5.1: IVGTF 1-7 Recommended Ride-Through and Must-Trip Requirements for DER](image)

4. Must-trip frequency thresholds in the existing IEEE Standard 1547 should be extended to accommodate an effective FRT envelope without overlap.

5. The time dimension of the VRT/FRT curves discussed previously represents cumulative time elapsed since the onset of a disturbance event that result in temporary excursions of voltage and/or frequency. The VRT/FRT envelopes should not establish must-run ranges for generators (i.e., they should not prevent intentional shutdown of a DER for reasons other than grid voltage and frequency disturbances, such as normal shutdown of PV at night or by operator action.)

6. The prospective disturbance tolerance standard should provide a default VRT and FRT envelope, but should allow for the time and frequency/voltage magnitudes to be adjustable, within certain limits, for coordination with local protection, in coordination with the distribution system operator.

7. FRT and VRT requirements should cover all DER that are normally grid connected, regardless of size or technology. However, a range of thresholds could be considered based on technology differences (e.g., inverter versus rotating machines), as some European grid codes do. In general, focusing requirements on the truly functional needs of the grid tends to eliminate the need to have technology-specific requirements.

8. The restarting of DER during system restoration should be considered during the development of DER interconnection requirements. While the restoration situation in North America is somewhat mitigated at present by the sequential nature in which distribution feeders will likely be re-energized after a major blackout, reliability impacts of DER should consider the automatic restarting of DER. Failure to consider and mitigate these impacts could lead to further instability during a disturbance.

Since this IVGTF report was posted in December 2014, efforts have commenced to harmonize the PRC-024-2 VRT and FRT requirements with IEEE 1547. Several ERSWG and DERTF members have been participating in IEEE 1547 Subgroup III Section 4.2 (voltage and frequency ride-through). As of this writing, it appears that the 1547 update will respect PRC-024-2 voltage and frequency ride-through requirements. As always, it will be incumbent on the local distribution owner/operator to ensure that IEEE 1547 are understood and implemented properly.
Chapter 6: NERC Reliability Standards

Background

NERC Reliability Standards exist to address the reliability needs of the interconnected electricity systems. These standards apply to the bulk electrical system (BES) as specified by the BES definition adopted by FERC in March 2014. In some cases, standards apply to devices and needs beyond the BES. Historically, standards have not been written to apply to equipment within the distribution utility unless it has a direct impact on the effect of grid reliability, such as load shedding or system restoration. Each standard identifies the applicable registered entities, and distribution providers are identified as applicable entities for some of the standards.

NERC generation standards, generally, do not address resources connected to the grid at voltages below 100kV, nor do they address resources with less than a registered capacity of 75MVA in aggregate or 20MVA for an individual unit. The standards do not explicitly address energy resources (e.g., solar, wind, or hydro facilities) that are contained within the distribution system footprint. However, some standards provide for the collection of pertinent information for planning and system operations purposes.

The impact of DER on the BPS is not a simple issue. Over the last several decades, the electric industry has operated with the majority of its generation integrated at the transmission system level. More recently, there has been a greater integration of generation resources within the distribution system under the support of renewable portfolios and societal expectations for a modernization of the grid. These changes have altered the power flows at the transmission-distribution (T-D) interface. Whereas distribution entities have drawn their generation needs from the BPS in the past, some distribution entities are increasingly a source of resources that will support some local needs or even flow power back to the BPS. At lower penetration levels, the overall impact of DER is minor and insignificant to the BPS; as the output of these resources varies throughout the day or if these resources were to trip off-line during large system disturbances, the changes imposed to BPS voltage and frequency are minor and are managed by existing BPS resources. However, as the penetration of DER increases, their impact on the BPS becomes more substantial. At higher penetration levels, issues may develop in transmission line loading, grid voltage, and system frequency during normal or disturbed operation. These actions will have similar impacts to those that NERC described in the ERS report published in December 2015.

Accurate models for the operation and planning processes are vital, and it is necessary for system planners and operators to have access to information regarding the capacity and behavior of DER at the T-D interface. Refined information and models allow planners and operators to make more informed decisions regarding resource adequacy, system improvements, recovery and demand balancing for the BPS. The addition of DER may initially appear to simply reduce the demand and the loading levels at the T-D interface, but the reality is actually more complex. Both planning and operating assessments need to accurately represent how DER interacts with the complex load characteristics of the distribution system. The inclusion of DER in models and assessments yields valuable insight into how the BPS will perform and how distribution level resources can impact operating limits and margins in the interconnected system.

Review of Existing NERC Standards

The DER task force reviewed the current set of NERC standards and determined there is no need for additional standards to be developed to address an increasing penetration of DER. However, the DERTF recommends that DP be added as an applicable entity in MOD-032, replacing the Load Serving Entity, which is a current applicable functional entity. MOD-032 provides planning coordinators and transmission planners with the mechanism to collect data necessary for steady state, dynamics, and short circuit modeling from applicable entities.

While there are no explicit NERC requirements to independently model and assess DER for purposes of BES system planning or operations, the transmission operators and transmission planners have requirements to accurately...
model and address reliability risks. This includes the impact of DER, where material. Current standards (TOP-003-3, IRO-010-2, & MOD-032-1) provide broad authority for system operators and transmission planners to obtain the information needed for models and reliability assessments. This provides the ability to collect pertinent information as related to distribution impacts on the BES. As described in Chapter 3, the necessary DER information can generally be in somewhat aggregated form, but with enough detail to allow accurate modeling of the characteristics and behaviors at the transmission-distribution (T-D) interface. This level of detail also extends to forecasting and operating issues. With this in mind, additional analysis is needed to ascertain how an increasing penetration of resources within the distribution system footprint will influence the change of power flows at the T-D interface. The DERTF recommends that a set of guidelines be developed to assist in modeling and assessments, such that owners/operators of the BPS can account for the impact of DER at the T-D interface.
Chapter 7: Recommendations

The recommendations of the DERTF are listed below. The DERTF has completed the scope for the task force, and additional efforts should be part of ongoing ERSWG efforts.

- **Guidelines:** The DERTF recommends that a set of guidelines be developed to assist in modeling and assessments, such that owners/operators of the BPS can account for the impact of DER. The DERTF also recommends that Distribution Provider (DP) be added as an applicable entity in MOD-032, replacing the Load Serving Entity that is currently an applicable entity, to provide for collecting pertinent information related to distribution impacts on the BPS (similar to what is already included in TOP-003-3).

- **Data Sharing:** Data requirements and sharing of information across the transmission-distribution (T-D) interface should be further evaluated to allow for adequate assessment of future DER deployments. The important near-term issue is sharing of information to facilitate accurate modeling for transmission planning and operations. At some point, additional consideration may be needed for stability, protection, forecasting, reactive needs, and real time estimates for operating needs.

- **Modeling:** Based on reliability considerations for modeling purposes, generation from DER should not be netted with load as penetration increases. Load and DER should be explicitly modeled in 1) steady-state power flow and short-circuit studies, and 2) dynamic disturbance ride-through studies and transient stability studies for BPS planning with a level of detail that is appropriate to represent the aggregate impact of DER on the modeling results over a 510 year planning horizon. A modular approach to represent DER in BPS studies, with some level of data validation, is recommended to ensure accurate representation of the resources for the specific BPS study type.

- **Dynamic Models:** Dynamic models for different DER technologies are available and should presently be used to model the evolving interconnection requirements and related performance requirements. WECC’s simplified distributed PV model (PVD1) provides a reasonable balance between modeling accuracy, computational requirements, and handling of the system model, but some further improvement may be needed.

- **Coordination:** A coordinated effort by distribution and transmission entities is needed to determine appropriate use of future DER capabilities (such as settings available under proposed IEEE 1547 revisions). This must be coordinated with voltage and frequency ride through performance and potentially coordinated with UFLS programs and BPS performance under PRC-024. Note that PRC-024 was developed with BES issues in mind, and where PRC-024-2 and desired distribution-level protection and operations conflict, the transmission and distribution utilities will need to coordinate the required DER ride-through settings to meet BPS reliability needs while minimizing distribution impact.

- **Definitions:** Further examination is needed to determine whether DSM should be included in the DER definition and if the DER definition should be added to the NERC glossary and/or NERC functional model.

- **Industry Collaboration:** Finally, the limited existing knowledge and experience of modeling DER in system planning studies and operating with higher levels of DER will require future collaborative research, knowledge exchange, and learning. The industry should collaborate with vendors of power system simulation software and DER product vendors to continuously enhance models for DER representation in BPS planning studies. NERC can assist with coordination across the industry to facilitate the reliable integration of DER into the BPS.
Appendix A: Typical Connection of DER

While defining DER is an important first step, to fully understand the potential interaction of these resources with the BPS, it is essential to understand how these resources are interconnected to the power grid.

DER, as defined within this document, are generally interconnected to a Distribution Provider’s electric system at the primary voltage (≤ 100 kV but > 1 kV) and/or secondary voltage (≤ 1 kV). Interconnection design and installation typically meet requirements of the National Electric Code, the National Electrical Safety Code, or any other locally designated code pertaining to electrical facility design, construction, or safety. Sample interconnection one-line diagrams of different types of DER that are currently operating in parallel with a distribution provider’s electric system are shown in the following figures. Shown in each figure are a point of change of equipment ownership, bi-directional meter, and a visible air-gap switch.

The point of change of equipment ownership (POCEO) defines the point where equipment owned and operated by the DER owner connects to equipment owned and operated by the distribution provider. Design and installation of equipment on either side of the POCEO is the responsibility of the owner of the equipment.

The bi-directional meter has two registers. One register captures energy flow from the distribution provider’s electric system to the DER facility (i.e., delivered energy). The other register measures energy flow from the DER facility to the utility (received energy). Depending on the power purchase agreement (PPA) executed between the DER owner and the distribution provider determines the type of meter installed. In some cases, the distribution provider may install an advanced meter with capability of capturing 30-minute interval real power (kW), reactive power (kVA), and real energy (kWh). In other cases, a simple energy meter is installed.

A visible air-gap switch is sometimes required for isolating the DER facility from the distribution provider’s electric system when work on a line section or equipment is performed, particularly for large DER. The switch is generally required for the purpose of providing a visibly verifiable break (or air gap) between the facility and the distribution provider’s electric system. Smaller DER systems may or may not be required to have a visible air-gap switch. All DER fed from DC sources are required to have a lockable DC disconnect switch.

The bidirectional-meter and visible air gap switch are minimum interconnection requirements for some distribution providers. Other requirements include intertie protection that is designed to quickly isolate the DER facility faults within the distribution provider electric system. The intertie protection may include a communication link between the DER facility and the distribution provider’s electric system to prevent unintentional islanding.

![Figure A.1: Interconnection of a Large Landfill Gas Generation Facility](image-url)
System impact studies performed by the distribution provider identified the need for a communications line for direct transfer trip of the DER facility. A tie-line recloser is required to maintain reliability of service to existing end-use customers served by the distribution provider.

The inverter is not UL listed. Therefore, a separate intertie breaker with relays is required. System impact studies performed by the distribution provider identified the need for a communications line for direct transfer trip of the DER facility.
Two UL-1741 listed inverter-based solar PV systems were installed primarily to offset electricity purchased from the distribution utility. In addition to this DER, customer also has a standby generator that can be used to serve critical loads within the facility.

![Figure A.4: Interconnection of a Solar PV Merchant Facility at a Residential Customer Site](image)

DER facility output is sold to the distribution provider through the bi-directional meter. The distribution provider provides electric service to the customer’s residence through two retail revenue meters and two service entrance breaker panel boards.
Figure A.5: Interconnection of a Behind the Meter Solar PV Merchant Facility at a Residential Customer Site

A single UL-1741 listed inverter-based system was installed to affect electricity purchased from the distribution utility. Net output from the facility is sold to the distribution provider through a bidirectional meter.
Appendix B: Operations and Long-Term Planning

As discussed throughout this report, the growth in quantity and diversity of DER require enhanced short-term forecasting for operational purposes, operational coordination between the BPS operator and the distribution utilities, and long-term forecasting for planning. It is also important to have situational awareness of DER contributions and impacts in the operating timeframe, as well as to understand the ability of DER to participate as a dispatchable resource and that they contribute ERS to the power grid in various ways.

This appendix provides an example of how these requirements are being viewed and addressed in California along with some general discussion. Given the many options and developing approaches to these topics, the DERTF offers some initial information in this appendix, but recommends that these topics receive additional consideration in future NERC task force, working group, or subcommittee activities.

**DER Impact on California ISO Operations**
Currently the greatest operational impact of DER in California comes from behind-the-meter solar photovoltaic (PV) installations. Figure B.1 is the latest forecast of PV growth in the CAISO Balancing Authority area (BAA).

![Figure B.1: CAISO Behind the Meter (BTM) PV DER forecast](image)

CAISO’s forecasted peak load in 2015 was 44,500 MW. In 2016, DER PV was over 10% of CAISO’s peak load. At lower loads, DER PV is a higher proportion of load. Voltage and frequency ride-through will not conform to BES requirements of PRC-024-2. BA load (such as for CAISO) is a calculated value consisting of net interchange and metered generation values.

\[
\text{BA Load} = \text{Generation} + \text{Net Actual Interchange}
\]

Behind-the-meter DER are not typically metered. In general, its effect is to reduce the amount of generation or net imports needed for system balance (i.e., the right-hand side of the above equation). Thus, DER directly lowers
the measured load in a BA. In Figure B.1, the “BTM Solar PV” value represents an equivalent amount of load that is not measured at the BA level.

In operations (resource commitment and dispatch) and planning (future needs) work, DER represent another variable to consider; a distribution circuit with a 10 MW load may see increasing DER penetration over time. Assuming the actual physical load remains 10 MW, DER will offset that value. Assuming a 50% penetration of PV, the distribution circuit load may see 5 MW of load at the circuit breaker, but the 10 MW of load is still there. As the solar angle decreases through the afternoon and evening, DER output will steadily decline while load remains high. This leads to lower than expected loads during the day with circuit load increasing much faster through the late afternoon and evening hours. Ultimately, the circuit peak load can be 10 MW, but it occurs in the evening rather than in late afternoon. Circuit load during the morning and early afternoon will be lower than previously experienced. Therefore, there is low resource commitment during the early part of the day, but very fast resource commitment and ramping requirements in late afternoon and evening. This is followed by a very fast de-commitment from evening to light load night hours. Each of these situations can challenge the operational capability of the system. Figure B.2 shows that actual net load is lower than originally estimated due to increased amount of renewable resources (including DER) on the CAISO system.
DER Forecasting for Operations and Planning

Long-term DER forecasting for planning purposes must address 1) the DER adoption or growth scenarios, and 2) the impact on net load of DER performance or autonomous behavior. Much of DER adoption and behavior may be characterized as autonomous, that is, driven by the needs of energy end users of all types whose interest is not in kWh per se but in the services they require at their residences and businesses. A challenge for planning is to forecast the adoption of various DER types over a planning horizon of ten years or more with sufficient locational granularity for identifying and planning needed BPS infrastructure upgrades. In addition to adoption, planners need to know how the performance or behavior of the DER will affect the net load at each T-D interface in terms of total energy, peak demand, and load profile.

When DER are comprised mainly of solar PV, forecasting behavior is manageable with good estimates of installed capacity by T-D interface and high-quality weather data. The composition of DER will soon become more complex, with more widespread installation of storage devices, PV combined with battery storage and penetration of electric vehicles. Current proceedings underway at the California Public Utilities Commission include developing methods and provisions for DER to substitute for distribution infrastructure investment and offer real-time operational services to the distribution utility. In many cases the CPUC provisions will entail “multiple-use” applications where specific DER may be located behind the retail meter to provide load management services to the customer. DER may also provide services to the distribution utility, and may be aggregated across multiple sites to form a virtual resource that participates in the wholesale market.

Short-term and long-term forecasting of DER behavior is difficult due to current modeling practices. In order for the CAISO to issue accurate dispatch instructions to balance supply and demand on the BPS, it needs accurate forecasts of net load at each T-D substation, looking ahead from 5 minutes to two or three hours. In this case, however, the installed capacity by resource type and T-D interface location should be well known to whichever entity is responsible for the forecast (distribution utility and/or BPS operator), as would any agreements between DER providers and distribution utilities for investment deferral or real-time services. Thus, uncertainty about the adoption of DER should not be part of the short-term forecasting problem.

Discussion

Reliable BPS operations requires grid operators to monitor the supply and demand balance and the state and availability of BPS elements, and the ability to accurately forecast the near term changes in load, availability of supply resources, state of transmission facilities, and external factors such as weather. This monitoring and forecasting is considered “situational awareness” and is required to dispatch the system and direct actions in response to unexpected disruptions. System dispatch relies on a sufficient quantity of generating resources under direct control to be able to provide voltage control, frequency support, and ramping capability such as essential reliability services (ERS) to balance and maintain the electric grid.

Traditionally, the basic grid operation is a free flowing transmission network connecting central station generation resources to load/demand buses with flow in a one-way direction to satisfy the load. The introduction of DER challenges the basic model of BPS operations as the load/demand bus now may become a source, or at the very least, cause a reduction in demand at a load bus. In addition, as stated in previous sections, the nature and characteristics of the load/demand bus in models is changing and impacting the expected needs and response of the system.

As the introduction of DER into the electric system are explored, several challenges become apparent:

- Transparency and observability of DER supply on the BPS
- Nature of the DER capabilities, typically inverter bases, ability to supply the ERS
- Variability of the DER supply by fuel source (typically renewable, or storage)
• Direct control of DER dispatch or inverter response
• The inverter impact modifying fault current

System operators that have relatively small quantities of DER embedded within their system currently see very little direct impact as the variations observable at the BPS level are minor. On the other hand, where there are high penetrations of DER, the system operator must consider the significant impacts on the ability to accurately forecast and control its system. The system operator must have adequate “situational awareness” and sufficient ERS levels to control the system reliably under all circumstances.

As seen in California, the growth in volume and diversity of DER will require some expanded coordination arrangements and functional capabilities on the part of the distribution utilities and the BPS operator. The NERC ERS effort should continue to monitor these developments addressing T-D interface issues and needs of the BPS.
Appendix C: Review of Existing NERC Standards

As stated in the report, the DERTF has reviewed the list of standards below. The flow of information relating to DER from distribution entities to Transmission Owner/Operator and planning entities is already captured in these Reliability Standards (with the necessary adjustments to MOD-032 as noted in the report) and accounts for the impacts of DER on the T-D interface in planning and operations processes.

BAL-001 Real Power Balancing Control Performance
BAL-002 Disturbance Control Performance
BAL-003 Frequency Response and Frequency Bias Setting
BAL-005 Automatic Generation Control
CIP-002 Cyber Security – BES Cyber System Categorization
CIP-003 Cyber Security – Security Management Controls
CIP-005 Cyber Security – Electronic Security Perimeters
CIP-006 Cyber Security – Physical Security of BES Cyber Systems
CIP-008 Cyber Security – Incident Reporting and Response Planning
CIP-009 Cyber Security – Recovery Plans for BES Cyber Systems
CIP-010 Cyber Security – Configuration Change Management and Vulnerability Assessments
EOP-005 System Restoration Plans
EOP-011 Emergency Operations
FAC-001 Facility Interconnection Requirements
FAC-002 Facility Interconnection Studies
FAC-008 Facility Ratings
FAC-010 System Operating Limits Methodology for the Planning Horizon
FAC-011 System Operating Limits Methodology for the Operations Horizon
FAC-013 Assessment of Transfer Capability for the Near-Term Transmission Planning Horizon
IRO-004 Reliability Coordination – Operations Planning
IRO-005 Reliability Coordination – Current Day Operations
IRO-010 Reliability Coordinator Data Specification and Collection
MOD-001 Available Transmission System Capability
MOD-004 Capacity Benefit Margin
MOD-008 Transmission Reliability Margin Calculation Methodology
MOD-010-0 Steady State Data for Modeling and Simulation of Interconnected Transmission System
MOD-012-0 Dynamics Data for Modeling and Simulation of the Interconnected Transmission System
MOD-016-1.1 Documentation of Data Reporting Requirements for Actual and Forecast Demands, Net Energy for Load, and Controllable Demand-Side Management
MOD-017-0.1 Aggregated Actual and Forecast Demands and Net Energy for Load
MOD-019-0.1 Reporting of Interruptible Demands and Direct Control Load Management
MOD-020-0 Providing Interruptible Demands and Direct Load Control Management Data to System Operators and Reliability Coordinators
MOD-021-1 Documentation of the Accounting Methodology for the Effects of Demand-Side Management in Demand and Energy Forecasts
MOD-025 Verification and Data Reporting of Generator Real and Reactive Power Capability and Synchronous Condenser Reactive Power Capability
MOD-026 Verification of Models and Data for Generator Excitation Control System and Plant Volt/VAR Control Functions
MOD-027 Verification of Models and Data for Turbine/Governor and Load Control or Active Power/Frequency Control Functions
MOD-028 Area Interchange Methodology
MOD-031 Demand and Energy Data
MOD-032 Data for Power System Modeling and Analysis (replaces MOD-010)
MOD-033 Steady-State and Dynamic System Model Validation (replaces MOD-012)
PRC-004 Protection System Misoperation Identification and Correction
PRC-006 Automatic Under frequency Load Shedding
PRC-008 Implementation and Documentation of Under frequency Load Shedding Equipment Maintenance Program
PRC-010 Under voltage Load Shedding
PRC-011 Under voltage Load Shedding System Maintenance and Testing
PRC-018 Disturbance Monitoring Equipment Installation and Data Reporting
PRC-019 Coordination of Generating Unit or Plant Capabilities, Voltage Regulating Controls and Protection
PRC-020 Under-Voltage Load Shedding Program Database
PRC-021 Under-Voltage Load Shedding Program Data
PRC-022 Under-Voltage Load Shedding Program Performance
PRC-024-2 (pending) Generator Voltage and Frequency Protective Relay Settings
PRC-027 Coordination of Protection Systems for Performance During Faults
TOP-001 Transmission Operations
TOP-002 Operations Planning
TOP-003 Operational Reliability Data
TOP-004 Transmission Operations
TOP-005 Operational Reliability Information
TPL-001 Transmission System Planning Performance Requirements
VAR-001 Voltage and Reactive Control
VAR-002 Generator Operation for Maintaining Network Voltage Schedules
Appendix D: Transmission-Distribution Interface

As noted in Chapter 1, demand side management (DSM) resources can affect the aggregate characteristics, modeling requirements, and potential BPS reliability impacts at the T-D interface. While DSM activities may not have the same characteristics or behaviors as resources that produce electricity, DSM activities can have impacts at the T-D interface that overlap and interact with those of DER.

Figure D.1: Relationship Between DSM Resources and DER at the T-D Interface
### Task Force Membership

<table>
<thead>
<tr>
<th>Name</th>
<th>Entity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gerald Beckerle</td>
<td>Ameren</td>
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<tr>
<td>Dave Canter</td>
<td>American Electric Power</td>
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<tr>
<td>Jim Fletcher</td>
<td>American Electric Power</td>
</tr>
<tr>
<td>Richard Hydzik</td>
<td>Avista Corporation</td>
</tr>
<tr>
<td>Clyde Loutan</td>
<td>California Independent System Operator</td>
</tr>
<tr>
<td>Lorenzo Kristov</td>
<td>California Independent System Operator</td>
</tr>
<tr>
<td>Brant Werts</td>
<td>Duke Energy</td>
</tr>
<tr>
<td>John Hughes</td>
<td>Electricity Consumers Resource Council</td>
</tr>
<tr>
<td>Robert Entriken</td>
<td>Electric Power Research Institute</td>
</tr>
<tr>
<td>Aidan Tuohy</td>
<td>Electric Power Research Institute</td>
</tr>
<tr>
<td>Jens Boemer</td>
<td>Electric Power Research Institute</td>
</tr>
<tr>
<td>Jack Cashin</td>
<td>Electric Power Supply Association</td>
</tr>
<tr>
<td>Julia Matevosyan</td>
<td>Electric Reliability Council of Texas</td>
</tr>
<tr>
<td>Alfred Corbett</td>
<td>Federal Energy Regulatory Commission</td>
</tr>
<tr>
<td>Hassan Hamdar</td>
<td>Florida Reliability Coordinating Council</td>
</tr>
<tr>
<td>Jason McDowell</td>
<td>General Electric</td>
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<tr>
<td>Nicholas Miller</td>
<td>General Electric</td>
</tr>
<tr>
<td>Sasoon Assaturian</td>
<td>Independent Electricity System Operator</td>
</tr>
<tr>
<td>John Simonelli</td>
<td>Independent System Operator of New England</td>
</tr>
<tr>
<td>Patricia Poli</td>
<td>Michigan Public Service Commission</td>
</tr>
<tr>
<td>Mike McMullen</td>
<td>MISO</td>
</tr>
<tr>
<td>Barry Mather</td>
<td>National Renewable Energy Laboratory (NREL)</td>
</tr>
<tr>
<td>Paul McCurley</td>
<td>National Rural Electric Cooperative Association</td>
</tr>
<tr>
<td>Mark Ahlstrom</td>
<td>NextEra Energy</td>
</tr>
<tr>
<td>Robert Cummings</td>
<td>North American Electric Reliability Corporation</td>
</tr>
<tr>
<td>Michelle Marx</td>
<td>North American Electric Reliability Corporation</td>
</tr>
<tr>
<td>John Moura</td>
<td>North American Electric Reliability Corporation</td>
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<tr>
<td>Ryan Quint</td>
<td>North American Electric Reliability Corporation</td>
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<tr>
<td>Pooja Shah</td>
<td>North American Electric Reliability Corporation</td>
</tr>
<tr>
<td>Elliott Nethercutt</td>
<td>North American Electric Reliability Corporation</td>
</tr>
<tr>
<td>Lee Pedowicz</td>
<td>Northeast Power Coordinating Council</td>
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<tr>
<td>Gary Keenan</td>
<td>Northwest Power Pool</td>
</tr>
<tr>
<td>Darilush Shirmohammadi</td>
<td>California Wind Energy Association</td>
</tr>
<tr>
<td>Todd Lucas</td>
<td>Southern Company</td>
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<tr>
<td>Sylvester Toe</td>
<td>Southern Company</td>
</tr>
<tr>
<td>Thomas Siegrist</td>
<td>Stone, Mattheis, Xenopoulos &amp; Brew, P.C.</td>
</tr>
<tr>
<td>Jagan Mandavilli</td>
<td>Texas Reliability Entity</td>
</tr>
<tr>
<td>Brian Evans-Mongeon</td>
<td>Utility Services</td>
</tr>
<tr>
<td>Charlie Smith</td>
<td>Utility Variable-Generation Integration Group</td>
</tr>
<tr>
<td>Anthony Jankowski</td>
<td>WE Energies</td>
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<td>Western Electricity Coordinating Council</td>
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</tbody>
</table>
References


[19] Proposed Changes to the WECC WT3 Generic Model for Type 3 Wind Turbine Generators. P. Pourbeik: Issued: 03/26/12 (revised 6/11/12, 7/3/12, 8/16/12, 8/17/12, 8/29/12, 1/15/13, 1/23/13, 9/27/13). Prepared under Subcontract No. NFT-1-11342-01 with NREL.

[20] Proposed Changes to the WECC WT4 Generic Model for Type 4 Wind Turbine Generators. P. Pourbeik: Issued: 12/16/11 (revised 3/21/12, 4/13/12, 6/19/12, 7/3/12, 8/16/12, 8/17/12, 8/29/12, 1/15/13, 1/23/13). Prepared under Subcontract No. NFT-1-11342-01 with NREL.


Proposed Amendments to the Bylaws of the Texas RE

Action
Approve proposed amendments to the Bylaws of the Texas Reliability Entity (Texas RE) and file with the applicable governmental authorities for approval. The amendments to the Texas RE Bylaws do not affect Texas RE’s qualifications or Texas RE’s ability to function as a Regional Entity under its Regional Delegation Agreement.

Background
Texas RE is proposing several amendments to its Bylaws for approval by the Board of Trustees (Board) and the Federal Energy Regulatory Commission (FERC or Commission). The first set of amendments relates to eliminating the Texas RE Reliability Standards Committee (RSC) and transferring its duties to the Texas RE Member Representatives Committee (MRC). The second set of amendments relates to the addition of a Texas RE Director Compensation Committee and the activities of the Texas RE Nominating Committee.

The first set of amendments was approved by the Texas RE Board on September 29, 2016 and the Texas RE membership on November 16, 2016. The second set of amendments was approved by the Texas RE Board on December 7, 2016 and the Texas RE membership on December 23, 2016.

The amendments to the Texas RE Bylaws do not affect Texas RE’s qualifications to serve as a Regional Entity with delegated authority from NERC and do not adversely impact the ability of Texas RE to function as a Regional Entity under the Regional Delegation Agreement. Accordingly, Texas RE requests that the Board approve the amended Texas RE Bylaws and forward to FERC for approval.

Summary
A summary of the changes to the Texas RE Bylaws is provided below:

Article I, Section 1(q): revises the definition of “Regional Reliability Standard” to include a variance; deletes reference to Exhibit C to the Regional Delegation Agreement as the Texas RE Standards Development Process is no longer an exhibit to that agreement.

Article III, Section 4(a): Removes the reference to “Interchange Authority” as this function is no longer included in the NERC Compliance Registry.

Article IV, Section 2(c)(1): clarifies current practice that, in addition to nominating the independent directors, the Texas RE Nominating Committee makes an annual recommendation to the Texas RE Board regarding the chair and vice chair; adds that the Texas RE Nominating Committee evaluates and recommends to the Texas RE Board candidates to serve as chief executive officer (CEO) in the event of a vacancy.
Article IV, Section 2(c)(2): clarifies that the Texas RE Nominating Committee shall select and nominate, by at least a two-thirds majority, qualified candidate(s) to serve as independent directors to present to the Texas RE membership for its approval.

Article IV, Section 2(c)(4) (new subsection): provides that the Texas RE Nominating Committee shall select and recommend to the Texas RE Board, by at least a two-thirds majority, a qualified candidate to serve as CEO; provides that directors may choose to participate in interviewing CEO candidates.

Article VIII: section requiring Texas RE to have a Reliability Standards Committee is deleted in its entirety.

Article VIII (formerly Article IX), Section 1: adds language from the Regional Delegation Agreement referencing the responsibility to develop Regional Reliability Standards and Regional Variances in accordance with Texas RE’s processes; adds language reflecting the Texas RE MRC’s new responsibility to provide a forum for the review and discussion of current and proposed continent-wide Reliability Standards.

Article VIII (formerly Article IX), Section 6(a): clarifies details regarding meetings of the Texas RE MRC and its subcommittees.

Article X (formerly Article XI), Section (1)(a)(new subsection): establishes a Texas RE Director Compensation Committee composed of two independent directors that are not currently serving as Texas RE Board chair or vice chair, the CEO, and two affiliated directors, which would meet annually to consider and make a final determination by simple majority vote regarding independent director compensation; provides that the Texas RE Board chair shall annually appoint an independent director as chair of the Texas RE Director Compensation Committee; creates new subsections (b) and (c) for clarity.
AMENDED AND RESTATED BYLAWS

OF

TEXAS RELIABILITY ENTITY, INC.

(A Texas Non-Profit Corporation)
Approved by Membership – November 16, 2016 and December 23, 2016
Approved by Federal Energy Regulatory Commission – ___________

Table of Contents

<table>
<thead>
<tr>
<th>Article</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Article I. Definitions</td>
<td>1</td>
</tr>
<tr>
<td>Article II. Purpose</td>
<td>3</td>
</tr>
<tr>
<td>Article III. Membership</td>
<td>3</td>
</tr>
<tr>
<td>Article IV. Board of Directors</td>
<td>6</td>
</tr>
<tr>
<td>Article V. Meetings of Members of the Corporation</td>
<td>9</td>
</tr>
<tr>
<td>Article VI. Meetings of the Board of Directors</td>
<td>10</td>
</tr>
<tr>
<td>Article VII. Officers</td>
<td>12</td>
</tr>
<tr>
<td>Article VIII. Member Representatives Committee</td>
<td>12</td>
</tr>
<tr>
<td>Article IX. Other Committees and SubCommittees</td>
<td>16</td>
</tr>
<tr>
<td>Article X. Budgets and Funding</td>
<td>16</td>
</tr>
<tr>
<td>Article XI. Amendments to the Bylaws</td>
<td>18</td>
</tr>
<tr>
<td>Article XII. Indemnification; Procedure; Dissolution</td>
<td>18</td>
</tr>
<tr>
<td>Article XIII. Conflicts of Interest</td>
<td>19</td>
</tr>
<tr>
<td>Article XIV. Books and Records; Audit; Fiscal Year</td>
<td>20</td>
</tr>
</tbody>
</table>
ARTICLE I.
DEFINITIONS

Section 1. Definitions. The capitalized terms used in the Bylaws of Texas Reliability Entity, Inc. (the “Corporation” or “Texas RE”), shall have the meanings set forth below, or if not set forth below, shall have the meanings given them in the NERC Rules of Procedure.

(a) “Affiliate” means any entity controlling, controlled by or under common control with the entity under consideration, and includes any entity (i.e., any commercial enterprise) in any of the following relationships: (i) an entity that directly or indirectly owns or holds at least five percent of the voting securities of another entity, (ii) an entity in a chain of successive ownership of at least five percent of the voting securities of another entity, (iii) an entity which shares a common parent with or is under common influence or control with another entity or (iv) an entity that actually exercises substantial influence or control over the policies and actions of another entity. Evidence of influence or control shall include the possession, directly or indirectly, of the power to direct or cause the direction of the management and/or policies and procedures of another, whether that power is established through ownership or voting of at least five percent of the voting securities or by any other direct or indirect means. In cases where the level of control or influence is disputed, the Board shall have discretion to determine whether or not the entities are Affiliates of one another. Membership in Texas RE shall not create an affiliation with Texas RE.

(b) “Board” means the Board of Directors of the Corporation.

(c) “Bulk Power System” or “BPS” means facilities and control systems necessary for operating an interconnected electric energy transmission network (or any portion thereof) and facilities generating electric energy as needed to maintain transmission system reliability, but does not include facilities used in the local distribution of electricity.

(d) “Delegated Authority” means the authority delegated by NERC to the Corporation to propose and enforce NERC Reliability Standards and perform other reliability-related activities in the ERCOT region under the Delegation Agreement executed by NERC and the Corporation and approved by the Federal Energy Regulatory Commission, pursuant to Section 215 of the Federal Power Act (16 U.S.C. §824o).

(e) “Delegation Agreement” means the agreement between the Corporation and NERC and approved by FERC which describes the Delegated Authority and may be amended from time to time.

(f) “Electric Reliability Organization” or “ERO” means the organization that is certified by FERC pursuant to Section 39.3 of its regulations, and has received recognition by appropriate regulatory authorities in Canada and Mexico, as applicable, to establish and enforce Reliability Standards for the Bulk Power Systems of the respective countries and that has entered into a delegation agreement with the Corporation pursuant to which the Electric Reliability Organization delegates enforcement authority for Reliability Standards for the Bulk Power System in the ERCOT region. NERC was certified as the ERO on July 20, 2006.

(g) “ERCOT region” means the geographic area and associated transmission and distribution facilities that are not synchronously interconnected with electric utilities operating outside the jurisdiction of the Public Utility Commission of Texas.

(h) “FERC” means the Federal Energy Regulatory Commission.
(i) “Independent Director” means a person who is not (a) an officer or employee of the Corporation; (b) a NERC Registered Entity or Member or an officer, director, or employee of a Member of the Corporation; or (c) an officer, director, or employee of any company or entity that would reasonably be perceived as having a direct financial interest in the outcome of Board decisions or having a relationship that would interfere with the exercise of independent judgment in carrying out the responsibilities of a Director, as more specifically described in Article IV of these Bylaws.

(j) “Member” means a member of the Corporation pursuant to Article III of these Bylaws.

(k) “NERC” means North American Electric Reliability Corporation, the entity certified by FERC as the ERO on July 20, 2006.

(l) “NERC Rules of Procedure” means the Rules of Procedure that are adopted by NERC and approved by FERC.

(m) “PUCT” means the Public Utility Commission of Texas.

(n) “OPUC” means the Texas Office of Public Utility Counsel.

(o) “Originally Elected Independent Director” means a Director approved by the membership on June 2, 2010, in the first election of Texas Reliability Entity, Inc. Independent Directors.

(p) “Regional Entity” means an entity with a Delegation Agreement with NERC, as ERO, including the following organizations, in addition to Texas Reliability Entity: Florida Reliability Coordinating Council (FRCC), Midwest Reliability Organization (MRO), Northeast Power Coordinating Council (NPCC), ReliabilityFirst Corporation (RF), Southeastern Electric Reliability Council (SERC), Southwest Power Pool (SPP), and Western Electricity Coordinating Council (WECC).

(q) “Regional Reliability Standard” means a standard or variance for the ERCOT region that is proposed and approved in accordance with the Texas RE Standards Development Process and either, (i) sets more stringent reliability requirements than a national Reliability Standard, or (ii) covers matters not covered by a national Reliability Standard.

(r) “Registered Entity” means an entity that is registered with NERC and listed on the NERC Compliance Registry (available at www.nerc.com).

(s) “Reliability Standard” means a requirement to provide for Reliable Operation of the Bulk-Power System, which is approved by NERC and FERC, pursuant to Section 215 of the Federal Power Act and all amendments thereto. This term includes requirements for the operation of existing Bulk-Power System facilities, including cybersecurity protection, and the design of planned additions or modifications to such facilities to the extent necessary to provide for Reliable Operation of the Bulk Power System.

(t) “Reliable Operation” means operating the elements of the Bulk Power System within equipment and electric system thermal, voltage, and stability limits so that instability, uncontrolled separation, or cascading failures of the Bulk Power System will not occur as a result of a sudden disturbance, including a cybersecurity incident, or unanticipated failure of system elements.
(u) “Sector” means a group of Members of the Corporation that are Bulk Power System owners, operators, or users, as defined in Article III, Section 4 of these Bylaws. Each Sector shall constitute a class of Members for purposes of Chapter 22 (Nonprofit Corporations) of the Texas Business Organizations Code.

ARTICLE II.
PURPOSE

Section 1. General Purpose. The purpose of the Corporation is to preserve and enhance reliability in the ERCOT region. In furtherance of this goal, the Corporation will:

(a) Perform Reliability Standards development, compliance monitoring, compliance enforcement, and other related activities as a Regional Entity, pursuant to 16 U.S.C. §824o, in accordance with the Corporation’s Delegation Agreement with NERC;

(b) Carry out other activities as set forth in the Delegation Agreement, the NERC Rules of Procedure, or as otherwise required or requested by NERC, in support of the Delegated Authority, including but not limited to organization registration and certification, reliability assessment and performance analysis, training and education, and situational awareness and infrastructure security; and

(c) Engage in any other lawful act or activity that is not in conflict with the Corporation’s duties as a Regional Entity and for which non-profit corporations may be organized under the Texas Business Organizations Code.

Section 2. Non-Profit Corporation. The Corporation is a Texas non-profit corporation.

Section 3. Geographic Area. The Corporation will perform its operations primarily within the ERCOT region.

ARTICLE III.
MEMBERSHIP

Section 1. Members. The Corporation is a membership corporation. Membership in the Corporation is voluntary and is open only to any entity that is a user, owner or operator of the ERCOT region Bulk Power System, registers with the Corporation as a Member, maintains its registration in accordance with this Article III, and complies with the other conditions and obligations of membership specified in these Bylaws. All Members must qualify and be registered in one of the Sectors defined in Article III, Section 4. Membership in the Corporation is not a condition to participating in the development or consideration of proposed Regional Standards.

Section 2. Registration as a Member. Any entity that is eligible to be a Member of the Corporation in accordance with Article III, Section 1 may become a Member by completing and submitting to the Corporation a membership registration on a form prescribed by the Corporation. The Member shall designate one representative and an alternative representative with authority to receive notices, cast votes, and execute waivers and consents on behalf of the Member. The Corporate Secretary shall maintain a current roster of the Members of the Corporation including each Member’s designated representative and alternative representative. All Members shall be required to renew or reaffirm their registrations annually. The Corporate
Secretary may remove any Member from the roster that has not submitted a registration renewal or reaffirmation by a date established by the Corporation.

Section 3. Obligations and Conditions of Membership.

(a) Members must agree to promote, support, and comply with Reliability Standards, and assist the Corporation in its compliance with the terms and provisions of the Corporation’s Delegation Agreement with NERC. Each Member shall agree, in writing, to accept the responsibility to comply with policies of NERC and the Corporation as set forth in their respective certificates of formation, bylaws, rules of procedure, and Reliability Standards, as applicable, as from time to time adopted, approved, or amended.

(b) As an additional condition of membership in the Corporation, each Member shall be required to execute an agreement with the Corporation, in a form to be specified by the Corporation, that such entity will hold all Directors, officers, employees, and agents of the Corporation, as well as volunteers participating in good faith in the activities of the Corporation, harmless for any injury or damage caused by any act or omission of any director, officer, employee, agent, or volunteer in the course of performance of his or her duties on behalf of the Corporation, other than for willful acts of misconduct.

(c) Consistent with applicable laws and regulations, Members must share nonproprietary information at the Corporation’s request as necessary for the furtherance of the Corporation’s activities and consistent with NERC, PUCT, or any other applicable rules relating to confidentiality.

Section 4. Membership Sectors. Each Member shall elect to be assigned to one of the following membership Sectors:

(a) System Coordination and Planning: An entity that is registered with NERC as a Reliability Coordinator (RC), Balancing Authority (BA), Planning Authority (PA), or Resource Planner (RP).

(b) Transmission and Distribution: An entity that is registered with NERC as a Transmission Owner (TO), Transmission Planner (TP), Transmission Service Provider (TSP), Distribution Provider (DP), and/or Transmission Operator (TOP) and is not a Cooperative or Municipal Utility.

(c) Cooperative Utility: An entity that is (a) a corporation organized under Chapter 161 of the Texas Utilities Code or a predecessor statute to Chapter 161 and operating under that chapter; or (b) a corporation organized as an electric cooperative in a state other than Texas that has obtained a certificate of authority to conduct affairs in the State of Texas; or (c) a cooperative association organized under Tex. Rev. Civ. Stat. 1396-50.01 or a predecessor to that statute and operating under that statute and is registered with NERC for at least one reliability function.

(d) Municipal Utility: A municipally owned utility as defined in Public Utility Regulatory Act, Tex. Util. Code §11.003 and is registered with NERC for at least one reliability function.

(e) Generation: An entity that is registered with NERC as a Generator Owner (GO) or Generator Operator (GOP).
(f) **Load-Serving and Marketing:** An entity that secures wholesale transmission service or is engaged in the activity of buying and selling of wholesale electric power in the ERCOT region on a physical or financial basis, or qualifies under any newly defined NERC reliability function for demand response.

Section 5. Participation.

(a) There is only one level of Membership, and no company or entity may simultaneously hold more than one Membership.

(b) Members must qualify in and join a Sector.

(c) A Member that is eligible for more than one Sector may join only one Sector and it must be the most appropriate Sector for its business. Any disputes regarding appropriateness of a Member’s Sector will be decided by a majority vote of the Board.

(d) A company or entity that is an Affiliate of a Member may hold a separate membership in a different Sector if the companies are separate legal entities.

(e) A Member must continue to vote in the same Sector for a minimum of the remainder of the membership year in which it becomes a Member or until it is no longer eligible to remain in such Sector, and it must give notice to the Corporate Secretary when it elects or is required to change Sectors.

(f) The Corporate Secretary may review the Sector qualification of any Member and upon a determination that a Member does not qualify for membership in a particular Sector, may require the Member to change Sectors or may terminate their membership.

(g) A Member that is no longer eligible or that is not in good standing may not vote on any matters that require membership.

Section 6. Membership Fees. There is no Membership Fee to join the Corporation.

Section 7. Term of Membership. Membership in the Corporation must be renewed or reaffirmed on an annual basis and will only be retained as long as a Member meets its respective qualifications, obligations, and conditions of membership as set forth in these Bylaws.

Section 8. Disciplinary Action. A Member or Member representative may be sanctioned, suspended, or expelled pursuant to a procedure that is fair and reasonable and is carried out in good faith. The Board will establish a procedure to sanction, suspend, or expel a Member that includes notice to the Member and exercise of appropriate due process procedures and allows for a determination by the Board in its sole discretion that in its judgment the Member has violated its obligations and responsibilities to the Corporation.

Section 9. Resignation. Any other provision of these Bylaws notwithstanding, any Member may withdraw from participation in the activities of the Corporation at any time upon written notice to the Secretary of the Corporation, whereupon it shall cease to be a Member, and its representatives shall cease to be entitled or obligated to participate in the activities of the Board or any activities requiring membership.
Section 10. Reinstatement. A former Member, except a Member subject to Disciplinary Action under Section 8, may submit a membership application form to rejoin the Corporation as a Member. A Member disciplined under Section 8 may submit a written request for reinstatement of Membership. The request for reinstatement will be considered by the Board, and will be granted or denied within the sole discretion of the Board.

ARTICLE IV.
BOARD OF DIRECTORS

Section 1. Board of Directors. The business and affairs of the Corporation shall be managed by the Board. The Board shall consist of (i) four (4) Independent Directors who are nominated and elected in accordance with the requirements and procedures specified in this Article IV (the “Independent Directors”); (ii) the Chairman of the PUCT or another PUCT Commissioner designated by the Chairman, as an ex officio non-voting member; (iii) Texas Public Counsel, from OPUC (or another employee of OPUC designated by Texas Public Counsel), as an ex officio non-voting member, representing the interests of residential and small commercial electricity consumers; (iv) the CEO of the Corporation as a voting member (the “Management Director”); (v) the chair of the Member Representatives Committee as a voting member; and (vi) the vice chair of the Member Representatives Committee as a voting member. The Directors who are the chair and vice chair of the Member Representatives Committee will be collectively referred to herein as “Affiliated Directors.” Each Director, including the Affiliated Directors and excluding the non-voting members of the Board, shall have one (1) vote on any matter brought before the Board for a vote. All Directors are expected to serve the public interest and to represent the reliability concerns of the entire ERCOT region Bulk Power System.

Section 2. Independent Directors. The Independent Directors shall be elected, shall have the qualifications specified, and shall serve in the manner provided in this Section.

(a) Qualifications:

(1) Experience in one or more of these fields: senior corporate leadership; professional disciplines of finance, accounting, engineering, bulk power systems, or law; regulation of utilities; and/or risk management.

(2) Independence of any NERC Registered Entity. Requirements of independence include but are not limited to the following:

(i) Independent Directors and the spouse, mother, father, sibling, or dependent, and any spouse of mother, father, or sibling and including any step and adoptive parents, siblings or children, and household members of Independent Directors and their spouses shall not have current or recent status (within the last two years) as a director, officer, or employee of an ERCOT region NERC Registered Entity.

(ii) Independent Directors and immediate family (any spouse or dependent) and household members of Independent Directors shall not have current status as a director, officer, or employee of a non-ERCOT region NERC Registered Entity.

(iii) Independent Directors and immediate family and household members of Independent Directors shall not have direct business relationships, other than retail customer relationships, with any NERC Registered Entity.
(iv) Independent Directors and immediate family and household members of Independent Directors shall not own stocks or bonds of NERC Registered Entities or their affiliates. To the extent that an Independent Director or his or her spouse, dependent child, or any other household member owns stocks or bonds of NERC Registered Entities, these must be divested or placed in a blind trust prior to being seated on the Board. Ownership in broadly diversified mutual funds or similar funds, which may include stocks or bonds of NERC Registered Entities or their affiliates, is not prohibited.

(v) Independent Directors shall not have any relationship that would interfere with the exercise of independent judgment in carrying out the responsibilities of a Board member, including the Delegated Authority.

(vi) Other criteria as approved by the Board.

(b) **Term.** The term for Independent Directors shall be staggered three year terms. An Independent Director may be elected for up to three consecutive terms. For the Originally Elected Independent Directors, two positions will have three-year terms, one position will have a two-year term, and one position will have a one-year term, and these terms shall not be counted for purposes of term limits. The term for the Affiliated Directors who are chair and vice chair of the Member Representatives Committee shall be two years, and the terms of the *ex officio* Directors will not expire. If an Independent Director is elected to fill an unexpired term in the event of a vacancy, that term shall not be counted for purposes of term limits.

(c) **Selection.**

(1) The Board shall appoint, on an annual basis, or more frequently if needed in the event of a special election pursuant to this subsection, a nominating committee (the “Nominating Committee”) to recommend candidates (i) to succeed the Independent Directors whose terms expire during the current year; (ii) to serve the remainder of the term of any Independent Director who ceased to serve as a Director subsequent to the last annual election of Directors; (iii) to serve as the Chair and Vice Chair on an annual basis; and (iv) to serve as CEO in the event of a vacancy. The Nominating Committee shall consist of two (2) Independent Directors whose terms do not expire during the current year and are not seeking re-election and one (1) Affiliated Director. The PUCT Chairman (or the PUCT Commissioner designated by the Chairman) may choose to participate on the Nominating Committee. The Board Chair shall appoint the Chair of the Nominating Committee. The Nominating Committee may retain an executive search firm to locate and present candidates to serve as Independent Directors with the required qualifications, as set forth in Article IV, Section 2(a) or to locate and present candidates to serve as CEO. Meetings of the Nominating Committee are not required to be publicly posted.

(2) The Nominating Committee shall select and nominate, by at least a two-thirds majority, qualified candidate(s) to serve as Independent Directors to present to the Membership for its approval. The Nominating Committee shall strive to ensure that the Board as a whole reflects expertise in the areas of technical electric operations and reliability, legal, senior corporate leadership, financial, risk management, and regulatory matters, and familiarity with regional system operation issues in the ERCOT region.
(3) The Membership shall vote by Sector as described in Article V in favor or against the proposed Independent Director(s). A proposed Independent Director who is approved by a majority of the Sectors shall become an Independent Director.

(4) The Nominating Committee shall select and recommend to the Board, by at least a two-thirds majority, a qualified candidate to serve as CEO. The Directors may choose to participate in interviewing CEO candidates.

(d) Director Voting Weights. All voting Directors shall have a single vote each.

(e) Alternates and Proxies. Independent Directors may designate another Independent Director as a proxy if unable to attend a Board meeting. Ex officio Directors may designate an alternate representative who may attend meetings in the absence of such Director. The chair and vice chair of the Member Representatives Committee may designate each other or may designate an Independent Director as their proxy if unable to attend a Board meeting.

Section 3. Appointment of Management Director. The president and chief executive officer (CEO) of the Corporation shall serve as the Management Director of the Corporation, effective as of the date of his or her appointment by the Board as CEO of the Corporation in accordance with these Bylaws, to serve until such time that he or she ceases to hold the position of CEO. No action of the Members of the Corporation shall be required in connection with the appointment of the CEO as the Management Director of the Corporation.

Section 4. Chair and Vice Chair. Annually, the Board shall elect from the Board’s membership, by resolution of the Board, a Chair and a Vice Chair. The Chair and Vice Chair shall each be one of the Independent Directors.

Section 5. Vacancies and Removal.

(a) Should any vacancy on the Board arise from the death, resignation, retirement, disqualification, or removal from office of any Director, or from any other cause, such vacancy shall be filled as follows:

(1) For an Independent Director, by the election of a new Independent Director at the next annual election of Directors to fill the remainder, if any, of the term of the departed Independent Director; provided, that the Board by resolution may in its discretion call a special election to fill any such vacancy for the remainder, if any, of the term of the departed Independent Director.

(2) For the Management Director, by the appointment of a new CEO or interim CEO to fill the vacancy.

(3) For an ex officio Director, by the appointment of a new PUCT Chair or Texas Public Counsel by whomever had the right to appoint such Director.

(4) For an Affiliated Director, by the election of a new chair or vice chair, as applicable, by the Member Representatives Committee.

(b) A Director may be removed with or without cause at any time by whomever had the right to appoint such Director (for ex officio Directors), or for the elected Independent Directors, by an affirmative vote of sixty percent (60%) of the Members. In addition, the Board
may remove any voting Director for cause, upon at least seventy-five percent (75%) affirmative votes of the eligible, remaining voting Directors. The right to elect Directors may not be assigned, sold, pledged or transferred in any manner.

**Section 6. Committees of the Board.** The Board shall by resolution create and appoint all committees of the Board as the Board deems necessary to perform its responsibilities. All committees of the Board shall have such duties as are prescribed and delegated by the Board. Committees to which any of the authority of the Board to manage the Corporation is delegated must have at least two Directors, and a majority of the members of the committee must be Directors.

**ARTICLE V. MEETINGS OF MEMBERS OF THE CORPORATION**

**Section 1. Annual and Other Meetings of Members.**

(a) An annual meeting of the Members to elect Directors, announce election results from electronic elections, and conduct such other business as may come before the meeting, shall be held in December each year. The failure to hold an annual meeting in accordance with these bylaws shall not affect the validity of a corporate action.

(b) Meetings of Members of the Corporation may be called for any purpose or purposes by resolution of the Board, by the chair of the Board, the CEO or the Corporate Secretary, or by a number of Members constituting at least ten (10) percent of all Members on the roster of Members maintained by the Corporate Secretary, which number shall include Members in at least three (3) of the Sectors. Meetings of Members shall be held at the principal office of the Corporation or at such other place fixed by the Board as shall be specified in the notice of meeting. Meetings shall be called upon written notice of the time, date, place, and purposes of the meeting given to all Members on the roster of Members maintained by the Corporate Secretary not less than ten (10) nor more than sixty (60) days prior to the date of the meeting. Only Members in good standing with the Corporation, as determined by the Board, have the right to vote at any meeting of the Members. Further, if at any point a Member no longer meets the qualifications for the Sector of which it is a member, the entity may immediately elect to become a member in any Sector for which it does qualify.

**Section 2. Quorum and Voting Requirements for Meetings of Members.**

(a) At any meeting of the Members of the Corporation, attendance in person or by proxy by a majority of the Members in each of at least two-thirds of the Sectors on the roster of Members maintained by the Corporate Secretary shall constitute a quorum.

(b) Except as otherwise expressly provided in the Corporation’s Certificate of Formation, these Bylaws, or applicable law, Members shall vote by Sector and each Sector shall have one vote.

(c) To the extent practicable, membership votes will be conducted electronically and prior to annual membership meetings.

(d) Except as otherwise expressly provided in the Corporation’s Certificate of Formation, these Bylaws or applicable law, actions by the Members of the Corporation shall be approved upon receipt of the affirmative vote of a majority of the Sectors of the Corporation at (1) a meeting at which a quorum is present, in person or by proxy, or (2) an electronic vote which has
participation by a quorum. Each Sector’s vote shall be determined by the affirmative vote of a majority of the members of the Sector voting at the meeting or in the electronic election.

Section 3. Waivers of Notice of Meetings of Members and Member Meeting Adjournments. Notice of a meeting of Members need not be given to any Member who waives notice, either electronically or in writing, in person or by proxy, whether before, during, or after the meeting. The attendance of any Member at a meeting, in person or by proxy, without protesting prior to the conclusion of the meeting the lack of proper notice of such meeting, shall constitute a waiver of notice of the meeting by such Member. When any meeting of Members is adjourned to another time or place, it shall not be necessary to give notice of the adjourned meeting if the time and place to which the meeting is adjourned are announced at the meeting at which the adjournment is taken, and if at the adjourned meeting only such business is transacted as might have been transacted at the original meeting.

Section 4. Action Without a Meeting of Members. Any action, required or permitted to be taken at a meeting of Members, may be taken without a meeting if the proposed action is posted to all Members (via direct email or email to an email distribution list to which Members may subscribe and by posting on the Corporation website) and consented to in writing by the minimum number of Members that would be required to approve the action at a meeting of the Members at which all Members were present. The voting in such a circumstance shall be performed in writing, including via email or other electronic means. The Members shall receive written notice of the results within ten (10) days of the action vote, and all written responses of the Members shall be filed with the Corporate records. The results of such voting will be posted on the Corporation’s website.

Section 5. Meetings of the Members to be Open. Notice to the public of the dates, places, and times of meetings of the Members, and all non-confidential material provided to the Members, shall be posted on the Corporation’s website at approximately the same time that notice is given to the Members. Meetings of the Members shall be open to the public, subject to reasonable limitations due to the availability and size of meeting facilities; provided, that the meeting may be held in or adjourned to closed session to discuss matters of a confidential nature, including but not limited to compliance and enforcement matters, personnel matters, litigation, or commercially sensitive or critical infrastructure information of the Corporation or any other entity. The results of any action taken without a meeting, as described above, will be posted on the Corporation’s website.

ARTICLE VI.
MEETINGS OF THE BOARD OF DIRECTORS

Section 1. Regular Meetings of the Board. Regular meetings of the Board shall be held at least quarterly. By resolution adopted at any meeting of the Board, the Board may provide for additional regular meetings that may be held as needed.

Section 2. Special Meetings of the Board. Special meetings of the Board for any purpose or purposes may be called at any time by the chair or by any two Directors. Such meetings may be held upon notice given to all Directors not less than three (3) days prior to the date of the meeting. Such notice shall specify the time, date, place, and purpose or purposes of the meeting and may be given by telephone, email or other electronic media, or by express delivery.

Section 3. Quorum and Voting Requirements for Meetings of the Board. Unless otherwise expressly provided in the Corporation’s Certificate of Formation, these Bylaws
or applicable law, (i) the quorum necessary for the transaction of business at meetings of the Board shall be a majority of the voting Directors in person or by proxy and at least three Independent Directors, and (ii) actions by the Board shall be deemed approved upon receipt of the affirmative vote of a majority of the Directors present and voting in person (by means of any communications system by which all persons participating in the meeting are able to hear each other) or by proxy at a meeting at which a quorum is present but in no case less than four votes.

Section 4. Meetings of the Board to be Open. Notice to the public of the dates, places, and times of meetings of the Board, and all non-confidential material provided to the Board, shall be posted on the Corporation’s website at approximately the same time that notice or such material is given to the Directors and at least five (5) business days prior to the scheduled meeting. Meetings of the Board shall be open to the public, subject to reasonable limitations due to the availability and size of meeting facilities; provided, that the Board may meet in or adjourn to closed session to discuss matters of a confidential nature, including but not limited to compliance and enforcement matters, personnel matters, litigation, or commercially sensitive or critical infrastructure information of the Corporation or any other entity. Any or all of the Directors or members of a Board committee, may participate in a meeting of the Board, or a meeting of a committee, in person or by proxy, by means of any communications system by which all persons participating in the meeting are able to hear each other.

Section 5. Waivers of Notice of Board Meetings and Board Meeting Adjournments. Notice of a board meeting need not be given to any Director who signs, or sends an email confirming a waiver of notice, in person or by proxy, whether before, during, or after the meeting, or who attends the meeting without protesting the lack of notice of such meeting prior to the conclusion of the meeting. Notice of an adjourned board meeting need not be given if the time and place to which the meeting is adjourned are announced at the meeting at which the adjournment is taken and if the period of adjournment does not exceed ten (10) days.

Section 6. Action Without a Meeting. Any action required or permitted to be taken at a meeting of the Board, or of any committee thereof, may be taken by the Board or by the committee without a meeting if the action is consented to in writing by the number of Directors or members of the committee, as the case may be, entitled to vote on the action that would be required to approve the action at a meeting of the Board or committee with all members of the Board or committee present. The call for action without a meeting of the Board may be initiated by the chair or by any two voting Directors. Notice of the proposed call for action without a meeting, and all non-confidential material provided to the Board in connection with the call for action without a meeting, shall be posted on the Corporation’s website and shall be sent via email to an email distribution list to which Members and the public may subscribe at approximately the same time notice of the call for action without a meeting or such material is provided to the Board. The call for action without a meeting of a committee of the Board may be initiated by the chair of the committee or by any two members of the committee. The Directors or members of the committee shall receive written notice of the results of such action within seven (7) days of the action vote. All written responses of the Directors shall be filed with the minutes of the Corporation, and all written responses of members of a committee shall be filed with the minutes of such committee.

Section 7. Emergency Meetings. The Board may meet on urgent matters with not less than two (2) hours’ public notice, as necessary or appropriate for emergency conditions threatening health or safety or a reasonably unforeseen situation.
ARTICLE VII.
OFFICERS

Section 1. Selection of Officers. The Board shall elect a CEO and shall ratify the selection of the officers of the Corporation (collectively, the "Officers"). The Management Director shall not participate in votes electing or ratifying Officers. The Corporation shall maintain a list of current Officers ratified by the Board. The duties and authority of the Officers shall be determined from time to time by the Board. Subject to any such determination, the Officers shall have the following duties and authority:

Section 2. Chief Executive Officer ("CEO"). The CEO shall be the chief executive officer of the Corporation. He or she shall be responsible for the day-to-day ongoing activities of the Corporation and shall have such other duties as may be delegated or assigned to him or her by the chair. The CEO may enter into and execute in the name of the Corporation contracts or other instruments not in the regular course of business that are authorized, either generally or specifically, by the Board.

Section 3. Corporate Secretary. The Secretary shall maintain the roster of Members of the Corporation, shall cause notices of all meetings to be served as prescribed in these Bylaws, shall keep or cause to be kept the minutes of all meetings of the Members and the Board, and shall have charge of the seal of the Corporation. The Secretary shall perform such other duties and possess such other powers as are incident to his or her office or as shall be assigned to him or her by the CEO. The CEO may select an Assistant Corporate Secretary at his or her discretion. The Assistant Corporate Secretary is not an Officer of the Corporation.

Section 4. Chief Financial Officer. A Chief Financial Officer shall have custody of the funds and securities of the Corporation, shall keep or cause to be kept regular books of account for the Corporation and shall have the duties normally assigned to a treasurer of a corporation. The Chief Financial officer shall perform such other duties and possess such other powers as are incident to his or her office or as shall be assigned to him or her by the CEO.

Section 5. Other Officers. The CEO may select such other Officers as he or she deems appropriate, subject to ratification by the Board. Any such Officer shall perform such other duties and possess such powers as are incident to his or her office or as shall be assigned to him or her by the CEO.

ARTICLE VIII.
MEMBER REPRESENTATIVES COMMITTEE

Section 1. Purpose of Member Representatives Committee. The Corporation shall have a "Member Representatives Committee" that shall provide advice and recommendations to the Board with respect to: annual budgets, business plans and funding mechanisms of the Corporation; the development of Regional Reliability Standards and Regional Variances in accordance with Texas RE’s process; other matters relevant to reliability of the ERCOT Bulk Power System; and other matters pertinent to the purpose and operations of the Corporation. The Member Representatives Committee shall provide its advice and recommendation to the Board through its chair and the vice chair, who also serve as the Affiliated Directors on the Board. The Member Representatives Committee may create subcommittees, task forces, or working groups ("subcommittees") as it deems appropriate to study or discuss selected technical or compliance matters, provide a forum for the review and discussion of current and proposed Reliability Standards, and to make recommendations to the Board as requested or required by the Board or as deemed appropriate to its purpose by the Member Representatives.
Committee. Because it is elected by the Members of the Corporation and not appointed by the Board, the Member Representatives Committee shall not be a standing committee of the Board of Directors of the Corporation, but is authorized to provide advice and recommendations directly to the Board, through its elected chair and vice chair.

Section 2. Composition of the Member Representatives Committee. The Member Representatives Committee shall consist of two representatives from each Sector to serve two-year terms and will select a chair and vice chair for the Member Representatives Committee to serve two-year terms. The representatives of each Sector shall be officers, employees, or directors of Members in that Sector (or the Member's parent, subsidiary, or other Affiliate); provided however, except for a Sector that has only one Member, only one officer, employee, or director of a Member in a Sector (or the Member’s parent, subsidiary, or other Affiliate) may be a representative from that Sector. The Board may by resolution create additional non-voting positions on the Member Representatives Committee on its own initiative or at the written request of any group of Members of the Corporation that believes its interests are not adequately represented on the Member Representatives Committee. There shall be no limit on the number of terms that an officer, employee, or director of a Member (or the Member’s parent, subsidiary, or other Affiliate), may serve on the Member Representatives Committee.

Section 3. Election of Representatives of the Member Representatives Committee. Unless a Sector adopts an alternative election procedure, the election of representatives from each Sector to the Member Representatives Committee, and any election to fill a vacancy, shall be conducted in accordance with the following process, which shall be administered by the Secretary of the Corporation.

(a) During the period beginning no more than ninety (90) days and ending no less than fifteen (15) days prior to an annual meeting, or beginning no more than forty-five (45) days and ending no less than fifteen (15) days prior to a special election to fill a vacancy on the Member Representatives Committee, nominations may be submitted for candidates for election to the Member Representatives Committee. A nominee for election as a Sector representative must be an officer, employee, or director of a Member in that Sector (or the Member’s parent, subsidiary, or other Affiliate). No more than one nominee who is an officer, employee, or director of a Member (or the Member’s parent, subsidiary, or other Affiliate) may stand for election in any single Sector; if more than one officer, employee, or director of a Member (or the Member’s parent, subsidiary, or other Affiliate) is nominated for election from a Sector, the Member shall designate which such nominee shall stand for election. The election of representatives shall be conducted over a period of ten (10) days using an electronic process approved by the Corporate Secretary.

(b) Each Member in a Sector shall have one vote for each Representative to be elected from the Sector in that election and may cast no more than one vote for any nominee. The nominee receiving the highest number of votes in each Sector shall be elected to one Representative position to be filled from that Sector and the nominee receiving the second highest number of votes shall be elected as the second Representative position for that Sector. To be elected on the first ballot, a nominee must receive a number of votes equal to a simple majority of the Members in the Sector casting votes in the election. If no nominee in a Sector receives a simple majority of votes cast in the first ballot, a second ballot shall be conducted which shall be limited to the number of candidates receiving the three (3) highest vote totals on the first ballot. The nominees receiving the two highest totals of votes on the second ballot shall be elected to the Representative positions for the Sector.

(c) A Sector may adopt an alternative procedure to the foregoing to nominate and elect its Representatives to the Member Representatives Committee if the alternative
procedure is approved by vote of at least two-thirds of the Members in the Sector, provided, however that any alternative procedure may be reviewed and disapproved by the Board.

(d) A Sector may elect an Alternate to serve in place and at the convenience of the Sector’s Member Representatives Committee Representative(s) in the event a Member Representatives Committee Representative cannot attend a Member Representatives Committee meeting.

Section 4. Chair and Vice Chair of the Member Representatives Committee. After the selection of its Representatives, the Member Representatives Committee shall select a chair and vice chair from among its voting Representatives by majority vote to serve during the upcoming two-year term and be the Affiliated Directors on the Board. The selected chair and vice chair may not be representatives of the same Sector and may not concurrently serve on the Board of ERCOT ISO. The Board shall be notified of the selection of the chair and vice chair, but the selection will not be subject to approval of the Board. The chair is responsible for ensuring that minutes of the meetings are properly maintained and made available to the public, but the chair may delegate this responsibility to the vice chair or to another Representative of the Member Representatives Committee who may be designated as secretary of the Member Representatives Committee.

Section 5. Vacancies on the Member Representatives Committee. In the event that any Representative of the Member Representatives Committee ceases to serve as a Representative of the Member Representatives Committee as a result of his or her death, resignation, retirement, disqualification, removal, or other cause, the Members in the Sector of which such Representative was a representative shall elect, as soon thereafter as reasonably practicable, and in accordance with the procedures in this Article VIII, a new Representative to replace the Representative of the Member Representatives Committee who ceased to serve. For those Sectors that have elected an Alternate, the Alternate will fill a vacancy left by the Sector’s Member Representative until a new Sector Member Representative is elected by the Sector.

Section 6. Meetings of the Member Representatives Committee. The Member Representatives Committee will plan and hold quarterly meetings, at a time and place determined by the Member Representatives Committee, normally shortly before the regular meetings of the Board, and posted on the Corporation’s website. Except for closed session meetings specifically allowed by this Section, all meetings shall be open to the public. The Member Representatives Committee shall adopt such procedural rules as are needed to operate in accordance with its purpose and will include procedures for coordinating with employees of the Corporation who provide administrative support, as set forth in subsection 6(c), below.

(a) Notice to the public of the dates, places, and times of meetings of the Member Representatives Committee and any subcommittees, and all non-confidential material provided to the Representatives on the Member Representatives Committee or any subcommittees, shall be posted on the Corporation’s website at approximately the same time that notice or such material is given to the Member Representatives Committee, which will normally be at least five (5) business days prior to the scheduled meeting. Meetings of the Member Representatives Committee and subcommittees shall be open to the public, subject to reasonable limitations due to the availability and size of meeting facilities; provided, that the Member Representatives Committee and subcommittees may meet in or adjourn to closed session to discuss matters of a confidential nature, including but not limited to confidential planning information, critical infrastructure information, or commercially sensitive information of the Corporation or any other entity. Participation in a meeting of the Member Representatives
Committee or subcommittee may be accomplished through use of a communications system by which all persons participating in the meeting are able to hear each other.

(b) Special meetings may be called for any purpose or purposes by the chair of the Member Representatives Committee or by any three (3) Representatives of the Member Representatives Committee, which number shall include representatives from at least three Sectors, and require notice given to all Representatives of the Member Representatives Committee not less than seven (7) days prior to the date of the meeting. Such notice shall specify the time, date, place, and purpose or purposes of the meeting and may be given by telephone, facsimile, or other electronic media, or by express delivery.

(c) The Member Representatives Committee shall effectively coordinate with the employees of the Corporation and adopt procedural rules for the voting for Representatives, scheduling of meetings, and public posting of required meeting information and minutes. The chair or vice chair of the Member Representatives Committee shall provide all meeting agendas, material, minutes and other information required or desired to be posted on the Corporation's website to appropriate Corporation employees at least one business day prior to the time such information should be posted.

Section 7. Action Without a Meeting of Members. Any action, required or permitted to be taken at a meeting of the Member Representatives Committee, may be taken without a meeting if the proposed action is posted to all Committee Members via direct email and consented to in writing by a majority of the Representatives. The voting in such a circumstance shall be performed in writing, including via email or other electronic means. The Representatives shall receive written notice of the results within ten (10) days of the action vote, and all written responses of the Representatives shall be retained as a corporate record. The results of such voting will be reported at the next in-person Member Representatives Committee meeting.

Section 8. Waivers of Notice of Meetings of the Member Representative Committee and Meeting Adjournments. Notice of a meeting of the Member Representatives Committee need not be given to any member of the Member Representatives Committee who waives notice electronically or otherwise in writing, in person or by proxy, whether before or after the meeting, or who attends the meeting without protesting, prior to the conclusion of the meeting, the lack of notice of such meeting. Notice of an adjourned meeting of the Member Representatives Committee need not be given if the time and place to which the meeting is adjourned are announced at the meeting at which the adjournment is taken and if the period of adjournment does not exceed ten (10) days.

Section 9. Quorums and Voting for Meetings of the Member Representatives Committee. The quorum necessary for the transaction of business at meetings of the Member Representatives Committee shall be the presence, in person or by proxy, of two-thirds of the voting Representatives on the Member Representatives Committee entitled to attend. Each voting member of the Member Representatives Committee shall have one (1) vote on any matter coming before the Member Representatives Committee that requires a vote. Except as otherwise expressly provided in the Corporation’s Certificate of Formation, these Bylaws or applicable law, actions by members of the Member Representatives Committee shall be approved upon receipt of the affirmative vote of a majority of the voting members of the Member Representatives Committee present (by means of any communications system by which all persons participating in the meeting are able to hear each other) and voting at any meeting at which a quorum is present.
Section 10. Alternates and Proxies. Member Representatives may designate another Member Representative or an employee of the Member Representative’s organization (or the Member’s parent, subsidiary, or other Affiliate) as a proxy if both the Member Representative and the Sector Alternate are unable to attend a Member Representatives Committee meeting. A member of the Member Representatives Committee may give a proxy only to a person who is an officer, employee, or director of a Member, registered in the same Sector (or the Member’s parent, subsidiary, or other Affiliate).

Section 11. Other Procedures of the Member Representatives Committee. Except as to any matter as to which the procedure to be followed by the Member Representatives Committee is expressly set forth in these Bylaws, the Member Representatives Committee may adopt such additional procedures, not inconsistent with these Bylaws, as it deems appropriate, subject to review and disapproval by the Board.

ARTICLE IX.
OTHER COMMITTEES AND SUBCOMMITTEES

Section 1. Committees of the Corporation. In addition to those committees specified by these Bylaws, to which the Board shall appoint members in accordance with the requirements of these Bylaws, the Board may by resolution create standing committees of the Corporation; and may in addition by resolution appoint the members of such committees, subcommittees, task forces and Sector-specific forums as the Board deems necessary or desirable to carry out the purposes of the Corporation. The Board shall appoint members to such standing committees and other committees of the Corporation that are representative of Members, other interested parties, and the public, that provide for balanced decision-making and that include persons with sufficient technical knowledge and experience. All committees, subcommittees, task forces and Sector-specific forums shall have such scope and duties, not inconsistent with law, as are specified in these Bylaws and the Rules of Procedure of the Corporation or otherwise determined by the Board.

ARTICLE X.
BUDGETS AND FUNDING

Section 1. Compensation of the Board and Member Representatives Committee.

(a) The Board shall have a Director compensation committee (the “Director Compensation Committee”) to have the right to evaluate and fix from time to time, by simple majority vote, the amount of the annual retainer fee or other compensation to be paid to the Independent Directors for their services to the Corporation, including any fees to be paid for each meeting of the Board or any Board committee attended by an Independent Director. The Director Compensation Committee will evaluate the fee or other compensation annually to ensure that Director compensation is appropriate. The Director Compensation Committee shall consist of two (2) Independent Directors that are not currently serving as Board Chair and Vice Chair, two (2) Affiliated Directors, and the CEO. The Board Chair shall appoint an Independent Director as the Chair of the Director Compensation Committee. Meetings of the Director Compensation Committee are not required to be publicly posted.

(b) No compensation shall be paid to any Management Director, Affiliated Director, or ex officio Director for his or her services on the Board, other than the compensation paid to the Management Director for services as CEO of the Corporation. No compensation shall
be paid by the Corporation to any member of the Member Representatives Committee for his or her services on the Member Representatives Committee.

(c) Independent Directors shall be entitled to be reimbursed their reasonable out-of-pocket expenditures for attending meetings and conducting the business of the Corporation.

Section 2. Preparation and Adoption of Annual Budget, Business Plan, and Funding Mechanism. The Board shall require the CEO to prepare for Board approval an annual business plan and budget for the administrative and other expenses of the Corporation, including the expenditures for the fiscal year for any material special projects undertaken by the Corporation and reasonable and proper reserves and provisions for contingencies, in accordance with all NERC and FERC requirements. The annual business plan, budget and funding mechanism of the Corporation shall be for a fiscal year commencing on January 1 and ending on December 31. Each annual business plan, budget, and funding mechanism shall be approved by the Board at a regular meeting or a special meeting of the Board duly called for that purpose. The Board shall approve each annual business plan, budget, and funding mechanism at a time that allows for timely submittal of the approved annual business plan, budget, and funding mechanism to the applicable regulatory authorities.

Section 3. Comments During Preparation of Annual Business Plan and Budget. In preparing the annual business plan and budget, the Board shall require that the CEO post a draft business plan and budget for review and comment by the Members of the Corporation, the Member Representatives Committee, and the standing committees of the Corporation for at least five (5) business days prior to the date of the meeting of the Board at which the annual business plan and budget is to be adopted.

Section 4. Modified or Supplemental Budgets. During the course of a fiscal year, the Board may modify any approved budget or develop and approve a supplemental budget if determined by the Board to be necessary due to such factors as a shortfall in revenues of the Corporation from projected levels, incurred or anticipated expenditures, duties, or new projects not provided for in the annual budget, or such other factors as in the judgment of the Board warrant modification of the budget for the fiscal year or development of a supplemental budget. In preparing a modified or supplemental budget, the Board shall follow the provisions of this Article X, Section 4 to the extent practicable in the judgment of the Board in light of the urgency of the circumstances necessitating preparation and approval of the modified or supplemental budget. Each modified or supplemental budget shall be approved by the Board at a regular meeting or a special meeting of the Board duly called for that purpose.

Section 5. Submission of Annual Business Plans and Budgets to the Regulatory Authorities. Each annual budget, annual business plan, and annual, modified, or supplemental budget approved by the Board shall be submitted by the Corporation to the ERO and any applicable regulatory authorities for approval in accordance with its regulations, and shall not be effective until approved by the applicable regulatory authorities. If ordered to modify or remand an annual budget, business plan, or annual, modified, or supplemental funding mechanism, the Board shall promptly following such order adopt such modifications to the business plan, budget, or funding mechanism as are required or directed by the order of the ERO and any applicable regulatory authority.
ARTICLE XI.
AMENDMENTS TO THE BYLAWS

Section 1. Amendments to the Bylaws. These Bylaws may be altered, amended, or repealed by action of the Membership, as set forth below. Any alteration, amendment, repeal or adoption of Bylaws shall be subject to any applicable requirements for filing with or approval by the ERO or any other applicable regulatory authority. These Bylaws may be altered, amended, or repealed as follows:

(a) Any Director or Member suggesting amendments to these Bylaws must submit a proposal of the amendment, including any necessary supporting documents, to the CEO.

(b) The CEO shall place the proposal on the agenda for a Board meeting in the time and manner prescribed by the Board and within ninety-five (95) days of the request.

(c) If the proposal is approved by an act of the Board as set forth in Article VI, Section 3, the Board shall place the proposal on the agenda of the next Annual Meeting of the Corporate Members unless the Board in its discretion calls a Special Meeting of the Corporate Members to vote on the proposal or determines to seek Membership approval without a meeting as provided in Article V, Section 4.

(d) If the proposal is not approved by the Board, the Members of the Corporation may call a meeting, pursuant to Article V, Section 1(b), for the purpose of voting on a proposal not approved by the Board. Any such proposal must be approved by a vote of five of the six Sectors at a meeting of Members called for that purpose or by written consent of five of the Sectors, where the number of votes for and against the proposed alteration, amendment, repeal or adoption of Bylaws shall be determined in accordance with Article V, Section 2.

ARTICLE XII.
INDEMNIFICATION; PROCEDURE; DISSOLUTION

Section 1. Indemnification. The Corporation shall indemnify each person who at any time shall serve, or shall have served, as an officer, Director, employee, or other corporate agent of the Corporation, is or was serving at its request as a director, officer, partner, venturer, proprietor, employee, agent or similar functionary of another foreign or domestic corporation, partnership, joint venture, sole proprietorship, trust, employee benefit plan or other enterprise ("Indemnified Parties"), to the full extent from time to time permitted by the Texas Business Organizations Code and other applicable law. Such right of indemnification shall inure to the benefit of the legal representative of any such Indemnified Party. The foregoing indemnification shall be in addition to, and not in restriction or limitation of, any privilege or power that the Corporation may have with respect to the indemnification or reimbursement of its Indemnified Parties. The Corporation shall also pay or advance reasonable expenses incurred by an Indemnified Party in connection with a proceeding in advance of the final disposition of the proceeding upon receipt of a written affirmation by the Indemnified Party of a good faith belief that the standard of conduct necessary for indemnification under this Article XII and the Texas Business Organizations Code has been met and a written undertaking by or on behalf of the officer, Director, or other corporate agent to repay the amount if it shall be ultimately determined that the Indemnified Party was not entitled to be indemnified by the Corporation.

Section 2. Parliamentary Rules. In the absence of and to the extent not inconsistent with specific provisions in these Bylaws, meetings or other actions pursuant to these
Bylaws shall be governed by procedures that the Board may, from time to time, establish by resolution.

**Section 3. Dissolution.** Upon dissolution of the Corporation, in accordance with the Certificate of Formation, the remaining assets of the Corporation after payment of debts shall be distributed in the manner determined by the Board, provided that, (i) no part of the assets shall be distributed to any Director of the Corporation, and (ii) the distribution of assets shall be consistent with the requirements of Section 501(c)(3) of the United States Internal Revenue Code of 1954.

**ARTICLE XIII. CONFLICTS OF INTEREST**

**Section 1. Conflicts of Interest.**

(a) Each Director shall have an affirmative duty to disclose to the Board or committee (as the case may be) any actual or potential conflicts of interest of the Director that arise during his or her tenure as a Director where, and to the extent that, such conflicts or potential conflicts directly or indirectly affect any matter that comes before the Board. A Director with a direct or potentially conflicting interest in a matter shall recuse himself from deliberations and actions on the matter in which the conflict arises and shall abstain on any vote on the matter and not otherwise participate in a decision on the matter. Any disclosure of a potential conflict of interest by a Director shall be noted in the minutes of the Board meeting at which the direct interest is disclosed. Mere attendance at the meeting, without participating in discussion of the issue raising the potential conflict, shall not constitute participation.

(b) The Corporation may not make any loan to a Director, committee member or officer of the Corporation. A Member, Director, officer, or committee member of the Corporation may not lend money to, or otherwise transact business with, the Corporation except as otherwise provided by these Bylaws, the Certificate of Formation, and applicable law. A related party transacting business with the Corporation has the same rights and obligations relating to those matters as other persons transacting business with the Corporation, provided the related party nature of the transaction is known to the Board. The Corporation may not borrow money from, or otherwise transact business with, a Member, Director, officer, or committee member of the Corporation unless the transaction is described fully in a legally binding instrument, is in the Corporation's best interests, and is on terms no less favorable to the Corporation than could be obtained in an arms-length transaction. The Corporation may not borrow money from, or otherwise transact business with, a Member, Director, officer, or committee member of the Corporation without full disclosure of all relevant facts and without the Board's approval, not including the vote of any person having a personal interest in the transaction.

**Section 2. Prohibited Acts.** No Member, Director, officer, or committee member of the Corporation may do any of the below-listed prohibited acts. Engaging in these prohibited acts may lead to sanction, suspension, expulsion or termination after a hearing as described in these Bylaws. The prohibited acts include the following:

(a) Do any act in violation of these Bylaws.

(b) Do any act in violation of a binding obligation of the Corporation except with the Board’s prior approval.
(c) Do any act with the intention of harming the Corporation or any of its operations.

(d) Receive an improper personal benefit from the operation of the Corporation.

(e) Use the Corporation’s assets, directly or indirectly, for any purpose other than carrying on the Corporation’s business.

(f) Wrongfully transfer or dispose of Corporation property, including intangible property such as goodwill.

(g) Use the Corporation’s name (or any substantially similar name) or any trademark or trade name adopted by the Corporation, except on behalf of Corporation in the ordinary course of its business or as a reference to the Corporation or its region.

(h) Disclose any of Corporation’s or Members’ business practices, trade secrets, or any other confidential or proprietary information not generally known to the business community to any person not authorized to receive it.

Section 3. Loans and Guarantees. Neither participation in the activities of the Corporation nor any provision of these Bylaws or of the Certificate of Formation shall be deemed to constitute a pledge or loan of the credit of any Member for the benefit of the Corporation or a guarantee by any Member of any obligation of the Corporation.

ARTICLE XIV.
BOOKS AND RECORDS; AUDIT; FISCAL YEAR

Section 1. Access to Books and Records. All Members of the Corporation will have access to the books and records of the Corporation, including financial statements and budgets; however, the Board shall establish procedures by which a Member, upon written demand stating the purpose of the demand may examine and copy the books and records of the Corporation. If necessary to protect the confidential information of the Corporation, a Member requesting examination of any of the Corporation’s non-public books and records will be required to sign a confidentiality and non-disclosure agreement before viewing such information. The procedures shall include policies that provide reasonable protection against the unnecessary disclosure of information related to individual employees, including their compensation.

Section 2. Audit. At least annually, an audit of the financial statements of the Corporation shall be performed by the Auditor approved by the Board. The Auditor’s opinion and the audited financial statements will be made available to all Members as described in Article XIV, Section 1.

Section 3. Fiscal Year. The fiscal year of the Corporation shall be from January 1 through the following December 31, unless otherwise established by resolution of the Board.
ARTICLE I.
DEFINITIONS

Section 1. Definitions. The capitalized terms used in these Bylaws of Texas Reliability Entity, Inc. (the “Corporation” or “Texas RE”), shall have the meanings set forth below, or if not set forth below, shall have the meanings given them in the NERC Rules of Procedure.

(a) “Affiliate” means any entity controlling, controlled by or under common control with the entity under consideration, and includes any entity (i.e., any commercial enterprise) in any of the following relationships: (i) an entity that directly or indirectly owns or holds at least five percent of the voting securities of another entity, (ii) an entity in a chain of successive ownership of at least five percent of the voting securities of another entity, (iii) an entity which shares a common parent with or is under common influence or control with another entity or (iv) an entity that actually exercises substantial influence or control over the policies and actions of another entity. Evidence of influence or control shall include the possession, directly or indirectly, of the power to direct or cause the direction of the management and/or policies and procedures of another, whether that power is established through ownership or voting of at least five percent of the voting securities or by any other direct or indirect means. In cases where the level of control or influence is disputed, the Board shall have discretion to determine whether or not the entities are Affiliates of one another. Membership in Texas RE shall not create an affiliation with Texas RE.

(b) “Board” means the Board of Directors of the Corporation.

(c) “Bulk Power System” or “BPS” means facilities and control systems necessary for operating an interconnected electric energy transmission network (or any portion thereof) and facilities generating electric energy as needed to maintain transmission system reliability, but does not include facilities used in the local distribution of electricity.

(d) “Delegated Authority” means the authority delegated by NERC to the Corporation to propose and enforce NERC Reliability Standards and perform other reliability-related activities in the ERCOT region under the Delegation Agreement executed by NERC and the Corporation and approved by the Federal Energy Regulatory Commission, pursuant to Section 215 of the Federal Power Act (16 U.S.C. §824o).

(e) “Delegation Agreement” means the agreement between the Corporation and NERC and approved by FERC which describes the Delegated Authority and may be amended from time to time.

(f) “Electric Reliability Organization” or “ERO” means the organization that is certified by FERC pursuant to Section 39.3 of its regulations, and has received recognition by appropriate regulatory authorities in Canada and Mexico, as applicable, to establish and enforce Reliability Standards for the Bulk Power Systems of the respective countries and that has entered into a delegation agreement with the Corporation pursuant to which the Electric Reliability Organization delegates enforcement authority for Reliability Standards for the Bulk Power System in the ERCOT region. NERC was certified as the ERO on July 20, 2006.

(g) “ERCOT region” means the geographic area and associated transmission and distribution facilities that are not synchronously interconnected with electric utilities operating outside the jurisdiction of the Public Utility Commission of Texas.

(h) “FERC” means the Federal Energy Regulatory Commission.
(i) “Independent Director” means a person who is not (a) an officer or employee of the Corporation; (b) a NERC Registered Entity or Member or an officer, director, or employee of a Member of the Corporation; or (c) an officer, director, or employee of any company or entity that would reasonably be perceived as having a direct financial interest in the outcome of Board decisions or having a relationship that would interfere with the exercise of independent judgment in carrying out the responsibilities of a Director, as more specifically described in Article IV of these Bylaws.

(j) “Member” means a member of the Corporation pursuant to Article III of these Bylaws.

(k) “NERC” means North American Electric Reliability Corporation, the entity certified by FERC as the ERO on July 20, 2006.

(l) “NERC Rules of Procedure” means the Rules of Procedure that are adopted by NERC and approved by FERC.

(m) “PUCT” means the Public Utility Commission of Texas.

(n) “OPUC” means the Texas Office of Public Utility Counsel.

(o) “Originally Elected Independent Director” means a Director approved by the membership on June 2, 2010, in the first election of Texas Reliability Entity, Inc. Independent Directors.

(p) “Regional Entity” means an entity with a Delegation Agreement with NERC, as ERO, including the following organizations, in addition to Texas Reliability Entity: Florida Reliability Coordinating Council (FRCC), Midwest Reliability Organization (MRO), Northeast Power Coordinating Council (NPCC), ReliabilityFirst Corporation (RF), Southeastern Electric Reliability Council (SERC), Southwest Power Pool (SPP), and Western Electricity Coordinating Council (WECC).

(q) “Regional Reliability Standard” means a standard or variance for the ERCOT region that is proposed and approved in accordance with the Texas RE Standards Development Process, as set forth in Exhibit C to the Delegation Agreement, and either, (i) sets more stringent reliability requirements than a national Reliability Standard, or (ii) covers matters not covered by a national Reliability Standard.

(r) “Registered Entity” means an entity that is registered with NERC and listed on the NERC Compliance Registry (available at www.nerc.com).

(s) “Reliability Standard” means a requirement to provide for Reliable Operation of the Bulk-Power System, which is approved by NERC and FERC, pursuant to Section 215 of the Federal Power Act an all amendments thereto. This term includes requirements for the operation of existing Bulk-Power System facilities, including cybersecurity protection, and the design of planned additions or modifications to such facilities to the extent necessary to provide for Reliable Operation of the Bulk Power System.

(t) “Reliable Operation” means operating the elements of the Bulk Power System within equipment and electric system thermal, voltage, and stability limits so that instability, uncontrolled separation, or cascading failures of the Bulk Power System will not occur...
as a result of a sudden disturbance, including a cybersecurity incident, or unanticipated failure of system elements.

(u) “Sector” means a group of Members of the Corporation that are Bulk Power System owners, operators, or users, as defined in Article III, Section 4 of these Bylaws. Each Sector shall constitute a class of Members for purposes of Chapter 22 (Nonprofit Corporations) of the Texas Business Organizations Code.

ARTICLE II.
PURPOSE

Section 1. General Purpose. The purpose of the Corporation is to preserve and enhance reliability in the ERCOT region. In furtherance of this goal, the Corporation will:

(a) Perform Reliability Standards development, compliance monitoring, compliance enforcement, and other related activities as a Regional Entity, pursuant to 16 U.S.C. §824o, in accordance with the Corporation’s Delegation Agreement with NERC;

(b) Carry out other activities as set forth in the Delegation Agreement, the NERC Rules of Procedure, or as otherwise required or requested by NERC, in support of the Delegated Authority, including but not limited to organization registration and certification, reliability assessment and performance analysis, training and education, and situational awareness and infrastructure security; and

(c) Engage in any other lawful act or activity that is not in conflict with the Corporation’s duties as a Regional Entity and for which non-profit corporations may be organized under the Texas Business Organizations Code.

Section 2. Non-Profit Corporation. The Corporation is a Texas non-profit corporation.

Section 3. Geographic Area. The Corporation will perform its operations primarily within the ERCOT region.

ARTICLE III.
MEMBERSHIP

Section 1. Members. The Corporation is a membership corporation. Membership in the Corporation is voluntary and is open only to any entity that is a user, owner or operator of the ERCOT region Bulk Power System, registers with the Corporation as a Member, maintains its registration in accordance with this Article III, and complies with the other conditions and obligations of membership specified in these Bylaws. All Members must qualify and be registered in one of the Sectors defined in Article III, Section 4. Membership in the Corporation is not a condition to participating in the development or consideration of proposed Regional Standards.

Section 2. Registration as a Member. Any entity that is eligible to be a Member of the Corporation in accordance with Article III, Section 1 may become a Member by completing and submitting to the Corporation a membership registration on a form prescribed by the Corporation. The Member shall designate one representative and an alternative representative with authority to receive notices, cast votes, and execute waivers and consents on behalf of the Member. The Corporate Secretary shall maintain a current roster of the Members of the
Corporation including each Member’s designated representative and alternative representative. All Members shall be required to renew or reaffirm their registrations annually. The Corporate Secretary may remove any Member from the roster that has not submitted a registration renewal or reaffirmation by a date established by the Corporation.

Section 3. Obligations and Conditions of Membership.

(a) Members must agree to promote, support, and comply with Reliability Standards, and assist the Corporation in its compliance with the terms and provisions of the Corporation’s Delegation Agreement with NERC. Each Member shall agree, in writing, to accept the responsibility to comply with policies of NERC and the Corporation as set forth in their respective certificates of formation, bylaws, rules of procedure, and Reliability Standards, as applicable, as from time to time adopted, approved, or amended.

(b) As an additional condition of membership in the Corporation, each Member shall be required to execute an agreement with the Corporation, in a form to be specified by the Corporation, that such entity will hold all Directors, officers, employees, and agents of the Corporation, as well as volunteers participating in good faith in the activities of the Corporation, harmless for any injury or damage caused by any act or omission of any director, officer, employee, agent, or volunteer in the course of performance of his or her duties on behalf of the Corporation, other than for willful acts of misconduct.

(c) Consistent with applicable laws and regulations, Members must share nonproprietary information at the Corporation’s request as necessary for the furtherance of the Corporation’s activities and consistent with NERC, PUCT, or any other applicable rules relating to confidentiality.

Section 4. Membership Sectors. Each Member shall elect to be assigned to one of the following membership Sectors:

(a) **System Coordination and Planning**: An entity that is registered with NERC as a Reliability Coordinator (RC), Balancing Authority (BA), Planning Authority (PA), or Resource Planner (RP), or Interchange Authority (IA).

(b) **Transmission and Distribution**: An entity that is registered with NERC as a Transmission Owner (TO), Transmission Planner (TP), Transmission Service Provider (TSP), Distribution Provider (DP), and/or Transmission Operator (TOP) and is not a Cooperative or Municipal Utility.

(c) **Cooperative Utility**: An entity that is (a) a corporation organized under Chapter 161 of the Texas Utilities Code or a predecessor statute to Chapter 161 and operating under that chapter; or (b) a corporation organized as an electric cooperative in a state other than Texas that has obtained a certificate of authority to conduct affairs in the State of Texas; or (c) a cooperative association organized under Tex. Rev. Civ. Stat. 1396-50.01 or a predecessor to that statute and operating under that statute and is registered with NERC for at least one reliability function.

(d) **Municipal Utility**: A municipally owned utility as defined in Public Utility Regulatory Act, Tex. Util. Code §11.003 and is registered with NERC for at least one reliability function.
(e) **Generation**: An entity that is registered with NERC as a Generator Owner (GO) or Generator Operator (GOP).

(f) **Load-Serving and Marketing**: An entity that secures wholesale transmission service or is engaged in the activity of buying and selling of wholesale electric power in the ERCOT region on a physical or financial basis, or qualifies under any newly defined NERC reliability function for demand response.

**Section 5. Participation.**

(a) There is only one level of Membership, and no company or entity may simultaneously hold more than one Membership.

(b) Members must qualify in and join a Sector.

(c) A Member that is eligible for more than one Sector may join only one Sector and it must be the most appropriate Sector for its business. Any disputes regarding appropriateness of a Member’s Sector will be decided by a majority vote of the Board.

(d) A company or entity that is an Affiliate of a Member may hold a separate membership in a different Sector if the companies are separate legal entities.

(e) A Member must continue to vote in the same Sector for a minimum of the remainder of the membership year in which it becomes a Member or until it is no longer eligible to remain in such Sector, and it must give notice to the Corporate Secretary when it elects or is required to change Sectors.

(f) The Corporate Secretary may review the Sector qualification of any Member and upon a determination that a Member does not qualify for membership in a particular Sector, may require the Member to change Sectors or may terminate their membership.

(g) A Member that is no longer eligible or that is not in good standing may not vote on any matters that require membership.

**Section 6. Membership Fees.** There is no Membership Fee to join the Corporation.

**Section 7. Term of Membership.** Membership in the Corporation must be renewed or reaffirmed on an annual basis and will only be retained as long as a Member meets its respective qualifications, obligations, and conditions of membership as set forth in these Bylaws.

**Section 8. Disciplinary Action.** A Member or Member representative may be sanctioned, suspended, or expelled pursuant to a procedure that is fair and reasonable and is carried out in good faith. The Board will establish a procedure to sanction, suspend, or expel a Member that includes notice to the Member and exercise of appropriate due process procedures and allows for a determination by the Board in its sole discretion that in its judgment the Member has violated its obligations and responsibilities to the Corporation.

**Section 9. Resignation.** Any other provision of these Bylaws notwithstanding, any Member may withdraw from participation in the activities of the Corporation at any time upon written notice to the Secretary of the Corporation, whereupon it shall cease to be a Member, and
its representatives shall cease to be entitled or obligated to participate in the activities of the Board or any activities requiring membership.

Section 10. Reinstatement. A former Member, except a Member subject to Disciplinary Action under Section 8, may submit a membership application form to rejoin the Corporation as a Member. A Member disciplined under Section 8 may submit a written request for reinstatement of Membership. The request for reinstatement will be considered by the Board, and will be granted or denied within the sole discretion of the Board.

ARTICLE IV.
BOARD OF DIRECTORS

Section 1. Board of Directors. The business and affairs of the Corporation shall be managed by the Board. The Board shall consist of (i) four (4) Independent Directors who are nominated and elected in accordance with the requirements and procedures specified in this Article IV (the “Independent Directors”); (ii) the Chairman of the PUCT or another PUCT Commissioner designated by the Chairman, as an ex officio non-voting member; (iii) Texas Public Counsel, from OPUC (or another employee of OPUC designated by Texas Public Counsel), as an ex officio non-voting member, representing the interests of residential and small commercial electricity consumers; (iv) the CEO of the Corporation as a voting member (the “Management Director”); (v) the chair of the Member Representatives Committee as a voting member; and (vi) the vice chair of the Member Representatives Committee as a voting member. The Directors who are the chair and vice chair of the Member Representatives Committee will be collectively referred to herein as “Affiliated Directors.” Each Director, including the Affiliated Directors and excluding the non-voting members of the Board, shall have one (1) vote on any matter brought before the Board for a vote. All Directors are expected to serve the public interest and to represent the reliability concerns of the entire ERCOT region Bulk Power System.

Section 2. Independent Directors. The Independent Directors shall be elected, shall have the qualifications specified, and shall serve in the manner provided in this Section.

(a) Qualifications:

(1) Experience in one or more of these fields: senior corporate leadership; professional disciplines of finance, accounting, engineering, bulk power systems, or law; regulation of utilities; and/or risk management.

(2) Independence of any NERC Registered Entity. Requirements of independence include but are not limited to the following:

(i) Independent Directors and the spouse, mother, father, sibling, or dependent, and any spouse of mother, father, or sibling and including any step and adoptive parents, siblings or children, and household members of Independent Directors and their spouses shall not have current or recent status (within the last two years) as a director, officer, or employee of an ERCOT region NERC Registered Entity.

(ii) Independent Directors and immediate family (any spouse or dependent) and household members of Independent Directors shall not have current status as a director, officer, or employee of a non-ERCOT region NERC Registered Entity.
(iii) Independent Directors and immediate family and household members of Independent Directors shall not have direct business relationships, other than retail customer relationships, with any NERC Registered Entity.

(iv) Independent Directors and immediate family and household members of Independent Directors shall not own stocks or bonds of NERC Registered Entities or their affiliates. To the extent that an Independent Director or his or her spouse, dependent child, or any other household member owns stocks or bonds of NERC Registered Entities, these must be divested or placed in a blind trust prior to being seated on the Board. Ownership in broadly diversified mutual funds or similar funds, which may include stocks or bonds of NERC Registered Entities or their affiliates, is not prohibited.

(v) Independent Directors shall not have any relationship that would interfere with the exercise of independent judgment in carrying out the responsibilities of a Board member, including the Delegated Authority.

(vi) Other criteria as approved by the Board.

(b) Term. The term for Independent Directors shall be staggered three year terms. An Independent Director may be elected for up to three consecutive terms. For the Originally Elected Independent Directors, two positions will have three-year terms, one position will have a two-year term, and one position will have a one-year term, and these terms shall not be counted for purposes of term limits. The term for the Affiliated Directors who are chair and vice chair of the Member Representatives Committee shall be two years, and the terms of the ex officio Directors will not expire. If an Independent Director is elected to fill an unexpired term in the event of a vacancy, that term shall not be counted for purposes of term limits.

(c) Selection.

(1) The Board shall appoint, on an annual basis, or more frequently if needed in the event of a special election pursuant to this subsection, a nominating committee (the “Nominating Committee”) to recommend candidates (i) to succeed the Independent Directors whose terms expire during the current year; and (ii) to serve the remainder of the term of any Independent Director who ceased to serve as a Director subsequent to the last annual election of Directors; (iii) to serve as the Chair and Vice Chair on an annual basis; and (iv) to serve as CEO in the event of a vacancy. The Nominating Committee shall consist of two (2) Independent Directors whose terms do not expire during the current year and are not seeking re-election and one (1) Affiliated Director. The PUCT Chairman (or the PUCT Commissioner designated by the Chairman) may choose to participate on the Nominating Committee. The Board Chair shall appoint the Chair of the Nominating Committee. The Nominating Committee may retain an executive search firm to locate and present candidates to serve as Independent Directors with the required qualifications, as set forth in Article IV, Section 2(a) or to locate and present candidates to serve as CEO. Meetings of the Nominating Committee are not required to be publicly posted.

(2) The Nominating Committee shall select and nominate, by at least a two-thirds majority, qualified candidate(s) to serve as Independent Directors to present to the Membership for its approval. The Nominating Committee shall strive to ensure that the Board as a whole reflects expertise in the areas of technical electric operations and reliability, legal, senior corporate leadership, financial, risk
management, and regulatory matters, and familiarity with regional system operation
issues in the ERCOT region.

(3) The Membership shall vote by Sector as described in Article V in favor or against the proposed Independent Director(s). A proposed Independent Director who is approved by a majority of the Sectors shall become an Independent Director.

(3)(4) The Nominating Committee shall select and recommend to the Board, by at least a two-thirds majority, a qualified candidate to serve as CEO. The Directors may choose to participate in interviewing CEO candidates.

(d) Director Voting Weights. All voting Directors shall have a single vote each.

e) Alternates and Proxies. Independent Directors may designate another Independent Director as a proxy if unable to attend a Board meeting. Ex officio Directors may designate a selected proxy or an alternate representative who may attend meetings in the absence of such Director. The chair and vice chair of the Member Representatives Committee may designate each other or may designate an Independent Director as their proxy if unable to attend a Board meeting.

Section 3. Appointment of Management Director. The president and chief executive officer (CEO) of the Corporation shall serve as the Management Director of the Corporation, effective as of the date of his or her appointment by the Board as CEO of the Corporation in accordance with these Bylaws, to serve until such time that he or she ceases to hold the position of CEO. No action of the Members of the Corporation shall be required in connection with the appointment of the CEO as the Management Director of the Corporation.

Section 4. Chair and Vice Chair. Annually, the Board shall elect from the Board’s membership, by resolution of the Board, a Chair and a Vice Chair. The Chair and Vice Chair shall each be one of the Independent Directors.

Section 5. Vacancies and Removal.

(a) Should any vacancy on the Board arise from the death, resignation, retirement, disqualification, or removal from office of any Director, or from any other cause, such vacancy shall be filled as follows:

(1) For an Independent Director, by the election of a new Independent Director at the next annual election of Directors to fill the remainder, if any, of the term of the departed Independent Director; provided, that the Board by resolution may in its discretion call a special election to fill any such vacancy for the remainder, if any, of the term of the departed Independent Director.

(2) For the Management Director, by the appointment of a new CEO or interim CEO to fill the vacancy.

(3) For an ex officio Director, by the appointment of a new PUCT Chair or Texas Public Counsel by whomever had the right to appoint such Director.

(4) For an Affiliated Director, by the election of a new chair or vice chair, as applicable, by the Member Representatives Committee.
(b) A Director may be removed with or without cause at any time by whomever had the right to appoint such Director (for ex officio Directors), or for the elected Independent Directors, by an affirmative vote of sixty percent (60%) of the Members. In addition, the Board may remove any voting Director for cause, upon at least seventy-five percent (75%) affirmative votes of the eligible, remaining voting Directors. The right to elect Directors may not be assigned, sold, pledged or transferred in any manner.

Section 6. Committees of the Board. The Board shall by resolution create and appoint all committees of the Board as the Board deems necessary to perform its responsibilities. All committees of the Board shall have such duties as are prescribed and delegated by the Board. Committees to which any of the authority of the Board to manage the Corporation is delegated must have at least two Directors, and a majority of the members of the committee must be Directors.

ARTICLE V.
MEETINGS OF MEMBERS OF THE CORPORATION

Section 1. Annual and Other Meetings of Members.

(a) An annual meeting of the Members to elect Directors, announce election results from electronic elections, and conduct such other business as may come before the meeting, shall be held in December each year. The failure to hold an annual meeting in accordance with these bylaws shall not affect the validity of a corporate action.

(b) Meetings of Members of the Corporation may be called for any purpose or purposes by resolution of the Board, by the chair of the Board, the CEO or the Corporate Secretary, or by a number of Members constituting at least ten (10) percent of all Members on the roster of Members maintained by the Corporate Secretary, which number shall include Members in at least three (3) of the Sectors. Meetings of Members shall be held at the principal office of the Corporation or at such other place fixed by the Board as shall be specified in the notice of meeting. Meetings shall be called upon written notice of the time, date, place, and purposes of the meeting given to all Members on the roster of Members maintained by the Corporate Secretary not less than ten (10) nor more than sixty (60) days prior to the date of the meeting. Only Members in good standing with the Corporation, as determined by the Board, have the right to vote at any meeting of the Members. Further, if at any point a Member no longer meets the qualifications for the Sector of which it is a member, the entity may immediately elect to become a member in any Sector for which it does qualify.

Section 2. Quorum and Voting Requirements for Meetings of Members.

(a) At any meeting of the Members of the Corporation, attendance in person or by proxy by a majority of the Members in each of at least two-thirds of the Sectors on the roster of Members maintained by the Corporate Secretary shall constitute a quorum.

(b) Except as otherwise expressly provided in the Corporation's Certificate of Formation, these Bylaws, or applicable law, Members shall vote by Sector and each Sector shall have one vote.

(c) To the extent practicable, membership votes will be conducted electronically and prior to annual membership meetings.
(d) Except as otherwise expressly provided in the Corporation’s Certificate of Formation, these Bylaws or applicable law, actions by the Members of the Corporation shall be approved upon receipt of the affirmative vote of a majority of the Sectors of the Corporation at (1) a meeting at which a quorum is present, in person or by proxy, or (2) an electronic vote which has participation by a quorum. Each Sector’s vote shall be determined by the affirmative vote of a majority of the members of the Sector voting at the meeting or in the electronic election.

Section 3. Waivers of Notice of Meetings of Members and Member Meeting Adjournments. Notice of a meeting of Members need not be given to any Member who waives notice, either electronically or in writing, in person or by proxy, whether before, during, or after the meeting. The attendance of any Member at a meeting, in person or by proxy, without protesting prior to the conclusion of the meeting the lack of proper notice of such meeting, shall constitute a waiver of notice of the meeting by such Member. When any meeting of Members is adjourned to another time or place, it shall not be necessary to give notice of the adjourned meeting if the time and place to which the meeting is adjourned are announced at the meeting at which the adjournment is taken, and if at the adjourned meeting only such business is transacted as might have been transacted at the original meeting.

Section 4. Action Without a Meeting of Members. Any action, required or permitted to be taken at a meeting of Members, may be taken without a meeting if the proposed action is posted to all Members (via direct email or email to an email distribution list to which Members may subscribe and by posting on the Corporation website) and consented to in writing by the minimum number of Members that would be required to approve the action at a meeting of the Members at which all Members were present. The voting in such a circumstance shall be performed in writing, including via email or other electronic means. The Members shall receive written notice of the results within ten (10) days of the action vote, and all written responses of the Members shall be filed with the Corporate records. The results of such voting will be posted on the Corporation’s website.

Section 5. Meetings of the Members to be Open. Notice to the public of the dates, places, and times of meetings of the Members, and all non-confidential material provided to the Members, shall be posted on the Corporation’s website at approximately the same time that notice is given to the Members. Meetings of the Members shall be open to the public, subject to reasonable limitations due to the availability and size of meeting facilities; provided, that the meeting may be held in or adjourned to closed session to discuss matters of a confidential nature, including but not limited to compliance and enforcement matters, personnel matters, litigation, or commercially sensitive or critical infrastructure information of the Corporation or any other entity. The results of any action taken without a meeting, as described above, will be posted on the Corporation’s website.

ARTICLE VI.
MEETINGS OF THE BOARD OF DIRECTORS

Section 1. Regular Meetings of the Board. Regular meetings of the Board shall be held at least quarterly. By resolution adopted at any meeting of the Board, the Board may provide for additional regular meetings that may be held as needed.

Section 2. Special Meetings of the Board. Special meetings of the Board for any purpose or purposes may be called at any time by the chair or by any two Directors. Such meetings may be held upon notice given to all Directors not less than three (3) days prior to the date of the meeting. Such notice shall specify the time, date, place, and purpose or purposes of
the meeting and may be given by telephone, email or other electronic media, or by express delivery.

Section 3. Quorum and Voting Requirements for Meetings of the Board. Unless otherwise expressly provided in the Corporation’s Certificate of Formation, these Bylaws or applicable law, (i) the quorum necessary for the transaction of business at meetings of the Board shall be a majority of the voting Directors in person or by proxy and at least three Independent Directors, and (ii) actions by the Board shall be deemed approved upon receipt of the affirmative vote of a majority of the Directors present and voting in person (by means of any communications system by which all persons participating in the meeting are able to hear each other) or by proxy at a meeting at which a quorum is present but in no case less than four votes.

Section 4. Meetings of the Board to be Open. Notice to the public of the dates, places, and times of meetings of the Board, and all non-confidential material provided to the Board, shall be posted on the Corporation’s website at approximately the same time that notice or such material is given to the Directors and at least five (5) business days prior to the scheduled meeting. Meetings of the Board shall be open to the public, subject to reasonable limitations due to the availability and size of meeting facilities; provided, that the Board may meet in or adjourn to closed session to discuss matters of a confidential nature, including but not limited to compliance and enforcement matters, personnel matters, litigation, or commercially sensitive or critical infrastructure information of the Corporation or any other entity. Any or all of the Directors or members of a Board committee, may participate in a meeting of the Board, or a meeting of a committee, in person or by proxy, by means of any communications system by which all persons participating in the meeting are able to hear each other.

Section 5. Waivers of Notice of Board Meetings and Board Meeting Adjournments. Notice of a board meeting need not be given to any Director who signs, or sends an email confirming a waiver of notice, in person or by proxy, whether before, during, or after the meeting, or who attends the meeting without protesting the lack of notice of such meeting prior to the conclusion of the meeting. Notice of an adjourned board meeting need not be given if the time and place to which the meeting is adjourned are announced at the meeting at which the adjournment is taken and if the period of adjournment does not exceed ten (10) days.

Section 6. Action Without a Meeting. Any action required or permitted to be taken at a meeting of the Board, or of any committee thereof, may be taken by the Board or by the committee without a meeting if the action is consented to in writing by the number of Directors or members of the committee, as the case may be, entitled to vote on the action that would be required to approve the action at a meeting of the Board or committee with all members of the Board or committee present. The call for action without a meeting of the Board may be initiated by the chair or by any two voting Directors. Notice of the proposed call for action without a meeting, and all non-confidential material provided to the Board in connection with the call for action without a meeting, shall be posted on the Corporation’s website and shall be sent via email to an email distribution list to which Members and the public may subscribe at approximately the same time notice of the call for action without a meeting or such material is provided to the Board. The call for action without a meeting of a committee of the Board may be initiated by the chair of the committee or by any two members of the committee. The Directors or members of the committee shall receive written notice of the results of such action within seven (7) days of the action vote. All written responses of the Directors shall be filed with the minutes of the Corporation, and all written responses of members of a committee shall be filed with the minutes of such committee.
Section 7. Emergency Meetings. The Board may meet on urgent matters with not less than two (2) hours’ public notice, as necessary or appropriate for emergency conditions threatening health or safety or a reasonably unforeseen situation.

ARTICLE VII.
OFFICERS

Section 1. Selection of Officers. The Board shall elect a CEO and shall ratify the selection of the officers of the Corporation (collectively, the “Officers”). The Management Director shall not participate in votes electing or ratifying Officers. The Corporation shall maintain a list of current Officers ratified by the Board. The duties and authority of the Officers shall be determined from time to time by the Board. Subject to any such determination, the Officers shall have the following duties and authority:

Section 2. Chief Executive Officer (“CEO”). The CEO shall be the chief executive officer of the Corporation. He or she shall be responsible for the day-to-day ongoing activities of the Corporation and shall have such other duties as may be delegated or assigned to him or her by the chair. The CEO may enter into and execute in the name of the Corporation contracts or other instruments not in the regular course of business that are authorized, either generally or specifically, by the Board.

Section 3. Corporate Secretary. The Secretary shall maintain the roster of Members of the Corporation, shall cause notices of all meetings to be served as prescribed in these Bylaws, shall keep or cause to be kept the minutes of all meetings of the Members and the Board, and shall have charge of the seal of the Corporation. The Secretary shall perform such other duties and possess such other powers as are incident to his or her office or as shall be assigned to him or her by the CEO. The CEO may select an Assistant Corporate Secretary at his or her discretion. The Assistant Corporate Secretary is not an Officer of the Corporation.

Section 4. Chief Financial Officer. A Chief Financial Officer shall have custody of the funds and securities of the Corporation, shall keep or cause to be kept regular books of account for the Corporation and shall have the duties normally assigned to a treasurer of a corporation. The Chief Financial officer shall perform such other duties and possess such other powers as are incident to his or her office or as shall be assigned to him or her by the CEO.

Section 5. Other Officers. The CEO may select such other Officers as he or she deems appropriate, subject to ratification by the Board. Any such Officer shall perform such other duties and possess such powers as are incident to his or her office or as shall be assigned to him or her by the CEO.

Article VIII.
RELIABILITY STANDARDS COMMITTEE

Section 1. Requirement. The Corporation shall have a Reliability Standards Committee, which shall operate in accordance with the Standards Development Process as set forth in Exhibit C to the Delegation Agreement with NERC and approved by FERC. The chair and vice chair of the Standards Committee must be accepted or approved by the Board, in accordance with said Exhibit C.

Article IX.
Section 1. Purpose of Member Representatives Committee. The Corporation shall have a “Member Representatives Committee” that shall provide advice and recommendations to the Board with respect to: annual budgets, business plans and funding mechanisms of the Corporation; the development Regional Reliability Standards and Regional Variances in accordance with Texas RE’s process; other matters relevant to reliability of the ERCOT Bulk Power System; and other matters pertinent to the purpose and operations of the Corporation. The Member Representatives Committee shall provide its advice and recommendation to the Board through its chair and the vice chair, who also serve as the Affiliated Directors on the Board. The Member Representatives Committee may create subcommittees, task forces, or working groups (“subcommittees”) as it deems appropriate to study or discuss selected technical or compliance matters, provide a forum for the review and discussion of current and proposed Reliability Standards, and to make recommendations to the Board as requested or required by the Board or as deemed appropriate to its purpose by the Member Representatives Committee. Because it is elected by the Members of the Corporation and not appointed by the Board, the Member Representatives Committee shall not be a standing committee of the Board of Directors of the Corporation, but is authorized to provide advice and recommendations directly to the Board, through its elected chair and vice chair.

Section 2. Composition of the Member Representatives Committee. The Member Representatives Committee shall consist of two representatives from each Sector to serve two-year terms and will select a chair and vice chair for the Member Representatives Committee to serve two-year terms. The representatives of each Sector shall be officers, employees, or directors of Members in that Sector (or the Member’s parent, subsidiary, or other Affiliate); provided however, except for a Sector that has only one Member, only one officer, employee, or director of a Member in a Sector (or the Member’s parent, subsidiary, or other Affiliate) may be a representative from that Sector. The Board may by resolution create additional non-voting positions on the Member Representatives Committee on its own initiative or at the written request of any group of Members of the Corporation that believes its interests are not adequately represented on the Member Representatives Committee. There shall be no limit on the number of terms that an officer, employee, or director of a Member (or the Member’s parent, subsidiary, or other Affiliate), may serve on the Member Representatives Committee.

Section 3. Election of Representatives of the Member Representatives Committee. Unless a Sector adopts an alternative election procedure, the election of representatives from each Sector to the Member Representatives Committee, and any election to fill a vacancy, shall be conducted in accordance with the following process, which shall be administered by the Secretary of the Corporation.

(a) During the period beginning no more than ninety (90) days and ending no less than fifteen (15) days prior to an annual meeting, or beginning no more than forty-five (45) days and ending no less than fifteen (15) days prior to a special election to fill a vacancy on the Member Representatives Committee, nominations may be submitted for candidates for election to the Member Representatives Committee. A nominee for election as a Sector representative must be an officer, employee, or director of a Member in that Sector (or the Member’s parent, subsidiary, or other Affiliate). No more than one nominee who is an officer, employee, or director of a Member (or the Member’s parent, subsidiary, or other Affiliate) may stand for election in any single Sector; if more than one officer, employee, or director of a Member (or the Member’s parent, subsidiary, or other Affiliate) is nominated for election from a Sector, the Member shall designate which such nominee shall stand for election. The election of representatives shall be conducted over a period of ten (10) days using an electronic process approved by the Corporate Secretary.
(b) Each Member in a Sector shall have one vote for each Representative to be elected from the Sector in that election and may cast no more than one vote for any nominee. The nominee receiving the highest number of votes in each Sector shall be elected to one Representative position to be filled from that Sector and the nominee receiving the second highest number of votes shall be elected as the second Representative position for that Sector. To be elected on the first ballot, a nominee must receive a number of votes equal to a simple majority of the Members in the Sector casting votes in the election. If no nominee in a Sector receives a simple majority of votes cast in the first ballot, a second ballot shall be conducted which shall be limited to the number of candidates receiving the three (3) highest vote totals on the first ballot. The nominees receiving the two highest totals of votes on the second ballot shall be elected to the Representative positions for the Sector.

(c) A Sector may adopt an alternative procedure to the foregoing to nominate and elect its Representatives to the Member Representatives Committee if the alternative procedure is approved by vote of at least two-thirds of the Members in the Sector, provided, however that any alternative procedure may be reviewed and disapproved by the Board.

(d) A Sector may elect an Alternate to serve in place and at the convenience of the Sector’s Member Representatives Committee Representative(s) in the event a Member Representatives Committee Representative cannot attend a Member Representatives Committee meeting.

Section 4. Chair and Vice Chair of the Member Representatives Committee. After the selection of its Representatives, the Member Representatives Committee shall select a chair and vice chair from among its voting Representatives by majority vote to serve during the upcoming two-year term and be the Affiliated Directors on the Board. The selected chair and vice chair may not be representatives of the same Sector and may not concurrently serve on the Board of ERCOT ISO. The Board shall be notified of the selection of the chair and vice chair, but the selection will not be subject to approval of the Board. The chair is responsible for ensuring that minutes of the meetings are properly maintained and made available to the public, but the chair may delegate this responsibility to the vice chair or to another Representative of the Member Representatives Committee who may be designated as secretary of the Member Representatives Committee.

Section 5. Vacancies on the Member Representatives Committee. In the event that any Representative of the Member Representatives Committee ceases to serve as a Representative of the Member Representatives Committee as a result of his or her death, resignation, retirement, disqualification, removal, or other cause, the Members in the Sector of which such Representative was a representative shall elect, as soon thereafter as reasonably practicable, and in accordance with the procedures in this Article VIIIIX, a new Representative to replace the Representative of the Member Representatives Committee who ceased to serve. For those Sectors that have elected an Alternate, the Alternate will fill a vacancy left by the Sector’s Member Representative until a new Sector Member Representative is elected by the Sector.

Section 6. Meetings of the Member Representatives Committee. The Member Representatives Committee will plan and hold quarterly meetings, at a time and place determined by the Member Representatives Committee, normally shortly before the regular meetings of the Board, and posted on the Corporation’s website. Except for closed session meetings specifically allowed by this Section, all meetings shall be open to the public. The Member Representatives Committee shall adopt such procedural rules as are needed to operate in accordance with its purpose and will include procedures for coordinating with employees of the Corporation who provide administrative support, as set forth in subsection 6(c), below.
(a) Notice to the public of the dates, places, and times of meetings of the Member Representatives Committee and any subcommittees thereof, and all non-confidential material provided to the Representatives on the Member Representatives Committee or any subcommittees thereof, shall be posted on the Corporation’s website at approximately the same time that notice or such material is given to the Member Representatives Committee, which will normally be at least five (5) business days prior to the scheduled meeting. Meetings of the Member Representatives Committee and subcommittees shall be open to the public, subject to reasonable limitations due to the availability and size of meeting facilities; provided, that the Member Representatives Committee and subcommittees may meet in or adjourn to closed session to discuss matters of a confidential nature, including but not limited to confidential planning information, critical infrastructure information, or commercially sensitive information of the Corporation or any other entity. Any or all Representatives of, and any other participants in, the Member Representatives Committee may participate in a meeting of the Member Representatives Committee or subcommittee may be accomplished by means of a communications system by which all persons participating in the meeting are able to hear each other.

(b) Special meetings may be called for any purpose or purposes by the chair of the Member Representatives Committee or by any three (3) Representatives of the Member Representatives Committee, which number shall include representatives from at least three Sectors, and require notice given to all Representatives of the Member Representatives Committee not less than seven (7) days prior to the date of the meeting. Such notice shall specify the time, date, place, and purpose or purposes of the meeting and may be given by telephone, facsimile, or other electronic media, or by express delivery.

(c) The Member Representatives Committee shall effectively coordinate with the employees of the Corporation and adopt procedural rules for the voting for Representatives, scheduling of meetings, and public posting of required meeting information and minutes. The chair or vice chair of the Member Representatives Committee shall provide all meeting agendas, material, minutes and other information required or desired to be posted on the Corporation’s website to appropriate Corporation employees at least one business day prior to the time such information should be posted.

Section 7. Action Without a Meeting of Members. Any action, required or permitted to be taken at a meeting of the Member Representatives Committee, may be taken without a meeting if the proposed action is posted to all Committee Members via direct email and consented to in writing by a majority of the Representatives. The voting in such a circumstance shall be performed in writing, including via email or other electronic means. The Representatives shall receive written notice of the results within ten (10) days of the action vote, and all written responses of the Representatives shall be retained as a corporate record. The results of such voting will be reported at the next in-person Member Representatives Committee meeting.

Section 8. Waivers of Notice of Meetings of the Member Representative Committee and Meeting Adjournments. Notice of a meeting of the Member Representatives Committee need not be given to any member of the Member Representatives Committee who waives notice electronically or otherwise in writing, in person or by proxy, whether before or after the meeting, or who attends the meeting without protesting, prior to the conclusion of the meeting, the lack of notice of such meeting. Notice of an adjourned meeting of the Member Representatives Committee need not be given if the time and place to which the meeting is adjourned are announced at the meeting at which the adjournment is taken and if the period of adjournment does not exceed ten (10) days.
Section 9. Quorums and Voting for Meetings of the Member Representatives Committee. The quorum necessary for the transaction of business at meetings of the Member Representatives Committee shall be the presence, in person or by proxy, of two-thirds of the voting Representatives on the Member Representatives Committee entitled to attend. Each voting member of the Member Representatives Committee shall have one (1) vote on any matter coming before the Member Representatives Committee that requires a vote. Except as otherwise expressly provided in the Corporation's Certificate of Formation, these Bylaws or applicable law, actions by members of the Member Representatives Committee shall be approved upon receipt of the affirmative vote of a majority of the voting members of the Member Representatives Committee present (by means of any communications system by which all persons participating in the meeting are able to hear each other) and voting at any meeting at which a quorum is present.

Section 10. Alternates and Proxies. Member Representatives may designate another Member Representative or an employee of the Member Representative’s organization (or the Member’s parent, subsidiary, or other Affiliate) as a proxy if both the Member Representative and the Sector Alternate are unable to attend a Member Representatives Committee meeting. A member of the Member Representatives Committee may give a proxy only to a person who is an officer, employee, or director of a Member, registered in the same Sector (or the Member’s parent, subsidiary, or other Affiliate).

Section 11. Other Procedures of the Member Representatives Committee. Except as to any matter as to which the procedure to be followed by the Member Representatives Committee is expressly set forth in these Bylaws, the Member Representatives Committee may adopt such additional procedures, not inconsistent with these Bylaws, as it deems appropriate, subject to review and disapproval by the Board.

Article IX. OTHER COMMITTEES AND SUBCOMMITTEES

Section 1. Committees of the Corporation. In addition to those committees specified by these Bylaws, to which the Board shall appoint members in accordance with the requirements of these Bylaws, the Board may by resolution create standing committees of the Corporation; and may in addition by resolution appoint the members of such committees, subcommittees, task forces and Sector-specific forums as the Board deems necessary or desirable to carry out the purposes of the Corporation. The Board shall appoint members to such standing committees and other committees of the Corporation that are representative of Members, other interested parties, and the public, that provide for balanced decision-making and that include persons with sufficient technical knowledge and experience. All committees, subcommittees, task forces and Sector-specific forums shall have such scope and duties, not inconsistent with law, as are specified in these Bylaws and the Rules of Procedure of the Corporation or otherwise determined by the Board.

Article X. BUDGETS AND FUNDING

Section 1. Compensation of the Board and Member Representatives Committee.

(a) The Board shall have a Director compensation committee (the "Director Compensation Committee") to have the right to evaluate and fix from time to time, by simple majority vote, resolution adopted by a majority of the Directors including a majority of the
Independent Directors then serving as Directors, the amount of the annual retainer fee or other compensation to be paid to the Independent Directors for their services to the Corporation, including any fees to be paid for each meeting of the Board or any Board committee attended by an Independent Director. The Board Director Compensation Committee will evaluate the fee or other compensation at least every three years annually, to ensure that Director compensation is appropriate. The Director Compensation Committee shall consist of two (2) Independent Directors that are not currently serving as Board Chair and Vice Chair, two (2) Affiliated Directors, and the CEO. The Board Chair shall appoint an Independent Director as the Chair of the Director Compensation Committee. Meetings of the Director Compensation Committee are not required to be publicly posted.

(b) No compensation shall be paid to any Management Director, Affiliated Director, or ex officio Director for his or her services on the Board, other than the compensation paid to the Management Director for services as CEO of the Corporation. No compensation shall be paid by the Corporation to any member of the Member Representatives Committee for his or her services on the Member Representatives Committee.

Section 1. (c) Independent Directors shall be entitled to be reimbursed their reasonable out-of-pocket expenditures for attending meetings and conducting the business of the Corporation.

Section 2. Preparation and Adoption of Annual Budget, Business Plan, and Funding Mechanism. The Board shall require the CEO to prepare for Board approval an annual business plan and budget for the administrative and other expenses of the Corporation, including the expenditures for the fiscal year for any material special projects undertaken by the Corporation and reasonable and proper reserves and provisions for contingencies, in accordance with all NERC and FERC requirements. The annual business plan, budget and funding mechanism of the Corporation shall be for a fiscal year commencing on January 1 and ending on December 31. Each annual business plan, budget, and funding mechanism shall be approved by the Board at a regular meeting or a special meeting of the Board duly called for that purpose. The Board shall approve each annual business plan, budget, and funding mechanism at a time that allows for timely submittal of the approved annual business plan, budget, and funding mechanism to the applicable regulatory authorities.

Section 3. Comments During Preparation of Annual Business Plan and Budget. In preparing the annual business plan and budget, the Board shall require that the CEO post a draft business plan and budget for review and comment by the Members of the Corporation, the Member Representatives Committee, and the standing committees of the Corporation for at least five (5) business days prior to the date of the meeting of the Board at which the annual business plan and budget is to be adopted.

Section 4. Modified or Supplemental Budgets. During the course of a fiscal year, the Board may modify any approved budget or develop and approve a supplemental budget if determined by the Board to be necessary due to such factors as a shortfall in revenues of the Corporation from projected levels, incurred or anticipated expenditures, duties, or new projects not provided for in the annual budget, or such other factors as in the judgment of the Board warrant modification of the budget for the fiscal year or development of a supplemental budget. In preparing a modified or supplemental budget, the Board shall follow the provisions of this Article XI, Section 4 to the extent practicable in the judgment of the Board in light of the urgency of the circumstances necessitating preparation and approval of the modified or supplemental budget. Each modified or supplemental budget shall be approved by the Board at a regular meeting or a special meeting of the Board duly called for that purpose.
Section 5. Submission of Annual Business Plans and Budgets to the Regulatory Authorities.

Each annual budget, annual business plan, and annual, modified, or supplemental budget approved by the Board shall be submitted by the Corporation to the ERO and any applicable regulatory authorities for approval in accordance with its regulations, and shall not be effective until approved by the applicable regulatory authorities. If ordered to modify or remand an annual budget, business plan, or annual, modified, or supplemental funding mechanism, the Board shall promptly following such order adopt such modifications to the business plan, budget, or funding mechanism as are required or directed by the order of the ERO and any applicable regulatory authority.

Article XII: AMENDMENTS TO THE BYLAWS

Section 1. Amendments to the Bylaws. These Bylaws may be altered, amended, or repealed by action of the Membership, as set forth below. Any alteration, amendment, repeal or adoption of Bylaws shall be subject to any applicable requirements for filing with or approval by the ERO or any other applicable regulatory authority. These Bylaws may be altered, amended, or repealed as follows:

(a) Any Director or Member suggesting amendments to these Bylaws must submit a proposal of the amendment, including any necessary supporting documents, to the CEO.

(b) The CEO shall place the proposal on the agenda for a Board meeting in the time and manner prescribed by the Board and within ninety-five (95) days of the request.

(c) If the proposal is approved by an act of the Board as set forth in Article VI, Section 3, the Board shall place the proposal on the agenda of the next Annual Meeting of the Corporate Members unless the Board in its discretion calls a Special Meeting of the Corporate Members to vote on the proposal or determines to seek Membership approval without a meeting as provided in Article V, Section 4.

(d) If the proposal is not approved by the Board, the Members of the Corporation may call a meeting, pursuant to Article V, Section 1(b), for the purpose of voting on a proposal not approved by the Board. Any such proposal must be approved by a vote of five of the six Sectors at a meeting of Members called for that purpose or by written consent of five of the Sectors, where the number of votes for and against the proposed alteration, amendment, repeal or adoption of Bylaws shall be determined in accordance with Article V, Section 2.

Article XIII: INDEMNIFICATION; PROCEDURE; DISSOLUTION

Section 1. Indemnification. The Corporation shall indemnify each person who at any time shall serve, or shall have served, as an officer, Director, employee, or other corporate agent of the Corporation, is or was serving at its request as a director, officer, partner, venturer, proprietor, employee, agent or similar functionary of another foreign or domestic corporation, partnership, joint venture, sole proprietorship, trust, employee benefit plan or other enterprise (“Indemnified Parties”), to the full extent from time to time permitted by the Texas Business Organizations Code and other applicable law. Such right of indemnification shall inure to the benefit of the legal representative of any such Indemnified Party. The foregoing indemnification shall be in addition to, and not in restriction or limitation of, any privilege or power that the Corporation may have with respect to the indemnification or reimbursement of its Indemnified Parties. The Corporation shall also pay or advance reasonable expenses incurred by an
Indemnified Party in connection with a proceeding in advance of the final disposition of the proceeding upon receipt of a written affirmation by the Indemnified Party of a good faith belief that the standard of conduct necessary for indemnification under this Article XIII and the Texas Business Organizations Code has been met and a written undertaking by or on behalf of the officer, Director, or other corporate agent to repay the amount if it shall be ultimately determined that the Indemnified Party was not entitled to be indemnified by the Corporation.

Section 2. Parliamentary Rules. In the absence of and to the extent not inconsistent with specific provisions in these Bylaws, meetings or other actions pursuant to these Bylaws shall be governed by procedures that the Board may, from time to time, establish by resolution.

Section 3. Dissolution. Upon dissolution of the Corporation, in accordance with the Certificate of Formation, the remaining assets of the Corporation after payment of debts shall be distributed in the manner determined by the Board, provided that, (i) no part of the assets shall be distributed to any Director of the Corporation, and (ii) the distribution of assets shall be consistent with the requirements of Section 501(c)(3) of the United States Internal Revenue Code of 1954.

Article XIV. ARTICLE XIII. CONFLICTS OF INTEREST

Section 1. Conflicts of Interest.

(a) Each Director shall have an affirmative duty to disclose to the Board or committee (as the case may be) any actual or potential conflicts of interest of the Director that arise during his or her tenure as a Director where, and to the extent that, such conflicts or potential conflicts directly or indirectly affect any matter that comes before the Board. A Director with a direct or potentially conflicting interest in a matter shall recuse himself from deliberations and actions on the matter in which the conflict arises and shall abstain on any vote on the matter and not otherwise participate in a decision on the matter. Any disclosure of a potential conflict of interest by a Director shall be noted in the minutes of the Board meeting at which the direct interest is disclosed. Mere attendance at the meeting, without participating in discussion of the issue raising the potential conflict, shall not constitute participation.

(b) The Corporation may not make any loan to a Director, committee member or officer of the Corporation. A Member, Director, officer, or committee member of the Corporation may not lend money to, or otherwise transact business with, the Corporation except as otherwise provided by these Bylaws, the Certificate of Formation, and applicable law. A related party transacting business with the Corporation has the same rights and obligations relating to those matters as other persons transacting business with the Corporation, provided the related party nature of the transaction is known to the Board. The Corporation may not borrow money from, or otherwise transact business with, a Member, Director, officer, or committee member of the Corporation unless the transaction is described fully in a legally binding instrument, is in the Corporation's best interests, and is on terms no less favorable to the Corporation than could be obtained in an arms-length transaction. The Corporation may not borrow money from, or otherwise transact business with, a Member, Director, officer, or committee member of the Corporation without full disclosure of all relevant facts and without the Board's approval, not including the vote of any person having a personal interest in the transaction.

Section 2. Prohibited Acts. No Member, Director, officer, or committee member of the Corporation may do any of the below-listed prohibited acts. Engaging in these
prohibited acts may lead to sanction, suspension, expulsion or termination after a hearing as described in these Bylaws. The prohibited acts include the following:

(a) Do any act in violation of these Bylaws.

(b) Do any act in violation of a binding obligation of the Corporation except with the Board’s prior approval.

(c) Do any act with the intention of harming the Corporation or any of its operations.

(d) Receive an improper personal benefit from the operation of the Corporation.

(e) Use the Corporation’s assets, directly or indirectly, for any purpose other than carrying on the Corporation’s business.

(f) Wrongfully transfer or dispose of Corporation property, including intangible property such as goodwill.

(g) Use the Corporation’s name (or any substantially similar name) or any trademark or trade name adopted by the Corporation, except on behalf of Corporation in the ordinary course of its business or as a reference to the Corporation or its region.

(h) Disclose any of Corporation’s or Members’ business practices, trade secrets, or any other confidential or proprietary information not generally known to the business community to any person not authorized to receive it.

Section 3. Loans and Guarantees. Neither participation in the activities of the Corporation nor any provision of these Bylaws or of the Certificate of Formation shall be deemed to constitute a pledge or loan of the credit of any Member for the benefit of the Corporation or a guarantee by any Member of any obligation of the Corporation.

**Article XV. ARTICLE XIV. BOOKS AND RECORDS; AUDIT; FISCAL YEAR**

Section 1. Access to Books and Records. All Members of the Corporation will have access to the books and records of the Corporation, including financial statements and budgets; however, the Board shall establish procedures by which a Member, upon written demand stating the purpose of the demand may examine and copy the books and records of the Corporation. If necessary to protect the confidential information of the Corporation, a Member requesting examination of any of the Corporation’s non-public books and records will be required to sign a confidentiality and non-disclosure agreement before viewing such information. The procedures shall include policies that provide reasonable protection against the unnecessary disclosure of information related to individual employees, including their compensation.

Section 2. Audit. At least annually, an audit of the financial statements of the Corporation shall be performed by the Auditor approved by the Board. The Auditor’s opinion and the audited financial statements will be made available to all Members as described in Article XIV XV, Section 1.
Section 3. Fiscal Year. The fiscal year of the Corporation shall be from January 1 through the following December 31, unless otherwise established by resolution of the Board.
**Action**
Update

**Background**
In early 2016, FERC order No. 824 directed NERC to give FERC access to certain NERC databases, specifically, the Generator Availability Data System (GADS), Transmission Availability Data System (TADS), and Misoperations database (MISOPS). On June 16, 2016, FERC issued a NOPR to amend FERC’s FOIA and CEII related regulations to implement provisions of FAST Act pertaining to the designation, protection, and sharing of CEII.

On November 17, 2016, FERC issued Order No. 833 adopting its NOPR proposals, which will become effective 60 days after publication in the Federal Register. FERC adopted the NOPR proposal to treat information downloaded from NERC databases as non-public. FERC clarified that downloaded data would be treated as CEII, while reiterating that FERC would evaluate whether data should be designated as CEII in response to a request for information or FERC determination to disclose.

NERC will begin to make this U.S. entity data available in the first quarter of this year, providing FERC that data which is required by the corresponding 1600 data request. In phase one, data will be provided in a standard spreadsheet format and uploaded to a secure portal on the NERC website and updated on a periodical basis. In phase two, FERC will establish a SQL server and the U.S. mandatory data and subsequent updates will be provided in a SQL server to SQL server secure connection.
U.S. Government Relations: New Administration Appointments

**Action**
Update

**Background**
With the election of Donald Trump as President, the transition team began work on nominations and appointments for the numerous positions within the new administration. Vice President Mike Pence chaired the transition team, with individuals identified as leads for specific agencies to vet personnel choices and work with the existing transition contacts who served within the Obama Administration. NERC’s Policy and External Affairs group maintained communication with transition team leaders throughout the transition.

**Summary**
The Policy and External Affairs group continues to track nominees for key positions within the administration. Recognizing that all nominees for cabinet secretaries and independent commissions require confirmation by the U.S. Senate before becoming official, the Board of Trustees will receive an update on transition announcements to date.
Western Interconnection Assurance Project

Action
Information

Background
NERC and WECC embarked on a joint project that focused on reliability in the Western Interconnection. The purpose of the project was to understand the current status of the region’s TOPs across key operational practice areas and assess the status of changes that were identified in the Joint NERC-FERC report on the September 2011 Southwest Outage. WECC and NERC jointly published a short public report in December 2016, which contains high-level findings, including best practices and areas requiring improvement.

Summary
The presentation at the February 9 Board of Trustees meeting will discuss the background, activities and outcomes of the project, as well as next steps.
Mexico Update

Action
Update

Background
In 2013 and 2014 Mexico enacted comprehensive energy reforms that included expanding the authority of the Mexican Energy Regulatory Commission (CRE), over reliability of the Mexican electricity system. In November 2015, Trustees and members of NERC senior management met with Mexican officials to discuss NERC’s role as the international ERO in North America and the possibility of Mexican participation in the ERO.

Since this initial meeting, Board of Trustees (Board) members and stakeholders have been provided updates at each quarterly meeting on Mexico’s implementation of reforms and the collaboration between NERC and appropriate authorities in Mexico to establish the mutual benefits of Mexican participation in the international ERO.

In October 2016, CRE hosted a meeting among senior officials from appropriate governmental authorities in Mexico, the U.S., Ontario, and British Columbia as well as NERC and the Western Electricity Coordinating Council (WECC). At this meeting, it was agreed that three separate agreements would be developed: 1) Bilateral reliability principles between the U.S. and Mexican governments; 2) a memorandum of understanding (MOU) between NERC, CRE, and the National Energy Control Center (CENACE); and 3) an updated membership and operating agreement (MOA) between WECC and CRE.

The first of these agreements, Bilateral Reliability Principles between the U.S. and Mexico, were signed on January 7, 2017 in Mexico City.

Summary
NERC management will update the Board on the status of the MOU between NERC, CRE, and CENACE and the relationship between the MOU and the WECC MOA.
E-ISAC Quarterly Update

Action
Information

Background
The Electricity Information Sharing and Analysis Center’s (E-ISAC’s) mission is to reduce cyber and physical security risk to the Electricity Subsector across North America by providing unique insights, leadership, and coordination. The E-ISAC gathers security information, coordinates incident management, and communicates mitigation strategies with stakeholders within the Electricity Subsector, across interdependent sectors, and with government and private partners. This quarterly report covers activity during the months of October through December 2017.

Summary
During the fourth quarter of 2016, the E-ISAC continued to increase the amount of data collection, analysis, and reporting for cyber and physical events affecting the Electricity Subsector. Activity that the E-ISAC reported from October to December included:

- 265 E-ISAC staff posts to the portal (+29% from Q3)
- 57 member responses to portal items (+20% from Q3)
- 35 calls to the E-ISAC hotline (-17% from Q3)
- 275 new portal accounts (+30% from Q3)

The E-ISAC publishes a weekly summary to the Electricity industry every Monday morning and a monthly summary report in conjunction with its monthly webinar. The webinars average 250 participants. The E-ISAC also publishes a daily report, as well as a quarterly CRISP report.

In October, the E-ISAC issued a Level 2 NERC Alert concerning issues with Internet-of-Things (IoT) devices that are connected to the public Internet. Within a few days of our Alert, there was a significant attack against an Internet Service Provider using IoT devices. There was no impact on grid operations, but the attack highlighted the seriousness of the subject and helped amplify the urgency of the defensive measures we included in the Alert. We also issued a TLP WHITE document (no restrictions on distribution) explaining how IoT attacks work and what can be done to prevent them or reduce their impact. This document was used by our trade associations to inform their members about the growing IoT threat.

Also in October, the E-ISAC hosted its annual Grid Security Conference (GridSecCon) in Quebec City. This was the largest GridSecCon to date, with over 400 participants representing entities in all of the NERC Regions. In addition to two days of conference talks and presentations, we had a full day of training and a half day of classified briefings. The next GridSecCon will be in St. Paul, MN, in October 2017.
In November, the E-ISAC launched the planning process for GridEx IV with a full day Initial Planning Meeting (IPM). The IPM laid out the schedule for GridEx IV, explained the objectives, and provided the over 400 planners that attended with an opportunity to provide input into the scenario development and to build messaging themes for their organizations to get the most out of the exercise. Additional planning meetings and trainings are scheduled in 2017. GridEx IV will take place November 15-16, 2017.

Also in November, the E-ISAC rolled out the last of several portal improvements that implement recommendations from the Member Executive Committee. These improvements corrected several outstanding performance issues, added a few new features, and positioned the site for ultimate migration to a new platform in 2017. Feedback on the improvements has been very positive.

In December, there were two significant cyber events – a reported attack on a major utility in Ukraine, and a misreported attack on a utility in Vermont. The Ukraine attack happened almost a year after the 2015 attack but was technically different. The E-ISAC published a TLP AMBER background briefing for its asset owners and operators and assisted the US federal government with analysis of the incident. There was no impact on the North American grid.

At the end of December, the FBI and DHS released a joint report on Russian hacking in the US during the Presidential election that included hundreds of technical “indicators” that might show similar activity in private networks and critical infrastructure networks. The US government asked all infrastructure owners to check for these indicators and report any findings. The E-ISAC published a Request for Information document containing the indicators and received information from a handful of utilities that there was a match for one or more of the indicators in their logs. One entity in Vermont also reported its findings to the federal government, and within a few hours, that report was passed to a major US newspaper. Unfortunately, the paper reported that the entity was attacked by Russia and implied that Russia was actively trying to penetrate the grid with a cyber attack. The E-ISAC worked closely with the utility and with the government to clarify the story and to help officials understand that the grid was not under attack. The utility was very cooperative with the investigation and also participated in our monthly industry call several days later to explain the situation and take questions.

The E-ISAC’s web portal upgrade project finished in the fourth quarter of 2016. This project addressed priority items identified by the Member Executive Committee and made the current site easier to use and navigate. A full transition to a new platform began in January 2017. We expect that the cut-over to the platform will happen in June 2017. In addition, we increased our unclassified CRISP data analytical capability with the addition of a new storage capability in our Washington, DC, offices and faster data connections to PNNL. We launched a STIX/TAXII automated information sharing pilot (dubbed CAISS – Cyber Automated Information Sharing System) in December 2016 with 10 utilities participating. CAISS will allow the E-ISAC to rapidly disseminate technical information about cyber and physical attacks using a computer-based sharing and analysis system.
Operating Committee Report

Action
Information

Operating Committee’s (OC) Major Accomplishments for 2016

1. **Reliability Guidelines** – The OC is developing, or has developed, reliability guidelines addressing:
   
a. Integrating Reporting ACE with the NERC Reliability Standards – This Reliability Guideline provides recommended practices for calculating and using Reporting ACE in the Tie Line Bias Control program integrated with the NERC Reliability Standards. The OC approved the Reliability Guideline: Integrating Reporting ACE with the NERC Reliability Standards at its December 13-14, 2016 meeting.

b. Inadvertent Interchange - This Reliability Guideline provides recommended practices for the management of Inadvertent Interchange accounting. With the goal of ensuring that, over the long term, Balancing Authority (BA) Areas do not excessively depend on the BA Areas in the Interconnection for meeting their demand or Interchange obligations. The OC approved the Reliability Guideline: Inadvertent Interchange at its December 13-14, 2016 meeting.

c. Situational Awareness for the System Operator - This Reliability Guideline provides a global recognition of the importance for the system operator to maintain situational awareness while operating the BES. It is meant to assist Transmission Operators (TOP), Balancing Authorities (BA), Reliability Coordinators (RC), Generator Operators (GOP) and other operating entities to use as they deem appropriate with the primary goal of supporting BES reliability. The OC approved posting the draft Reliability Guideline: Situational Awareness for the System Operator for a 45-day public comment period.

d. Real Power Energy Storage Applications

e. A revision to the Reliability Guideline: Primary Frequency Control to include asynchronous generation

f. The Operating Committee approved Version 4.0 of the Time Monitoring Reference Document at its September 13-14, 2016 meeting. The reference document outlines responsibilities of Reliability Coordinators serving as time monitors in the North American Interconnections and specifies how manual Time Error Corrections (MTEC) are to be implemented. The document also outlines how to resolve issues if needed and outlines procedural responsibilities assigned to the time monitor. The process to monitor time error remains the same; however, the NERC Resources Subcommittee will determine future needs for time error corrections and whether approval from the Operating Committee is needed for any proposed changes.

2. **OC Strategic Plan** – At its March 2016 meeting, the OC formed a task team to review and revise its 2015-2019 Strategic Plan. The OC approved a revised strategic plan at its September 2016 meeting. The OC leadership and NERC staff continue to monitor progress.
3. **OC and Subcommittee Work Plans** – The OC Executive Committee and the leadership of its subcommittees met in early February to draft the 2016 Work Plans. At the December 2016 OC meeting, the OC continued to review and refine these Work Plans as well as track progress on the work plan items. The OC Executive Committee along with the leadership of its subcommittees met in Charlotte, NC on January 12, 2017 to review, check and adjust these Work Plans for the next three years.

4. **Essential Reliability Services Working Group (ERSWG)** – The OC reviewed and accepted the ERSWG scope, the Distributed Energy Resources Task Force scope, and the ERSWG work plan. The OC accepted the ERSWG Sufficiency Guidelines Whitepaper at the December 2016 meeting. The DERTF presented its final report to the OC in December 2016. The final report was approved by the OC. The DERTF was also dissolved by the OC and the work of the DERTF will be absorbed into the ERSWG.


**OC’s Major Initiatives for 2016**

1. **Essential Reliability Services Working Group (ERSWG) and the Distributed Energy Resources Task Force (DERTF)** – The OC is providing leadership to the ERSWG and the DERTF. The DERTF expects to complete its report to the ERSWG and the OC by year end 2016. The ERSWG is studying the sufficiency of the proposed measures. The OC’s Resources Subcommittee will play a key role in the further development of the frequency response and ramping measures.

2. **Resources Subcommittee** – The RS will review and revise several reliability guidelines, reference documents and training guides under its purview.


5. **OC Strategic Plan** – The OC reviewed and revised its 2015-2019 Strategic Plan. The OC approved a revised strategic plan at its September 2016 meeting.

**December 2016 Meeting Summary:**

The following is a summary of the OC’s December 2016 meeting, which highlights the latest activities of the OC and its associated subcommittees in support of the NERC or OC mission and corporate goals. The December 2016 OC Meeting Minutes are posted on the NERC website.

1. **Joint Planning and Operating Committee Meeting** – A joint meeting of the Planning Committee and the Operating Committee was held from 10:00 a.m. to 12:00 p.m. on December 13, 2016. The agenda for the joint session allowed the committees to discuss agenda items of mutual interest to both committees which included:

   a. ERO Strategic Plan
   b. Development of an IROL Task Force
   c. Revisions to NERC Functional Model
   d. Essential Reliability Services Sufficiency Guidelines White Paper
2. Past Chairs and Secretary Roundtable - Chair Case convened a panel of past OC Chairs (Sam Holeman, Tom Bowe and Jim Castle) and the immediate past OC Secretary (Larry Kezele) to discuss their experience leading the OC over the past 6 years. Chair Case asked a series of questions and each of the participants responded with their thoughts and experience during their tenure on the OC. At the conclusion of the panel, Chair Case read a Resolution of Appreciation for Larry Kezele, who retired from NERC October 31, 2016.

3. Operating Reliability Subcommittee (ORS) – The ORS continues to receive updates from the EIDSN Steering Committee on the IDC Tool enhancements. Specifically, ORS has developed metrics that test the effectiveness of the Parallel Flow Visualization (PFV) project so that they can be incorporated into the field trial of the project. The PFV Project is intended to improve the data quality used by the IDC during curtailment of transactions and may eventually result in changes to both NERC Reliability Standards and NAESB Business Practices. Through EIDSN, the IDC Working Group is proceeding with a change order to incorporate the agreed to metrics.

The ORS received updates on Hurricane Hermine and Matthew operations, impacts and restoration. The ORS will continue to ask for lessons learned / good practices that resulted from the storm.

The ORS also recommended archiving/retiring the Electric System Restoration Reference Document. The OC approved the recommendation.

4. Events Analysis Subcommittee (EAS) – EAS Chair Hamdar discussed certain NERC Reliability Standards requirements to perform Real-time Assessments. The EAS has concerns regarding these requirements when an entity loses their EMS capability. The EAS made a request to form a task force to:
   a. Discuss how Real-time Assessments are completed when there is a loss of EMS
   b. Investigate the compliance and reliability concerns
   c. Develop any necessary guidance

The OC approved the request and volunteers to participate on the Task Force were seated.

EAS Chair Hamdar reviewed the final revisions to the EA Process which were posted for a 45-day comment period which ended on November 14, 2016. Revisions were made to align category 2a with EOP-004 requirements and include Interpersonal Communications and Alternative Interpersonal Communications. The EAS sought approval from the OC with an effective date of January 1, 2017. The OC approved the request.

5. Frequency Response Initiative - Motion made to approve the addition of two data points on the BAAL and CPS 1 data collection form per month: Clock-Minutes CPS1 <-700% and BAAL Clock-Minute Exceedances to begin in the 1st quarter of 2017. The OC approved the motion to collect the additional data.
Motion made to endorse the document that describes proposed collection of data that supports the previously approved NERC OC Generator Survey (September 2016 OC meeting). The proposed new data relates to generator ID info and on/off status. This data would be collected from Reliability Coordinators in lieu of individual data collection from Balancing Authorities. The OC approved the motion.

6. **OC Charter Revisions** - Jerry Rust reported that there were no additional revisions made to the OC Charter since the September meeting. The OC approved the revised charter for presentation to the Board of Trustees for their approval.

7. **Methods for Establishing IROLS Task Force (MEITF)** - Ryan Quint, NERC Staff, presented information on the formation of the MEITF as presented at the Joint OC/PC meeting. The summary of this request is:

   In order to facilitate the development of a team of technical experts to assess the issue and develop technical materials regarding the IROL issues outlined herein, the SC is requesting technical assistance from the Operating Committee and Planning Committee. Specifically, the SC is seeking the formation of a joint task force, comprised of both operating and planning subject matter experts, for the purpose of developing technical material for the IROL-related issues identified above. The technical material developed by the joint task force can be used by industry as a resource to enhance the manner in which certain interconnection limits are established, and also, by the SDT (or other future standard drafting team addressing the IROL issue) as revisions are developed to the related Reliability Standards.

   The MEITF Scope document has been reviewed closely by OC and PC leadership and Project 2015-09 SDT leadership. Motion made to approve the scope document and the OC approved the motion. Chair Case requested volunteers to participate on the MEITF.
Planning Committee Report

Action
Information

Summary
The Planning Committee (PC) has updated its report to the Board of Trustees (Board) to present pertinent information, not only on its recent achievements, but also to give you a glimpse of what the PC will be addressing prior to the next Board meeting. We feel that this update will provide a clear understanding of what our future planning needs and assessments will be in the next three months.

Upcoming Initiatives and Board Approvals for Early-2017

- Distributed Energy Resources (DER) Report

  *Will be provided to the Board for approval in February 2017*
  
  This report examines the reliability implications of increasing DERs on the Transmission-Distribution Interface (TDI) and its associated impact on the bulk power system (BPS). It also explores existing policies oriented toward supporting the reliable integration of DERs and will further examine the interplay with the ERS as previously identified in the 2015 ERS Report and Abstract Document. The report was approved by the PC in December and will be presented to the Board in February for approval.

- NERC Special Assessment: Single Point of Disruption

  *Board approval is expected in Q3 2017 (approval date TBD)*
  
  NERC requested PC volunteers to join a steering committee for the development of the next special assessment on single points of disruption related to natural gas-fired resources. The report is in-development and will be presented to the PC in Q2 2017, with the final report to the Board in Q3 2017.

Recently Completed Committee Activities and Initiatives

- Essential Reliability Services (ERS) Sufficiency Guidelines White Paper

  *No Board Action Needed*
  
  The ERSWG has been working to identify, evaluate, and develop ‘Sufficiency Guidelines’ for each quantifiable ERS measure. The methodology to develop these sufficiency guidelines has been explained in a white paper that was accepted by the PC in December 2016. This accepted white paper will serve as the basis for a Reliability Guideline sponsored by the PC. (Note: The final draft is provided in the link below and is currently undergoing a publications review and final edit.)

  **Link:** [Essential Reliability Services (ERS) Sufficiency Guidelines White Paper](#)
• Three Reliability Guidelines Received Final Approval  
*No Board Action Needed* 
The committee approved the final release of three Reliability Guidelines: **PMU Placement and Installation; Reactive Power Planning; and Modeling Distributed Energy Resources in Dynamic Load Models**. Interested stakeholders provided feedback for all three draft guidelines in late-2016. These comments were reviewed by the respective PC subgroups and presented to the PC for approval in December 2016.

• Approved Posting of Draft Reliability Guideline for Comment: Developing Load Model Composition Data  
*No Board Action Needed* 
This Reliability Guideline is intended to provide Transmission Planners (TPs) and Transmission Owners (TOs) with technical guidelines and reference material for developing reasonable and suitable load composition data for dynamic load models used in stability simulations. This guideline describes aspects of dynamic load modeling such as motor performance, protection modeling, or performing sensitivity studies. The draft guideline has been approved by the PC to post for a 45-day comment period.

• Established Methods for Establishing IROLs Task Force (MEITF)  
*No Board Action Needed* 
The Project 2015-09 standard drafting team (SDT) initiated revisions to certain FAC standards with the purpose of providing greater clarity and consistency in the establishment of SOLs and IROLs. The SDT has requested the technical expertise of the NERC PC and OC. The MEITF scope document was approved by the PC in December 2016.

• Established Probabilistic Assessment Working Group (PAWG)  
*No Board Action Needed* 
The PC approved the creation of the Probabilistic Assessment Working Group (PAWG). The scope of activities includes identifying improvement opportunities for Probabilistic Resource Adequacy Assessment (PRAA), recommending common data collection approaches to support a robust NERC PRAA, and to develop technical document(s) regarding reliability measures for PRAA. The PAWG will further advance the work initiated by the Generation & Transmission Reliability Planning Models Task Force (GTRPMTF) which replaces the old Probabilistic Assessment Improvement Task Force (PAITF). The PAWG will report to the PC’s Reliability Assessment Subcommittee (RAS).

• Revamped Geomagnetic Disturbance Task Force (GMDTF)  
*No Board Action Needed* 
On September 22, 2016, the Federal Energy Regulatory Commission (FERC) issued Order No. 830 approving Reliability Standard TPL-007-1 (Transmission System Planned Performance for Geomagnetic Disturbance Events). In the Order, FERC additionally directs NERC to: (i) make certain modifications to the standard; (ii) conduct additional research into geomagnetic disturbance (GMD)-related areas; and (iii) collect, pursuant to Section 1600 of the NERC Rules of Procedure, certain GMD-related data already in
existence. This task force has been revamped to facilitate these objectives. The Planning Committee approved a revised scope for the task force.

- **Established Power Plant Modeling & Verification Task Force (PPMVTF)**

  *No Board Action Needed*

  The Power Plant Modeling and Verification Task Force (PPMVTF) will bring together power plant testing experts, GOs/GOPs, TOs/TOPs, TPs/PCs, and the manufacturing community to develop technical guidance materials related to power plant modeling, power plant model verification (PPMV), and generator testing procedures. The PC approved the creation at its December 2016 meeting.

**Future Meetings**

- March 7-8, 2017 – Atlanta, GA
Critical Infrastructure Protection Committee Report

Action
Approve

Items for Approval

- The Critical Infrastructure Protection Committee (CIPC) requests the Board of Trustees approve its revised CIPC Strategic Plan. The CIPC aligned the CIPC Strategic Plan with the Electric Reliability Organization (ERO) Enterprise Strategic Plan and Metrics 2017-2020. The CIPC Executive Committee will annually assess its work plan and strategic initiatives to help ensure that the work being performed by the CIPC will align to the ERO Enterprise Strategic Plan. The CIPC membership approved the CIPC Strategic Plan at its December 2016 meeting.

Additional Information

- The CIPC revised its Organizational Chart to show new leadership of the Physical Security Subcommittee and a new member of the Executive Committee.

- The table below summarizes the key initiatives and activities the CIPC will prioritize for the 2017 and 2018 work plan.

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<tr>
<th>CIPC Work Plan (2 years)</th>
<th>2017</th>
<th>2018</th>
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<tr>
<td>Security Metrics</td>
<td>Develop additional context around existing metrics</td>
<td>Develop one new metric</td>
</tr>
<tr>
<td>Collaboration</td>
<td>Four regions will present security successes and challenges to the CIPC</td>
<td>Remaining four regions will present security successes and challenges to the CIPC</td>
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<td></td>
<td>Test notion of having closed sessions at CIPC meetings</td>
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<td></td>
<td>Identify joint OC/PC/CIPC project opportunities</td>
<td></td>
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<tr>
<td></td>
<td>Foster relationships with National Labs</td>
<td>Formalize relationship with National Labs</td>
</tr>
<tr>
<td></td>
<td>Expand security narrative in the State of Reliability Report</td>
<td>State of security report (notional draft)</td>
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<tr>
<td>Supply Chain</td>
<td>Support the implementation of the new Reliability Standard</td>
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<tr>
<td>Emerging Technologies</td>
<td>Act as forum for discussions</td>
<td>Monitor for new technologies</td>
</tr>
<tr>
<td>GridEx</td>
<td>Complete GridEx 3 recommendations</td>
<td>Address GridEx 4 recommendations</td>
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<tr>
<td></td>
<td>GridEx 4 planning</td>
<td>GridEx 5 planning</td>
</tr>
<tr>
<td>Guidance</td>
<td>Prioritize emerging technologies guidance topics</td>
<td>Develop new guidance</td>
</tr>
<tr>
<td></td>
<td>Evaluate alternate delivery/development vehicles &amp; processes</td>
<td>Test alternate processes</td>
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<tr>
<td>Comment Body</td>
<td>Future Meetings</td>
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<td></td>
</tr>
<tr>
<td>Update connecting business networks guideline</td>
<td>March 8-9, 2017 – Atlanta, GA</td>
<td></td>
</tr>
<tr>
<td>Evaluate resiliency and vulnerability assessment best practices guideline</td>
<td>June 6-7, 2017 – TBD</td>
<td></td>
</tr>
<tr>
<td>Publish new resiliency and vulnerability assessment best practices guideline</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Update threat and incident response guideline</td>
<td></td>
<td></td>
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<tr>
<td>Publish vulnerability risk management guideline</td>
<td></td>
<td></td>
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<tr>
<td>Develop vulnerability risk management guideline</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comment Body</td>
<td>Future Meetings</td>
<td></td>
</tr>
<tr>
<td>Executive committee to study feasibility and logistics</td>
<td>March 8-9, 2017 – Atlanta, GA</td>
<td></td>
</tr>
<tr>
<td>Implement recommendations</td>
<td>June 6-7, 2017 – TBD</td>
<td></td>
</tr>
</tbody>
</table>
Critical Infrastructure Protection Committee
Strategic Plan 2015-2018
CIPC Executive Committee

Updated: December 13, 2016
Table of Contents

Preface ......................................................................................................................................................... iv
Executive Summary ........................................................................................................................................ v
Introduction ................................................................................................................................................... vi
Mission, Vision, and Guiding Principals ...................................................................................................... 1
  NERC Mission Statement ............................................................................................................................... Error! Bookmark not defined.
  CIPC Mission ................................................................................................................................................ 1
  CIPC Vision .................................................................................................................................................. 1
  Guiding Principles ....................................................................................................................................... 1
Areas of Strategic Focus in Support of ERO Goals ...................................................................................... 2
  Advisory Panel to the NERC Board ................................................................................................................ 2
  Risk Profile #8: Physical Security Vulnerabilities; Risk Profile #9: Cybersecurity Vulnerabilities ............. 2
  Cyber and Physical Security Guidelines and Technical Reports ................................................................. 2
  Risk Profile #8: Physical Security Vulnerabilities; Risk Profile #9: Cybersecurity Vulnerabilities ............. 2
  NERC Standards Implementation and Compliance Input ........................................................................... 2
  Risk Profile #8: Physical Security Vulnerabilities; Risk Profile #9: Cybersecurity Vulnerabilities ............. 2
  BES Security Metrics ................................................................................................................................... 2
  Risk Profile #8: Physical Security Vulnerabilities; Risk Profile #9: Cybersecurity Vulnerabilities ............. 2
  Coordination and Communications ............................................................................................................. 2
  Risk Profile #8: Physical Security Vulnerabilities; Risk Profile #9: Cybersecurity Vulnerabilities ............. 2
  Information Sharing ...................................................................................................................................... 3
  Risk Profile #8: Physical Security Vulnerabilities; Risk Profile #9: Cybersecurity Vulnerabilities ............. 3
  CIPC will provide subject matter expertise to joint public/private task forces as needed to address threats and vulnerabilities to the BES ........................................................................................................... 3
  Risk Profile #8: Physical Security Vulnerabilities; Risk Profile #9: Cybersecurity Vulnerabilities ............. 3
  CIP Training and Educational Outreach ....................................................................................................... 3
  Risk Profile #8: Physical Security Vulnerabilities; Risk Profile #9: Cybersecurity Vulnerabilities ............. 3
  CIPC Member Involvements .......................................................................................................................... 3
  Risk Profile #8: Physical Security Vulnerabilities; Risk Profile #9: Cybersecurity Vulnerabilities ............. 3
Strategic Plan/Vision (2017-2018) ................................................................................................................ 4
  Alignment with NERC Strategic Plan ........................................................................................................... 4
  CIPC Work Plan ........................................................................................................................................... 4
  Statement of the Risk .................................................................................................................................... 4
  CIPC Work Plan .......................................................................................................................................... 7
  Statement of the Risk .................................................................................................................................... 7
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIPC Work Plan</td>
<td>10</td>
</tr>
<tr>
<td>Appendix 1: CIPC Work Plan 2017-2018</td>
<td>11</td>
</tr>
<tr>
<td>Advisory Panel to Board</td>
<td>11</td>
</tr>
<tr>
<td>Cyber and Physical Security Guidelines and Technical Reports</td>
<td>12</td>
</tr>
<tr>
<td>NERC Standards Implementation and Compliance Input</td>
<td>12</td>
</tr>
<tr>
<td>BES Security Metrics</td>
<td>12</td>
</tr>
<tr>
<td>Public-Private Partnership</td>
<td>12</td>
</tr>
<tr>
<td>Information Sharing</td>
<td>13</td>
</tr>
<tr>
<td>Risks and Emerging Issues</td>
<td>13</td>
</tr>
<tr>
<td>CIP Training and Educational Outreach</td>
<td>13</td>
</tr>
<tr>
<td>CIPC Member and Industry Observer involvement</td>
<td>13</td>
</tr>
</tbody>
</table>
Preface

The North American Electric Reliability Corporation (NERC) is a not-for-profit international regulatory authority whose mission is to assure the reliability of the bulk power system (BPS) in North America. NERC develops and enforces Reliability Standards; annually assesses seasonal and long-term reliability; monitors the BPS through system awareness; and educates, trains, and certifies industry personnel. NERC’s area of responsibility spans the continental United States, Canada, and the northern portion of Baja California, Mexico. NERC is the electric reliability organization (ERO) for North America, subject to oversight by the Federal Energy Regulatory Commission (FERC) and governmental authorities in Canada. NERC’s jurisdiction includes users, owners, and operators of the BPS, which serves more than 334 million people.

The North American BPS is divided into eight Regional Entity (RE) boundaries as shown in the map and corresponding table below.

The North American BPS is divided into eight Regional Entity (RE) boundaries. The highlighted areas denote overlap as some load-serving entities participate in one Region while associated transmission owners/operators participate in another.

<table>
<thead>
<tr>
<th>FRCC</th>
<th>Florida Reliability Coordinating Council</th>
</tr>
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<tbody>
<tr>
<td>MRO</td>
<td>Midwest Reliability Organization</td>
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<tr>
<td>NPCC</td>
<td>Northeast Power Coordinating Council</td>
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<td>RF</td>
<td>ReliabilityFirst</td>
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<tr>
<td>SERC</td>
<td>SERC Reliability Corporation</td>
</tr>
<tr>
<td>SPP RE</td>
<td>Southwest Power Pool Regional Entity</td>
</tr>
<tr>
<td>Texas RE</td>
<td>Texas Reliability Entity</td>
</tr>
<tr>
<td>WECC</td>
<td>Western Electricity Coordinating Council</td>
</tr>
</tbody>
</table>
Executive Summary

The Executive Committee members of the Critical Infrastructure Protection Committee (CIPC) developed the CIPC Work Plan (Appendix 1) and comprehensively reviewed the work activities and deliverables to be produced for each CIPC subcommittee. This level of Executive Committee involvement promotes firsthand knowledge of group activity. CIPC Executive Committee engaged all subgroup leadership in appropriate discussion of deliverables to be produced by each group, and the expectations of the analysis and reports.
Introduction

This is a living document, meant to address the current and future CIPC strategic issues. The landscape in which the electric industry operates is dynamic and rapidly changing. Therefore, a regular review of the strategic plan by the CIPC Executive Committee should be conducted to ensure that it remains accurate.

The CIPC chair will provide regular strategic plan updates to the CIPC members, and will send status reports to the NERC Board of Trustees (Board).

Furthermore, if there are any key changes that emerge, CIPC will revisit the work plan to ensure alignment with the NERC Electric Reliability Organization (ERO) Enterprise. This work plan addresses activities, interests, and concerns of the NERC enterprise related to critical infrastructure planning of the interconnected bulk power system (BPS).

This document is created to identify strategic activities as well as highlight the alignment of CIPC activities from several perspectives, including:

- Conforming to priorities of the NERC ERO Enterprise, the Reliability Issues Steering Committee (RISC), and Federal, state/provincial regulators;
- Providing a technical foundation for reliability issues;
- Matching CIPC resources with priorities; and
- Efficiently using CIPC resources.
Mission, Vision, and Guiding Principals

CIPC Mission
The mission of the CIPC is to advance the physical and cyber security of the critical electricity infrastructure of North America.

CIPC Vision
Foster information sharing, provide industry leadership and a forum for exchanging ideas, and promote dialogue on key issues regarding the critical Infrastructure protection of the BES.

Guiding Principles
Continue to strive for excellence in:

- Maintaining relationships and promoting information sharing with other committees;
- Maintaining high level of expertise;
- Aligning priorities with ERO and across the other standing committees;
- Ensuring CIPC resources are used efficiently.
Areas of Strategic Focus in Support of ERO Goals

Advisory Panel to the NERC Board
Risk Profile #8: Physical Security Vulnerabilities; Risk Profile #9: Cybersecurity Vulnerabilities
CIPC serves as an expert advisory panel to the NERC Board, RISC, and standing committees in the areas of physical and cyber security.

Cyber and Physical Security Guidelines and Technical Reports
Risk Profile #8: Physical Security Vulnerabilities; Risk Profile #9: Cybersecurity Vulnerabilities
CIPC will identify needed guidelines and technical reports on critical infrastructure security and reliability with guidance or communication efforts that would benefit from asset owner perspectives. That technical support will be provided as needed to standard drafting teams created by the Standards Committee and to the Electricity Information Sharing and Analysis Center (E-ISAC).

NERC Standards Implementation and Compliance Input
Risk Profile #8: Physical Security Vulnerabilities; Risk Profile #9: Cybersecurity Vulnerabilities
CIPC will support NERC compliance initiatives, including implementation guidance, by providing timely topical expertise on matters related to cyber and physical security. The Compliance Enforcement Input Working Group (CEIWG) is established to solicit industry stakeholders for input to NERC staff to assist and clarify compliance documents.

BES Security Metrics
Risk Profile #8: Physical Security Vulnerabilities; Risk Profile #9: Cybersecurity Vulnerabilities
CIPC will utilize the expertise of its members, NERC staff, and others to provide direction, technical oversight, feedback on the collection of industry metrics, and reporting of BPS security performance metrics. The BES Security Metrics Working Group (BESSMWG) is established to develop measureable security metrics of cyber and physical security threats to the BPS. The BESSMWG will collaborate with the E-ISAC to produce an annual security assessment of the BPS.

Coordination and Communications
Risk Profile #8: Physical Security Vulnerabilities; Risk Profile #9: Cybersecurity Vulnerabilities
- CIPC will coordinate and communicate with those responsible for both physical and cyber security in all industry segments, including, among others E-ISAC, American Public Power Association (APPA), Canadian Electric Association (CEA), Edison Electric Institute (EEI), Electric Power Research Institute (EPRI), Electric Power Supply Association (EPSA), ISO/RTO Council (IRC), National Rural Electric Cooperative Association (NRECA), North American Standards Board (NAESB), the Nuclear Energy Institute (NRC), and the NERC Regional Entities (REs).
- Liaise with government, including the Department of Energy (DOE) national labs, about critical infrastructure protection matters.
**Information Sharing**  
**Risk Profile #8: Physical Security Vulnerabilities; Risk Profile #9: Cybersecurity Vulnerabilities**

CIPC will facilitate and advocate information sharing among industry segments and with governmental authorities. CIPC will identify current information sharing protocols and improvements to facilitate actionable information sharing within industry and between government and industry.

**CIPC will provide subject matter expertise to joint public/private task forces as needed to address threats and vulnerabilities to the BES**  
**Risk Profile #8: Physical Security Vulnerabilities; Risk Profile #9: Cybersecurity Vulnerabilities**

CIPC will utilize the expertise of its members and collaborate with NERC staff and the E-ISAC to identify risks and emerging issues and to recommend timely and appropriate action. A CIPC representative will be nominated to the NERC Board and RISC to assist in the analysis and prioritization of risks and emerging issues for Board consideration. Additionally, CIPC will act on the lessons learned from the biennial NERC grid security exercise (GridEx) to improve industry’s security posture.

**CIP Training and Educational Outreach**  
**Risk Profile #8: Physical Security Vulnerabilities; Risk Profile #9: Cybersecurity Vulnerabilities**

CIPC will provide to industry the opportunity to participate in physical, cyber and operational security training, and educational outreach activities.

- CIPC will support the planning, development, and execution of the biennial NERC GridEx incident response exercise to validate the current readiness of the electricity industry.
- CIPC will support the training development through workshops and webinars.

**CIPC Member Involvements**  
**Risk Profile #8: Physical Security Vulnerabilities; Risk Profile #9: Cybersecurity Vulnerabilities**

CIPC will utilize the expertise of the committee members by providing opportunities to participate in CIPC activities.
Alignment with NERC Strategic Plan
As a NERC Board committee, CIPC is dedicated to the success of the ERO mission and works to ensure the goals of the committee maps directly to the goals of the enterprise.

CIPC Work Plan
The CIPC Executive Committee will annually assess its work plan and strategic imperatives in order to ensure that the work being performed by the committee will align to the NERC Strategic Plan. Where there are specific work items, they will be listed as such in Appendix 1.

Alignment with RISC Priorities
Note: This mid-term strategic plan update, being the first to be mapped specifically to the NERC RISC priorities, is initially focused on the near-term recommendations of the RISC report (1-2 year timeframe). The CIPC Executive Committee has performed a brief analysis for the mid-term (3-5 year) and long-term (>5 year) recommendations and has identified items listed below for additional committee opportunities and will update subsequent annual work plans accordingly.

Statement of the Risk
Risk Profile #8: Physical Security Vulnerabilities
Intentional damage, destruction, or disruption to facilities can cause localized to extensive Interconnection-wide BPS disruption potentially for an extended period.

<table>
<thead>
<tr>
<th>Risk Profile #8: Physical Security Vulnerabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Near-term (1−2 year timeframe)</strong></td>
</tr>
<tr>
<td>1. The ERO Enterprise should continue to oversee the implementation of NERC’s Physical Security Reliability Standard entitled Critical Infrastructure Protection (CIP-014-1).</td>
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<tr>
<td>2. E-ISAC and industry should expand communications among information sharing analysis centers (ISACs), including the Telecommunications, Water, and Natural Gas ISACs.</td>
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<tr>
<td>3. The ERO Enterprise should develop effective metrics formulated to understand the trend of physical attacks and potential threats</td>
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</tbody>
</table>
4. Assess the risks of physical attack scenarios on midstream or interstate natural gas pipelines on natural gas availability impacting generation and the reliability of the BPS in the NERC’s long-term reliability assessments and planning activities.

The BES Security Working Group established by CIPC will develop, test, implement, and revise physical security metrics and contribute to the development of the annual NERC State of Reliability Report.

Status: ONGOING

5. Promote existing and new efforts to improve a spare equipment strategy and prioritization.

CIPC will stand ready to assist ESCC or the E-ISAC in efforts to stand up spare equipment processes. CIPC guidelines will be updated accordingly.

Status: PENDING

6. Develop a catalog of regional/national exercises that incorporate extreme physical events and share with industry, supporting increased participation across industry, and whenever possible expand exercises to include more facilities and industries.

CIPC, through the GridEx Working Group, will ensure that scenarios will include events that are timely and realistic. CIPC will stand ready to assist ESCC or the E-ISAC in efforts to monitor and participate in as many national or regional exercises as prudent.

Status: ONGOING

7. The forums and trade groups should perform the following activities:
   a) Identify and promote specific resiliency and vulnerability assessment best practices with planning for extreme events, including appropriate physical security assessment practices.
   b) Develop an event guideline outlining prevention strategies and event response and recovery protocols for sabotage scenarios.

CIPC’s physical security subcommittee will:
   a) Evaluate need for guidance or a joint project with the trade groups or the NERC operating or planning committees
   b) Evaluate the need to update threat and incident response guidelines

Status: PENDING

<table>
<thead>
<tr>
<th>Mid-term (3–5 year timeframe)</th>
<th>CIPC Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>8. The industry should review and update restoration plans reflecting consideration of physical security scenarios.</td>
<td>The physical security subcommittee will evaluate need for new guidance</td>
</tr>
<tr>
<td>Status: PENDING (2019-2022 workplan)</td>
<td></td>
</tr>
<tr>
<td>9. Develop performance and metrics reporting on joint E-ISAC and Telecommunications ISAC assessments of potential physical attack disruptions, differentiating from vandalism or theft incidents.</td>
<td>The CIPC BES Security Metrics WG will work with the E-ISAC to develop and optimize metrics as necessary to assist in performance measurements</td>
</tr>
<tr>
<td>Status: PENDING (2019-2022 workplan)</td>
<td></td>
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</tbody>
</table>
10. Conduct a special regional assessment that addresses natural gas availability and pipeline impacts under physical attack scenarios.  
   CIPC will be ready to assist ESCC or the E-ISAC in efforts to conduct regional assessments  
   Status: PENDING

11. The Department of Energy, the industry, trade groups, and forums will identify appropriate mitigations to spare equipment gaps and transportation logistics.  
   The physical security subcommittee will evaluate the need for new guidance  
   Status: PENDING (2019-2022 workplan)

12. The ERO Enterprise, the industry, trade groups, and forums should evaluate inventories of critical spare transmission equipment as necessary based on a spare equipment strategy and prioritization.  
   CIPC will be prepared to assist ESCC or the E-ISAC in evaluating spare equipment programs  
   Status: PENDING

13. The industry should evaluate mechanisms for cost recovery of implementing specific resiliency strategies by the industry.  
   CIPC will partner with others interested in engaging with the committee to deliver cost recovery strategies  
   Status: PENDING

14. Industry should work with the technical committees, forums, and trade groups to develop mitigation strategies and physical security assessment best practices.  
   The CIPC physical security subcommittee will publish new resiliency and vulnerability assessment best practices guideline  
   Status: PENDING (2017-2018 workplan)

15. Expand participation in security exercises other than GridEx that reflect extreme physical events.  
   CIPC will be prepared to assist ESCC or the E-ISAC in efforts to monitor and participate in the appropriate national or regional exercises  
   Status: ONGOING

16. Facilitate planning considerations to reduce the number/exposure of critical facilities.  
   CIPC will partner with the NERC planning committee to consider a whitepaper or study  
   Status: PENDING (2019-2022 workplan)

17. Institutionalize relationships among ESCC, government, and industry partners, to enhance the culture of recognizing and addressing extreme physical event preparedness across industry.  
   The CIPC Executive Committee will annually assess the effectiveness of the committee and the content of the quarterly meetings to ensure a collaborative environment exists to meet the needs of all stakeholders  
   Status: ONGOING

<table>
<thead>
<tr>
<th>Long-term (greater than 5-year timeframe)</th>
<th>CIPC Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>17. Institutionlize relationships among ESCC, government, and industry partners, to enhance the culture of recognizing and addressing extreme physical event preparedness across industry.</td>
<td>The CIPC Executive Committee will annually assess the effectiveness of the committee and the content of the quarterly meetings to ensure a collaborative environment exists to meet the needs of all stakeholders</td>
</tr>
</tbody>
</table>
18. Foster the development of methods, models, and tools to simulate system reliability impacts for the planning and operational planning time horizons. The CIPC GridEx Working Group will continue its efforts to simulate reliability impacts using the tools already available or, where lacking, develop new tools.

Status: ONGOING

CIPC Work Plan

**Risk Profile #8: Physical Security Vulnerabilities**

The CIPC physical security subcommittee is charged with managing CIPC efforts related to the physical protection of BPS facilities. The Physical Security Workgroup (PSWG) maintains close ties with the E-ISAC and will serve as a forum for collaboration and best-practice identification. The Physical Security Guidelines Workgroup (PSGWG) will be charged with developing or updating existing guidelines related to threat and incident response, and vulnerability assessment best practices.

(See Appendix 1 for the current CIPC Work Plan)

**Statement of the Risk**

**Risk Profile #9: Cybersecurity Vulnerabilities**

Exploitation of cybersecurity vulnerabilities can potentially result in loss of control or damage to BPS related voice communications, data, monitoring, protection and control systems, or tools. Successful exploitation can damage equipment causing loss of situational awareness and, in extreme cases, can result in degradation of reliable operations to the BPS, including loss of load.

<table>
<thead>
<tr>
<th><strong>Near-term (1–2 year timeframe)</strong></th>
<th><strong>CIPC Activities</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Address FERC critical infrastructure protection (CIP) directives in <em>Revised Critical Infrastructure Protection Reliability Standards</em>, 154 FERC ¶ 61,037 (2016).</td>
<td>The CIPC will monitor statistics for most-violated requirement under the CIP reliability standards to discover opportunities for new or better guidance. Status: ONGOING</td>
</tr>
<tr>
<td>2. Address FERC directives <em>Revised Critical Infrastructure Protection Reliability Standards</em>, 156 FERC ¶ 61,050 (2016) to address supply chain risk management.</td>
<td>CIPC will monitor standard drafting team activities to identify guidance opportunities. Status: PENDING (2018)</td>
</tr>
<tr>
<td>3. NERC and the Critical Infrastructure Protection Committee (CIPC) should develop an ongoing cyber vulnerability risk guidance process to inform and educate the industry.</td>
<td>CIPC will publish a vulnerability risk management guidelines. Status: PENDING (2017-2018)</td>
</tr>
<tr>
<td></td>
<td>Strategic Plan/Vision (2017-2018)</td>
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<td>4.</td>
<td>NERC should continue information sharing protocols among interdependent information sharing and analysis centers (ISACs).</td>
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<tr>
<td>5.</td>
<td>The E-ISAC should continue outreach to industry to increase registration and utilization of E-ISAC portal.</td>
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<tr>
<td>6.</td>
<td>The E-ISAC should mature the cybersecurity risk information sharing program (CRISP) and encourage expanded participation.</td>
</tr>
<tr>
<td>7.</td>
<td>NERC and the CIPC should prioritize lessons learned from regional and national exercises (e.g., GridEx) and publish lessons learned and guidelines as needed.</td>
</tr>
<tr>
<td>8.</td>
<td>Facilitate planning considerations to reduce the number/exposure of critical facilities.</td>
</tr>
<tr>
<td>9.</td>
<td>The industry should encourage the development of a peer review process for emerging risks.</td>
</tr>
<tr>
<td>10.</td>
<td>The industry should create and foster an internal culture of cyber awareness and safety.</td>
</tr>
</tbody>
</table>
11. NERC should develop effective metrics formulated to understand the trend of cyber-attacks and potential threats. The CIPC BES Security Working Group will continue its mission to develop, test, implement, and optimize security metrics to better understand the trend of cyber issues facing asset owners. Status: ONGOING

<table>
<thead>
<tr>
<th>Mid-term (3–5 year timeframe)</th>
<th>CIPC Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>12. The ERO Enterprise should develop feedback mechanism from CIP standards implementation to evaluate the standard and lessons learned from technology deployments.</td>
<td>The CIPC will monitor statistics for the most-violated requirements under the CIP standards to discover opportunities for new or better guidance. Status: ONGOING</td>
</tr>
<tr>
<td>13. The ESCC should operationalize the cyber mutual assistance framework to address recovery following a cyber-attack: a) Cross industry sharing of best practice incident response plans. b) Creation and/or expansion of security operations center(s) that incorporate the BPS (IT/OT convergence areas).</td>
<td>CIPC will be prepared to assist ESCC in its efforts where possible. Status: PENDING</td>
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</table>

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<thead>
<tr>
<th>Long-term (greater than 5-year timeframe)</th>
<th>CIPC Activities</th>
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</thead>
<tbody>
<tr>
<td>14. Assist industry efforts to address supply chain vulnerability</td>
<td>CIPC will monitor for opportunities to assist asset owners. Status: PENDING (2019-2022 workplan)</td>
</tr>
<tr>
<td>15. The ERO Enterprise and industry should develop agreed-upon levels of cyber-resilience suitable for BPS planning and operations.</td>
<td>CIPC will monitor for opportunities to assist the ERO Enterprise. Status: PENDING</td>
</tr>
</tbody>
</table>

| 16. The ERO Enterprise with industry, should develop methods, models, and tools to simulate cyber impacts on system reliability, enabling BPS planning to withstand an agreed upon level of cyber-resiliency. | CIPC will monitor for opportunities to assist the ERO Enterprise. Status: PENDING |
| 17. The ERO Enterprise with industry, should develop industry operating guidelines that incorporate an agreed-upon level of cyber-resilience. | CIPC will monitor for opportunities to assist the ERO Enterprise. Status: PENDING |
18. The ERO Enterprise should create and document pathways enabling the integration of new technologies, while maintaining or enhancing the agreed-upon level of cyber-resilience.

CIPC will monitor for opportunities to assist the ERO Enterprise

Status: PENDING

CIPC Work Plan

Risk Profile #9: Cybersecurity Vulnerabilities

The CIPC cyber security subcommittee and certain work groups under the operating security and policy subcommittees will address items from the near-term (one to two year timeframe) recommendations from the RISC report. Supply chain risk management is a topic being addressed by a new standard, and CIPC will be prepared to assist with guideline development or to offer technical assistance for the drafting team.

(See Appendix 1 for the current CIPC Work Plan)
Appendix 1: CIPC Work Plan 2017-2018

The CIPC will deliver on this strategy by undertaking the following work plan activities:

<table>
<thead>
<tr>
<th>CIPC Work Plan (1-2 years)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2017</strong></td>
</tr>
<tr>
<td><strong>Security Metrics</strong></td>
</tr>
<tr>
<td>Develop additional context around existing metrics</td>
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<tr>
<td><strong>2018</strong></td>
</tr>
<tr>
<td><strong>Develop one new metric</strong></td>
</tr>
<tr>
<td><strong>Collaboration</strong></td>
</tr>
<tr>
<td>Four regions will present security successes and challenges to the CIPC</td>
</tr>
<tr>
<td><strong>2018</strong></td>
</tr>
<tr>
<td>Remaining four regions will present security successes and challenges to the CIPC</td>
</tr>
<tr>
<td><strong>Test notion of having closed sessions at CIPC meetings</strong></td>
</tr>
<tr>
<td><strong>Identify joint OC/PC/CIPC project opportunities</strong></td>
</tr>
<tr>
<td><strong>Supply Chain</strong></td>
</tr>
<tr>
<td>Support the implementation of the new Reliability Standard</td>
</tr>
<tr>
<td><strong>Emerging Technologies</strong></td>
</tr>
<tr>
<td>Act as forum for discussions</td>
</tr>
<tr>
<td><strong>2018</strong></td>
</tr>
<tr>
<td>Monitor for new technologies</td>
</tr>
<tr>
<td><strong>GridEx</strong></td>
</tr>
<tr>
<td>Complete GridEx 3 recommendations</td>
</tr>
<tr>
<td><strong>2018</strong></td>
</tr>
<tr>
<td>Address GridEx 4 recommendations</td>
</tr>
<tr>
<td><strong>Guidance</strong></td>
</tr>
<tr>
<td>Prioritize emerging technologies guidance topics</td>
</tr>
<tr>
<td><strong>2018</strong></td>
</tr>
<tr>
<td>Develop new guidance</td>
</tr>
<tr>
<td><strong>Evaluate alternate delivery/development vehicles &amp; processes</strong></td>
</tr>
<tr>
<td><strong>Test alternate processes</strong></td>
</tr>
<tr>
<td><strong>Update connecting business networks guideline</strong></td>
</tr>
<tr>
<td><strong>Evaluate resiliency and vulnerability assessment best practices guideline</strong></td>
</tr>
<tr>
<td><strong>Publish new resiliency and vulnerability assessment best practices guideline</strong></td>
</tr>
<tr>
<td><strong>Update threat and incident response guideline</strong></td>
</tr>
<tr>
<td><strong>Develop vulnerability risk management guideline</strong></td>
</tr>
<tr>
<td><strong>Publish vulnerability risk management guideline</strong></td>
</tr>
<tr>
<td><strong>Comment Body</strong></td>
</tr>
<tr>
<td>Executive committee to study feasibility and logistics</td>
</tr>
<tr>
<td><strong>Implement recommendations</strong></td>
</tr>
</tbody>
</table>

Advisory Panel to Board

CIPC will fulfill this commitment with the following activities:

1. Provide reports of CIPC activities at the Board meeting.
2. Provide a representative to serve on the Reliability Issues Steering Committee (RISC).
3. Coordinate across all NERC committees and working groups to assure the highest degree of collaboration possible.
4. Encourage and solicit CIPC engagement and assist NERC staff as appropriate.
Appendix 1: CIPC Work Plan 2017-2018

Cyber and Physical Security Guidelines and Technical Reports
CIPC will continue to support the NERC Reliability Standards with the following activities:

1. Create and maintain appropriate Task Forces and Working Groups to develop, periodically review, and revise CIPC security guidelines.
2. Issue guidelines in accordance with the process described in Appendix 1 of the CIPC Charter.
3. Develop and issue technical reports that contribute to the reliable operation of the BPS.

NERC Standards Implementation and Compliance Input
CIPC will continue to support the NERC Reliability Standards with the following activities:

1. Assist in the development of guidance and implementation of NERC Reliability Standards.
2. Assist the standards development process by providing expertise in support of the development of critical infrastructure protection standard authorization requests and standards.
3. Assist the standards development process by providing a forum for education, sharing of views, and informed debate of critical infrastructure protection standards.
4. Facilitate the implementation of critical infrastructure protection standards by developing reference documents and performing other activities.
5. Contribute to the Compliance Operations and Enforcement initiatives at NERC through the Compliance and Enforcement Input Working Group (CEIWG) by providing timely topical expertise on matters related to cyber and physical security.

BES Security Metrics
The CIPC will provide technical insight and advice into the development and improvement of BES security metrics, and identify a set of security performance measures to benchmark BES security. CIPC will utilize the expertise of its members, NERC staff and others to provide direction, technical oversight, feedback on the collection of industry metrics, and reporting of BES security performance metrics.

The CIPC will continue to deliver recommendations with the following actions:

1. The BES Security Metrics Working Group (BESSMWG) will develop measureable security metrics of cyber and physical security threats to the BES and industry responses.
2. The BESSMWG will provide BES security metrics to the NERC annual State of Reliability report.
3. The BESSMWG will continue to develop additional context to existing metrics to assist asset owners and NERC to understand and react to dramatic changes in trends.
4. The BESSMWG will develop and implement one new metric for the 2018 NERC State of Reliability Report.

Public-Private Partnership
The protection of the BPS requires the prompt dissemination of security-related information between public and private stakeholders and across international boundaries.

The CIPC will deliver recommendations by the following actions:

1. Contribute expertise to government initiatives.
2. Act as a coordinating body for dissemination of information from government to CIPC members.
3. Develop and test logistics for holding closed-session meetings when needed.
4. Foster relations with the DOE National Labs to identify collaboration opportunities

Information Sharing

Common information-sharing protocols will enhance passage of information, ensuring that vital actionable information is disseminated quickly and accurately.

1. CIPC will study present protocols existing between industry and government. The Committee will continue to identify and research the information sharing structures, methods and requirements, and search for efficiencies and alternatives to improve or recommend changes in protocols.
2. CIPC will present recommendations to E-ISAC and NERC staff for consideration and improvement of the Public-Private Partnership, streamlining of the event reporting process for the industry with the E-ISAC, and the sharing of actionable information between government and industry.
3. Propose solutions that will build on practices and tools already in place.
4. CIPC quarterly meetings will be enhanced by the inclusion of regional information-sharing briefings. Once every two-years, voting members from each of the eight regions will deliver a briefing to CIPC (closed session if necessary) with the stated purpose of sharing security successes and challenges faced by each region.

Risks and Emerging Issues

CIPC, utilizing the expertise of its members and NERC staff, will stay abreast of new and emerging issues related to Critical Infrastructure Protection of the BPS and take action where appropriate to address these issues, and provide expertise, and direction to NERC and the electric industry.

1. CIPC will respond to the issues raised from the biennial GridEx by developing CIPC actions to address lessons learned by tasking CIPC Task Force and Work Group to develop recommendations.
2. CIPC will modify its work plan to directly address cyber and physical security recommendations identified in the RISC report.

CIP Training and Educational Outreach

The CIPC will deliver with the following actions:

1. CIPC will conduct exercises, forums, and workshops related to the scope of CIPC and in cooperation with NERC.
2. CIPC will collaborate with the E-ISAC to:
   a. Identify and prioritize current topics related to the scope of CIPC.
   b. Coordinate by requesting NERC resources, if necessary, to support its activities for the forums and workshops.
   c. Schedule security training and education.

CIPC Member and Industry Observer involvement

The Critical Infrastructure Protection Committee will deliver on this strategy by:

1. Encouraging and engaging CIPC voting member active participation.
2. Encouraging and engaging CIPC alternate members as active participants.
3. Encouraging and engaging industry observers as active participants.
4. CIPC Executive Committee will identify potential leadership candidates for subgroups.
5. CIPC subcommittees will review Task Force and Work Group rosters to identify gaps in expertise.
6. CIPC subcommittees will review Task Force and Work Group deliverables
7. CIPC Executive Committee will encourage and recognize excellence.
Personnel Certification Governance Committee Report

Action
Information

Background
This report summarizes the key activities of the Personnel Certification Governance Committee (PCGC) during 2016. The PCGC meets four times per year. Standing Task force meetings via conference call and/or webinar are held as needed between meetings. The fourth quarter 2016 meeting minutes are under review and pending approval. Draft minutes were posted to the NERC website during the fourth quarter of 2016.

Quarterly Metrics
There are several metrics tracked by the PCGC that are used to evaluate the efficacy of the System Operator Certification (SOC) program. Below is an overview of key metrics for 2016.

SOC Exam Development
The SOC Exam Development Metric (Figure 1) is used to track the development of SOC exams during the 36-month development cycle. The Exam Working Group (EWG) has reduced the previous 36-month development cycle to 24 months. Over the course of 2016, the EWG wrote new items to address gaps in the item pool; as well as, reviewed and edited items for accuracy, fairness, and ease of understanding. Selected industry members participated in an Item Writing Workshop in November 2016. All of these efforts resulted in new content outlines and new SOC exams. The new content outlines and new cut scores are published on the NERC website. The new exams will begin on February 13, 2017. The new exams will incorporate the Linear on the Fly Testing (LOFT) feature.

The LOFT capability offered by PSI has reduced the exam development cycle and increased the integrity of exams. The EWG has successfully written and vetted the required number of items to implement LOFT. All new items will continue to be vetted as pretest items prior to inclusion as a final scored item. The EWG will continue to write new items for the upcoming exams.

The metric below demonstrates the exam development cycle for the next set of exams.
Exam Development Activities Scheduled for 2017

- Revise SOC Exam Cycle: Jan-Feb 2017
- Publish New Exams: Feb. 13, 2017
- Items Review/Analyze Statistical Performance: Jan-Dec 2017
- Write New Items: Mar-Dec 2017
- Item Writing Workshop: TBD

System Operator Certification and Continuing Education Database (SOCCED) Availability Metric

The SOCCED Availability Metric is used to track the availability of the SOCCED Database. The metric reports the percentage of time both the website and Structured Query Language (SQL) server, used to support the database, are available. As the metric below demonstrates, both the website and SQL server were available 100 percent during 2016.

<table>
<thead>
<tr>
<th>Objective</th>
<th>Goal</th>
<th>Actual</th>
<th>Timeframe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Website Availability</td>
<td>99%</td>
<td>100%</td>
<td>2016</td>
</tr>
<tr>
<td>SQL Server Availability</td>
<td>99%</td>
<td>100%</td>
<td>2016</td>
</tr>
</tbody>
</table>

SOC Examination Pass Rate

The SOC Exam Pass Rate Metric is used to track the pass rate of the SOC exams for the period 2012-2016 (third quarter). Figure 2 compares the number of exams taken to the number of exams passed and Figure 3 provides the breakdown of exams based on exam credential type for 2016.
There are four Certified System Operator exams:

- **RC**: Reliability Coordinator
- **BT**: Balancing, Interchange, and Transmission
- **BI**: Balancing and Interchange
- **TO**: Transmission Operator

**Figure 2: SOC Exam Pass Rate by Exam 2012-2016 (3rd Qtr.)**

The average overall pass rate for all exams for 2012–2013 is 69.7 percent. The average pass rate for 2014 and 2015 is 76.3 percent. The total number of exams taken (650) through the third quarter of 2016 is slightly below the projected number of exams taken for the quarter (675). The average pass rate through the third quarter of 2016 is 72.7 percent.
While the percentage is trending downward, the RC exam continues to be the most popular credential among System Operators. The RC credential provides more flexibility to the system operator. The RC credential is also attractive to support functions within the utility industry such as Planners and EMS Engineers.

**SOC Program Budget**

Under Section 602.4.10 of the NERC Rules of Procedure, the PCGC shall have control over the matters related to the Personnel Certification and re-Certification Programs, without being subject to approval by any other body. Section 602.4.10 further states that financial matters related to the operation of the program shall be segregated from other NERC activities.

The Program Budget Metric tracks the SOC Program budget. While the financials for the SOC Program were not available in time for publication of the fourth quarter 2016 report, the 2016 third quarter Funding – Funding vs. Expenses (Figure 4), details the revenue received from SOC Exams taken and SOC Certifications renewed as compared to the expenses necessary to sustain the SOC Program.
Figure 4: PCGC - 2016 (3rd Qtr.) Funding

Figure 5 and Figure 6 detail the Exams Taken and Renewals (2012 – 2016 third quarter) which can affect the Actual vs. Budget for revenue.

Figure 5: Exams Taken Projected vs. Actual (2016-3rd Qtr.)

Third quarter 2016 system operator credential renewals (1333) are on track to meet the budgeted number of 1650 renewals for 2016.
Accomplishments for 2016

- Categorization of Exam Items in Item Bank
- Completed Program Manual Review and Update
- Completed PCGC Charter Review and Update
- Review and Update Appendix A (Based on Job Task Analysis results)
- French Translation of Item Bank
- Item Writing Workshop
- Test center options for Canadian provinces
- Review Exam Development Process
- Strategic Planning for Program future

Standing task forces have been created to provide deliverables related to each of the metrics included in this report. Each task force meets, outside of the quarterly meetings, as needed to address issues within their scope.

Future Tasks (2017)

- Publish New Exams (LOFT)
- Implement new SOCCED
- Development of a Certification Program white paper
- Identify and Implement Pre-requisites for NERC Certification
Standards Committee Report

Action
Accept the 2017-2019 Standards Committee Strategic Work Plan.

Background
The 2017-2019 Standards Committee Strategic Work Plan is presented with the understanding that the focus of standards development is on addressing a small number of Federal Energy Regulatory Commission directives, continuing with Periodic Reviews, and addressing emerging risks, including inputs from the Reliability Issues Steering Committee.

The Standards Committee offers the Strategic Plan for Board of Trustees acceptance.
Introduction
The 2017-2019 Standards Committee (SC) Strategic Work Plan (Plan) is presented with the understanding that Standards development activities will be focused on addressing Federal Energy Regulatory Commission (FERC) directives, continuing with Enhanced Periodic Reviews (EPRs), and addressing emerging risks, including input from the Reliability Issues Steering Committee (RISC) and the industry. The SC will continue to provide oversight for standards grading activities to evaluate Standards for quality and content, and prioritize standards development activities based on all of the above considerations.

Enhanced Periodic Review
As adopted by the SC in 2014 and implemented in 2016, all EPR projects involve the use of an EPR Template. Each EPR “Review Team” shall be comprised of: a Standing Team and a stakeholder Subject Matter Expert (SME) team, appointed consistent with the approach identified in Section 13 of the Standard Processes Manual. This chart helps illustrate the Review team composition.

**EPR Review Team Composition**

<table>
<thead>
<tr>
<th>Standing Team</th>
<th>SMEs Team</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Non-CIP Standards</strong></td>
<td><strong>The SC will appoint stakeholder SMEs for the particular standard(s) being reviewed. The SMEs will work together with the Standing Team to conduct its review of the standard(s) and complete the template below.</strong></td>
</tr>
<tr>
<td>Chairs of the following NERC Standing Committees¹:</td>
<td></td>
</tr>
<tr>
<td>• SC (Also, the SC chair or his/her delegate from the SC will chair the Standing Team)²</td>
<td></td>
</tr>
<tr>
<td>• Planning Committee (PC)</td>
<td></td>
</tr>
<tr>
<td>• Operating Committee (OC)</td>
<td></td>
</tr>
<tr>
<td>The Standing Team also includes a representative from NERC and the Regions. The Standing Team will meet with SMEs and help to ensure a consistent strategy and approach across all of the reviews.</td>
<td></td>
</tr>
</tbody>
</table>

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¹ Each committee chair may, at his or her discretion, delegate participation on the Standing Periodic Review Team to another member of his or her committee.

² The SC chair may delegate one member of the SC to chair one Standing Team’s review of a standard(s), and another SC member to chair a review of another standard(s).
CIP Standards | Chairs of the following NERC Standing Committees⁴:
- SC (Also, the SC chair or his/her delegate from the SC will chair the Standing Team)
- Critical Infrastructure Protection Committee (CIPC)

The Standing Team also includes a representative from NERC and the Regions. The Standing Team will meet with SMEs and help to ensure a consistent strategy and approach across all of the reviews.

The SC will appoint stakeholder SMEs for the particular standard(s) being reviewed. The SMEs will work together with the Standing Team to conduct its review of the standard(s) and complete the template below.

With consideration of stakeholder comments, the Review Team will indicate, for each Standard it has reviewed, the following indicators:

☐ REAFFIRM (GREEN)

☐ REVISE - Indicate whether the revisions are necessary to support reliability (RED), or discretionary (YELLOW) (Would include revision of associated RSAW.)

☐ REVISE OR RETIRE (RED) (Would include revision of associated RSAW.)
For those Red Standards, the Review Team shall develop a Standard Authorization Request for consideration by the SC.

Emerging Risks
The SC develops new or revised Standards, as appropriate, to address emerging risks. Standards required to address emerging risks may be identified, for example, by a NERC technical committee in conjunction with input from RISC or a governmental authority, such as FERC.

Vision, Mission and Guiding Principles

Vision
A comprehensive body of Reliability Standards that collectively helps to achieve an adequate level of reliability and promote the reliable operation of the North American bulk power system.

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³ Each committee chair may, at his or her discretion, delegate participation on the Review Team to another member of his or her committee.
Mission
For the SC to effectively manage and oversee the development of a comprehensive set of Reliability Standards that are aligned with NERC’s strategic goals through open and inclusive processes and procedures.

Guiding Principles

- Consistent with the 2017-2019 Reliability Standards Development Plan (RSDP), this Plan recognizes the transition of a Standard development process addressing a small number of FERC directives, EPRs, and emerging risks. The details of the goals and objectives for 2017-2019 are set forth in greater detail within the RSDP.

- SC continues to promote and implement a collaborative working environment with the other NERC Standing Committees, NERC Standards staff, stakeholders and standard drafting teams.

- SC continues to execute the Standards development process for the effective and efficient use of NERC and industry resources.

- SC continues to promote and take a leadership role on consensus building activities.

Work Plan

Task No. 1 – Implementation of Enhanced Periodic Review

- Project Management and Oversight Subcommittee and NERC staff to work together to present for SC endorsement, a prioritization and scheduling of 2017 EPRs. The 2016 EPR Standing Team’s grading of Standards shall be an input into the prioritization.

To be completed by end of February 2017.

Task No. 2 – Standards Grading

- NERC staff and the chair of the SC, or his delegate, (acting in the capacity of the Standing Team’s facilitator) will start the 2017 grading of Standards as soon as practicable, so to provide all involved (Standing Team, stakeholders) additional time to conduct and comment on the grading. As in 2016, the Standard grades will be presented to SC as an attachment to the RSDP and the SC will be requested to endorse that the process adopted for the grading of Standards meeting was followed. ④

To be completed by June 2017, if possible, but no later than the end of August 2017 to coordinate with the development of the 2018-2020 RSDP.

④ The SC endorsed the process for the grading of Standards at its 2016 March meeting.
Task No. 3 – Guidelines and Technical Basis

- SC leadership will work with NERC staff and Legal to develop a draft policy statement and/or draft revisions to the NERC Standard Processes Manual that set forth the process by which Guidelines and Technical Basis (GTB) documents developed by standard drafting teams are appropriately recognized by the Electric Reliability Organization (ERO) as a technically sound basis to promote an understanding of the requirements by the ERO, including auditors and registered entities. For clarity, GTB is not Compliance Monitoring and Enforcement Program Implementation Guidance as outlined in the Compliance Guidance Policy. SC leadership will provide proposal draft policy statement and/or draft revisions to the Standard Processes Manual to SC for endorsement.

To be completed by the March 2017, if not sooner.

Task No. 4 – Standards Committee Process Subcommittee (SCPS)

- NERC staff and the SCPS will endeavor to complete all currently ongoing projects and seek associated SC endorsement, with a priority on changes to Section 6, 7 and 11 of the Standard Processes Manual. This target for completion does not apply to new tasks added in 2017.

To be completed by December 2017.

Task No. 5 – Fourth Quarter Review of SC 2017-2019 Strategic Work Plan

- The SC will conduct a review of its 2017-2019 Strategic Work Plan and provide any changes for 2018-2020 to the SC for endorsement.

- The SC Executive Committee (SCEC) shall evaluate the need for additional reforms or enhancements to the SC Charter and provide any changes for 2018-2020 to the SC for endorsement.

To be completed by end of December 2017.
Reliability Issues Steering Committee Report

**Action**
Information

**Summary**
The Reliability Leadership Summit will be held on March 21, 2017, in Washington, DC. The Reliability Issues Steering Committee (RISC) met via conference call in December 2016 to discuss a draft agenda for the Reliability Leadership Summit, as well as a schedule for developing the 2017 ERO Reliability Risk Priorities Report. In an effort to better align with the strategic planning process and business plan and budget development, the final report will be presented to the Board of Trustees for approval in August 2017 instead of November. The RISC will hold its next meeting via conference call in mid-February to include the newly appointed RISC members and continue finalizing the agenda for the Reliability Leadership Summit.

Mr. Peter Brandien, chair of the RISC, will provide an update on RISC activities.
Compliance and Certification Committee Report

Action
Approve

Summary
The Compliance and Certification Committee (CCC) is providing its 2017 Work Plan for approval. The CCC approved its 2017 Work Plan on November 29, 2016. The attached plan reflects input and comments from NERC staff.

Additional Highlights

- Held CCC meeting in Arlington, VA at the NRECA offices on November 29-30, 2016. NERC’s Enforcement team conducted Hearing Training for the CCC membership. The focus of the meeting was on concluding the annual work plan activities and the kick-off for the Consistency Task Force collaboration with NERC leadership in response to the Board of Trustees request from the August and November 2016 meetings.

- The CCC’s ERO Monitoring Subcommittee (EROMS) presented the final results of the Electric Reliability Organization (ERO) Stakeholder Survey and associated recommendations to the CCC. The CCC took action without a meeting and approved the CCC ERO Enterprise Stakeholder Survey Report on December 23, 2017. The CCC also provides this report to NERC’s Enterprise-wide Risk Committee (EWRC) and will discuss the report at the February 2017 meeting.

- The CCC’s Organization Registration and Certification Subcommittee (ORCS) continues to support NERC in the review of NERC’s Organization Registration and Certification Programs (ORCP), as well as consideration of any possible Rules of Procedure changes in response to stakeholder input and program changes.

- The CCC is collaborating with NERC on potential outreach opportunities related to the Risk-based Compliance Monitoring and Enforcement Program (CMEP) in response to some of the recommendations from the feedback session at the CCC meeting in June 2016.

- The Compliance Processes and Procedures Subcommittee (CPPS) continues to participate in review and feedback on Reliability Standard Audit Worksheets to the CCC. The CPPS also provides compliance expertise as well as industry feedback in CMEP and ORCP areas in a number of specific areas, such as Compliance Implementation Guidance, new program document development (e.g., Inherent Risk Assessment and Internal Control Evaluations), development of an ERO Enterprise process to support the evaluation of consistency of CMEP and ORCP programs and support rollout of key activities as requested.

- The CCC received an application from the Nuclear Energy Institute (NEI) to become a Pre-Qualified Organization for purposes of being eligible to submit Implementation Guidance for potential endorsement by the ERO. This is the first request the CCC has received. CPPS and the CCC will administer NEI’s application in Quarter 1, 2017.

- The next CCC meeting will be March 15-16, 2017 in Atlanta, GA at the NERC offices.
NERC Compliance and Certification Committee
2017 Work Plan

NERC Board Approved: [Insert Date]
# Table of Contents

Preface ....................................................................................................................................................................... iii
Executive Summary ................................................................................................................................................... iv
Introduction ................................................................................................................................................................ v
Revision History ...................................................................................................................................................... v
2017 Work Plan Deliverables .....................................................................................................................................1
Key Strategic Activities ...............................................................................................................................................4
  Project 1 – Assist with Review of Information....................................................................................................4
  Project 2 – Feedback on CMEP Programs ..............................................................................................................4
  Project 3 – ERO Enterprise Risk Input ..................................................................................................................4
  Project 4 – Stakeholder Collaboration ...................................................................................................................4
  Project 5 – Program Support Efforts for CMEP and ORCP ..................................................................................4
Ongoing Responsibilities ............................................................................................................................................5
  ERO Enterprise Stakeholder Survey ......................................................................................................................5
  Independent Audit of Standard Processes Manual and Standards Applicable to NERC ........................................5
  NERC Self-Certifications ....................................................................................................................................5
  Enterprise-wide Risk Committee Work-Plan ..........................................................................................................5
  Review and Update of CCC Programs and Procedures ......................................................................................6
Logistics and NERC Budget Requirements for CCC Activities ..............................................................................7
  CCC Quarterly Meetings (Cost to be determined by NERC) ..............................................................................7
  Hearings and Appeals (Cost to be determined by NERC) ...................................................................................7
  Mediation (Cost to be determined by NERC) .........................................................................................................7
  CCC Program Audits/Review ...............................................................................................................................7
  WebEx/Conference Calls (Cost to be determined by NERC) ..............................................................................7
  Stakeholder Perception Survey (Cost to be determined by NERC) ....................................................................7
  Training (Cost to be determined by NERC) ............................................................................................................7
Preface

The North American Electric Reliability Corporation (NERC) is a not-for-profit international regulatory authority whose mission is to assure the reliability of the bulk power system (BPS) in North America. NERC develops and enforces Reliability Standards; annually assesses seasonal and long-term reliability; monitors the BPS through system awareness; and educates, trains, and certifies industry personnel. NERC’s area of responsibility spans the continental United States, Canada, and the northern portion of Baja California, Mexico. NERC is the electric reliability organization (ERO) for North America, subject to oversight by the Federal Energy Regulatory Commission (FERC) and governmental authorities in Canada. NERC’s jurisdiction includes users, owners, and operators of the BPS, which serves more than 334 million people.

The North American BPS is divided into eight Regional Entity (RE) boundaries as shown in the map and corresponding table below.

The North American BPS is divided into eight Regional Entity (RE) boundaries. The highlighted areas denote overlap as some load-serving entities participate in one Region while associated transmission owners/operators participate in another.

<table>
<thead>
<tr>
<th>RE</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FRCC</td>
<td>Florida Reliability Coordinating Council</td>
</tr>
<tr>
<td>MRO</td>
<td>Midwest Reliability Organization</td>
</tr>
<tr>
<td>NPCC</td>
<td>Northeast Power Coordinating Council</td>
</tr>
<tr>
<td>RF</td>
<td>ReliabilityFirst</td>
</tr>
<tr>
<td>SERC</td>
<td>SERC Reliability Corporation</td>
</tr>
<tr>
<td>SPP RE</td>
<td>Southwest Power Pool Regional Entity</td>
</tr>
<tr>
<td>Texas RE</td>
<td>Texas Reliability Entity</td>
</tr>
<tr>
<td>WECC</td>
<td>Western Electricity Coordinating Council</td>
</tr>
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Executive Summary

The purpose of this work plan is to identify the anticipated activities and deliverables of the North American Electric Reliability Corporation (NERC) Compliance and Certification Committee (CCC) for the year 2017. The plan is based on the responsibilities assigned to the CCC by the NERC Board of Trustees (Board) through programs across the Electric Reliability Organization (ERO) and tasks identified by the CCC that are required to fulfill these responsibilities. Additionally, the CCC identified projects and deliverables that will further support the goals of the ERO Enterprise Strategic Plan 2017-2020.

There are several main project areas on which CCC activities will focus:

1. **Objective and Risk-informed Compliance Monitoring, Enforcement, and Organization Registration and Certification**: As a committee providing support and advice but otherwise independent of the execution of NERC’s Compliance Monitoring and Enforcement Program (CMEP), Registration and Certification programs, the CCC will develop criteria to assess NERC’s adherence to the Rules of Procedure (ROP) for these programs on an ongoing basis. In a similar manner, as a committee independent of the NERC Reliability Standards development process, the CCC will develop criteria to assess NERC’s adherence to the ROP regarding the NERC Reliability Standards development process until such time as proposed changes to procedural rules are approved. In 2017, the CCC will continue to work with NERC staff and stakeholders to continue to refine the maturing and ongoing role for the CCC with respect to the ERO’s adherence to its processes, procedures, and statutory obligations in light of the maturation of the ERO and its processes as well as NERC’s internal audit functions.

2. **Effective and Efficient ERO Enterprise Operations**: Provide continued and ongoing input and support into the design of ERO Program development and revision efforts. The CCC will assist in identifying modifications for improvements and associated changes to the NERC ROP and associated documents or processes.

3. **Identification and Mitigation of Significant Risks to Reliability**: In 2017, the CCC will begin working with NERC staff and stakeholders to identify areas where collaboration with stakeholder committees will assist with the further development and maturation of successful risk mitigation and program administration to support the success of the ERO Enterprise.

4. **Identification of Emerging Risks to Reliability**: The CCC will participate in discussions on the continued development of risk metrics to further evaluate potential emerging issues or threats and trends to facilitate reliability of the Bulk Electric System (BES). The CCC will also identify necessary actions as inputs to NERC management.

The CCC has subcommittees performing certain assigned tasks on behalf of and under the supervision of the CCC. The CCC will use these subcommittees, along with NERC and Regional Entity staff, as the primary resource for projects and activities. The subcommittees include:

- Organization Registration and Certification Subcommittee (ORCS)
- Compliance Processes and Procedures Subcommittee (CPPS)
- ERO Monitoring Subcommittee (EROMS)
- CCC Nominating Subcommittee

The following pages represent an outline of the deliverables of the work plan and detailed project information.
Introduction

The CCC is a Board-appointed stakeholder committee serving and reporting directly to the Board. In that capacity under a NERC Board-approved charter,¹ and as approved by FERC² and set forth in NERC's ROP, the CCC will engage with, support, and advise the Board, NERC Board of Trustees Compliance Committee (BOTCC), and the NERC Board of Trustees Enterprise-wide Risk Committee (EWRC) regarding all facets of the NERC CMEP, Organization Registration program, Organization Certification program, and Reliability Standards Development Process.

The CCC will continue to partner with NERC leadership on key NERC initiatives and criteria for evaluation and assessment of the effectiveness of NERC programs. In order to support this endeavor, the CCC has developed this annual work plan to identify the activities that the CCC intends to perform in 2017 to fulfill the responsibilities the Board has established for the CCC.

The CCC provides for balanced discussion, commentary, and recommendations on compliance issues by bringing together a diversity of opinions and perspectives from NERC member sectors. Members are appointed to the CCC by the Board and serve on the committee at the pleasure of the Board.

Individuals deemed qualified to serve on the committee will generally include senior-level industry experts who have particular familiarity, knowledge, and experience in the areas of compliance, compliance enforcement, compliance administration and management, organization responsibilities and registration, organization certification, and NERC and Regional standards. These individuals are normally involved with internal compliance programs within their respective organizations. Committee members are expected to represent the interests of the sector they represent, to the best of their ability and judgment.

Revision History

<table>
<thead>
<tr>
<th>Date</th>
<th>Version Number</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>10/21/2016</td>
<td>1.0</td>
<td>Initial Draft - CCC Executive Committee and NERC review</td>
</tr>
<tr>
<td>11/29/2016</td>
<td>1.1</td>
<td>Version for CCC Approval</td>
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<td></td>
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<td>CCC Approved</td>
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</table>


2017 Work Plan Deliverables

The tables below summarize the list of CCC work plan deliverables for projects in 2017. Further details on the deliverables and projects are discussed in the next section by the project number identified below.

<table>
<thead>
<tr>
<th>Project Area: Support ERO Program Effectiveness and Efficiencies in CCC focus areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applicable ERO 2017-2020 Strategic Goal No. 5: The ERO supports and encourages transparency, consistency, quality, efficiency and timeliness of results, and operates as a collaborative enterprise. This supports various Contributing Activities as defined in the 2017-2020 ERO Strategic Plan.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Project #</th>
<th>Project Name</th>
<th>Activities</th>
<th>Schedule</th>
<th>Resource(s)</th>
</tr>
</thead>
</table>
| 1         | Assistance with Review of Information Production, Capture and Response | • Review information production for efficiency and effectiveness opportunities  
• Assist with evaluation of oversight and monitoring tools for issue resolution | Ongoing    | CCC Chair, ORCS Chair and Vice Chair |
| 2         | Feedback on CMEP Programs                                               | • Define problem set and categorize if possible  
• Identify solutions where necessary  
• Identify training if necessary | Q1-Q4 2017 | CCC, NERC Management            |

<table>
<thead>
<tr>
<th>Project Area: Participation in Risk Identification and Mitigation Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applicable ERO 2017-2020 Strategic Goal No. 4: Risks to Reliability – The ERO Enterprise identifies, evaluates, studies, and independently assesses emerging risks to reliability. This supports various Contributing Activities as defined in the 2017-2020 ERO Strategic Plan.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Project #</th>
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<th>Resource(s)</th>
</tr>
</thead>
</table>
| 3         | ERO Enterprise Risk Input                                               | • Provide stakeholder and subject matter expertise to NERC management in development of risk analysis and elements  
• Participate in and support RISC, Leadership Summit, and development of Risk Elements | Ongoing    | Past CCC Chair / CCC, RISC, NERC Management |
## Stakeholder Collaboration

- Identify industry stakeholder groups where CCC collaboration will strengthen ERO processes and approach

<table>
<thead>
<tr>
<th>#</th>
<th>Deliverable</th>
<th>Details</th>
<th>Status</th>
<th>Responsible</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ongoing</td>
<td>CCC, Stakeholder Committees</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Project Area: Continuous Improvement

**Applicable ERO 2017-2020 Strategic Goal No. 2:** The ERO Enterprise is a strong enforcement authority that is objective, fair, and promotes a culture of reliability excellence through risk-informed compliance monitoring, enforcement, certification and registration. ERO Enterprise compliance activities are risk-informed, efficient and effective. This supports various Contributing Activities as defined in the 2017-2020 ERO Strategic Plan.

<table>
<thead>
<tr>
<th>#</th>
<th>Program Support Efforts (CMEP, ORCP, SPM)</th>
<th>Details</th>
<th>Status</th>
<th>Responsible</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ongoing</td>
<td>CCC, NERC Management</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Participate in risk-based compliance assurance outreach and feedback discussions
- Support rollout of key activities or program revisions as requested
- Partnership with ERO Enterprise related to RSAW
- Reviews and associated actions with the Compliance Guidance Policy
- Evaluate programs and associated ROP sections for necessary efforts as program development occurs
Ongoing Responsibilities

Applicable ERO 2017-2020 Strategic Goal No. 2: The ERO Enterprise is a strong enforcement authority that is objective, fair, and promotes a culture of reliability excellence through risk-informed compliance monitoring, enforcement, certification and registration. ERO Enterprise compliance activities are risk-informed, efficient, and effective. This supports various Contributing Activities as defined in the 2017-2020 ERO Strategic Plan.

ERO 2017-2020 Strategic Goal No. 5: The ERO supports and encourages transparency, consistency, quality, efficiency and timeliness of results, and operates as a collaborative enterprise. This supports various Contributing Activities as defined in the 2017-2020 ERO Strategic Plan.

<table>
<thead>
<tr>
<th>Responsibility #</th>
<th>Project Name</th>
<th>Activities</th>
<th>Schedule</th>
<th>Resource(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ERO Effectiveness Survey</td>
<td>• Participate on the ERO Effectiveness Survey Advisory Group&lt;br&gt;Support development efforts for future surveys</td>
<td>Quarters I and 2 of 2017</td>
<td>CCC, EROMS, TalentQuest, NERC Management</td>
</tr>
<tr>
<td>2</td>
<td>Independent Audit of Standard Processes Manual and Standards Applicable to NERC</td>
<td>• Participate and support&lt;br&gt;Coordinate with NERC on criteria development, process, and assessment of adherence to SPM and SAN</td>
<td>Quarters I and 2 of 2017</td>
<td>CCC, Mechelle Thomas (NERC), and independent audit firm</td>
</tr>
<tr>
<td>3</td>
<td>NERC Self-Certifications</td>
<td>• Participate and support&lt;br&gt;Coordinate with NERC on criteria development, process, and assessment of adherence to NERC ROP</td>
<td>Quarters 2 and 3 of 2017</td>
<td>CCC, Mechelle Thomas (NERC), EROMS</td>
</tr>
<tr>
<td>4</td>
<td>Enterprise-wide Risk Committee (EWRC) Work Plan</td>
<td>• Provide input as requested by the EWRC&lt;br&gt;Fulfill advisory role as requested</td>
<td>Quarters I and 4 of 2017/ As requested</td>
<td>CCC Leadership, Mechelle Thomas (NERC), EWRC, and ERO Enterprise Management</td>
</tr>
<tr>
<td>5</td>
<td>Review and Update of CCC Programs and Procedures</td>
<td>• Continuous updates to CCC Procedures as changes occur in the ERO</td>
<td>Ongoing</td>
<td>CCC, NERC Management</td>
</tr>
</tbody>
</table>

Key Strategic Activities

Project 1 – Assist with Review of Information
- Receive reports for awareness from RE Management Group on Regional Consistency Tool (RCT) results and actions taken for issue resolution
- Participate in evaluation of oversight monitoring tools and real-time reporting capability versus historical look provided by Stakeholder survey
- Participate in review and evaluation of CMEP information for Industry created by NERC

Project 2 – Feedback on CMEP Programs
- Define specifics around registered entity’s inconsistency feedback to identify options for productive conversation and identify solutions
  - Opportunities for Consistency
  - Processes or outcomes

Project 3 – ERO Enterprise Risk Input
- Perform outreach efforts with stakeholders to gather input for emerging risks
- Participate and support Reliability Leadership Summit as opportunity occurs
- Participate in Reliability Issues Steering Committee (RISC)
- Participate in creation or evaluation of ERO Risk Elements

Project 4 – Stakeholder Collaboration
- Identify opportunities where the CCC can provide compliance expertise in collaboration with other industry stakeholder committees
- Strengthen committee collaboration and create joint work products, as necessary

Project 5 – Program Support Efforts for CMEP and ORCP
- Participate in continued outreach efforts to drive clarity in expectations and processes related to risk, controls and compliance within the Risk-based Compliance Monitoring and Enforcement Program (RB-CMEP)
  - IRA / ICE Case Studies – benefits and lessons learned
  - Survey inputs / Case studies / Recommendations
  - Outreach Events – Panel Discussions or support
  - Industry Implementation Updates – RB-CMEP experiences
- Hold periodic discussions to identify opportunities for improvement on specific issues and serve as a focus group working with ERO staff to drive specific improvements and information sharing.
Ongoing Responsibilities

ERO Enterprise Stakeholder Survey

- Participate on the ERO’s Effectiveness Survey Advisory Group
- Support development efforts of the ERO Effectiveness Survey by contributing input on survey objectives, content, and delivery in preparation for future surveys

Independent Audit of Standard Processes Manual and Standards Applicable to NERC

- Work with NERC management (Internal Audit) to develop criteria for the 2017 audits of the Standard Processes Manual (SPM) and Standards Applicable to NERC (SAN). Those Standards were still applicable for part of the audit period
- Provide subject matter expertise as observers for the audit
- Review audit report based on audit criteria as completed by the independent audit firm
- Monitor mitigation of any non-conformance audit findings

NERC Self-Certifications

- Develop self-certification forms and request NERC self-certify adherence to the ROP on a rotational basis dependent on cycle for independent audits for the following items:
  - Compliance Monitoring and Enforcement Program (CMEP)
  - Organization Registration and Certification Programs (ORCP)
  - Standards Applicable to NERC (SAN)
  - Standard Processes Manual (SPM)
- Coordinate with NERC to prepare a summary report of the results of NERC’s assessment for the Board through the EWRC

Enterprise-wide Risk Committee Work-Plan

- Work with NERC to provide input for the annual EWRC Work Plan
- Participate in advisory capacity as requested in planning for EWRC-identified Regional Entity (RE) Audits
- Review the criteria for annual RE Evaluations as required. Suggest modifications per procedure to this program and criteria as appropriate. Items to consider here may include the following:
  - Update criteria for assessing effectiveness of RE CMEP activities
  - Continue to assess how CMEP practices change after Risk-based CMEP implementation in regards to: (a) monitoring practices (as embodied in CCCPP-010 and also including assisting CPPS in the annual RE Audit Criteria work); (b) enforcement; and (c) Reliability Standards development
  - Update effectiveness criteria, based on input from NERC on progress, for program evaluation and identification of opportunities for improvement
Ongoing Responsibilities

- Update CCCPP-010 to incorporate any revised criteria to appropriately reflect expected program improvements, results, and evaluation
- Assist NERC with annual evaluation of goals, tools, and procedures of each RE CMEP to determine effectiveness of each RE CMEP, using criteria developed by the NERC CCC
- Work with NERC to address any concerns or input received from the REs
- Coordinate with the EWRC to determine the use of Spot Checks of NERC processes annually for those areas for which the CCC is responsible for monitoring in coordination with the EWRC
- Support EWRC to determine the use of third parties to conduct required audits per the NERC ROP

Review and Update of CCC Programs and Procedures

- Review CCC programs and procedures in consultation with NERC management to identify necessary changes and procedural review or approval requirements
  - Monitoring of ERO adherence to the NERC ROP and make recommendations for updates to the ROP as deemed necessary
  - Update procedures related to confidentiality for CCC members
Logistics and NERC Budget Requirements for CCC Activities

**CCC Quarterly Meetings (Cost to be determined by NERC)**
Assumptions: Four CCC meetings per year
- NERC staff attendance
- NERC travel expenses
- Hotel (Conference rooms if applicable – normally hosted at stakeholder locations or NERC offices)
- Food

**Hearings and Appeals (Cost to be determined by NERC)**
Assumptions: No hearings expected, but noted here as a placeholder
- Administrative Law Judge’s fee
- Hearing refresher training (if applicable, administered by NERC Legal Staff in 2016)
- Transcription costs
- Travel expenses

Note: The CCC conducted hearing training in 2016. The need to conduct the training again is dependent on CCC membership turnover or those CCC members that have not received training. CCC will notify NERC and the Board if additional hearings are expected that would require an increase to the budget.

**Mediation (Cost to be determined by NERC)**
Assumptions: No mediations expected, but noted here as a placeholder
- Mediator fee and travel expenses

**CCC Program Audits/Review**
Assumptions: Audit/Review using an Independent Contractor
- Audit frequency changes dependent on NERC internal monitoring capability as it continues to mature, based upon recommendations of independent reviewer
- There are scheduled audits in 2017 with planning beginning in Q4 of 2016

**WebEx/Conference Calls (Cost to be determined by NERC)**
Assumptions: Three CCC/Subcommittees NERC WebEx or conference calls quarterly

**Stakeholder Perception Survey (Cost to be determined by NERC)**
Assumptions: At the request of the NERC Board, the CCC previously engaged a professional survey firm to conduct stakeholder perception surveys. The stakeholder survey has now been combined with the ERO effectiveness survey.

**Training (Cost to be determined by NERC)**
Assumptions: Half day of hearing training appended to regular CCC meeting every even year. Five to ten CCC members should be trained with capability to assist with observation and audit criteria for audits of NERC. This training will be conducted annually or as needed.
TO: NERC Board of Trustees (BOT)

FROM: Thomas J. Galloway, NATF President and CEO

SUBJECT: NATF Periodic Update to the NERC BOT – February 2017

Attachments: 1. Selected Program Highlights (Practices, Training)

The North American Transmission Forum (NATF) mission is to promote excellence in the reliable operation of the electric transmission system, with the vision to see reliability continuously improve. To augment our strategic goals, the NATF has focused on several topics that serve as the base for external collaboration. In both 2016 and 2017 (to date) those focus areas were:

1. Resiliency / Security (tangible actions to improve response and recovery for all relevant hazards)
2. Human Performance (reduced frequency and consequences of human error)
3. Equipment Performance and Asset Management
4. Operating Experience Exchange – cause analyses, corrective action, and lessons learned
5. Continuous performance improvement mechanisms / processes including risk reduction

Over the last several years the Reliability Issues Steering Committee (RISC) priorities have matured and stabilized. There has been considerable discussion between NERC, RISC, Technical Committees, Trades, NATF, and others about the opportunity to focus on RISC priorities presence in terms of advancing reliability, security, and resiliency; leveraging strengths of various organizations; and avoiding duplicative effort. The NATF supports added emphasis on RISC priorities for these reasons. Over the next few months NATF plans to progressively identify those RISC priorities and associated actions most on-point with NATF’s mission, vision, strengths, and focus for prospective leadership. An initial assessment is listed below:

<table>
<thead>
<tr>
<th>#</th>
<th>RISC Priority Description</th>
<th>NATF Role</th>
<th>RISC Rec#s</th>
<th>NATF Focus Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Changing Resource Mix</td>
<td>Low</td>
<td>6</td>
<td>Share lessons learned and develop superior practices regarding priorities 1-2 as pertain to Transmission</td>
</tr>
<tr>
<td>2</td>
<td>Bulk Power System Planning</td>
<td>Low</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Resource Adequacy &amp; Performance</td>
<td>Low</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Asset Management &amp; Maintenance</td>
<td>High</td>
<td>1-10</td>
<td>Continue progress on well-established practice groups to identify and prioritize equipment performance (unique equipment, related processes) issues.</td>
</tr>
<tr>
<td>5</td>
<td>Human Performance / Skilled Workforce</td>
<td>High</td>
<td>1-4, 5-7</td>
<td>Continue progress on well-established practice group to consistently implement tools which reduce error frequency and consequence. Grow near-miss reporting. Evolve training offerings and knowledge transfer techniques to support needed workforce skills.</td>
</tr>
<tr>
<td>6</td>
<td>Loss of situational awareness</td>
<td>Med</td>
<td>5,6, 8-12</td>
<td>Evolve existing focus group to support improved situational awareness (tools, training, procedures) for normal and off-normal situations.</td>
</tr>
<tr>
<td>7</td>
<td>Extreme natural events</td>
<td>Low</td>
<td>6-8, 10</td>
<td>Include relevant aspects in overall resiliency efforts.</td>
</tr>
<tr>
<td>8</td>
<td>Physical security vulnerabilities</td>
<td>Med</td>
<td>3,5, 7-17</td>
<td>Evolve existing well-established practice groups to incorporate maturity models. Synch security efforts with overall resiliency efforts.</td>
</tr>
<tr>
<td>9</td>
<td>Cybersecurity vulnerabilities</td>
<td>Med</td>
<td>3, 9, 10, 13a</td>
<td></td>
</tr>
</tbody>
</table>

*All effort linked through NATF programs (peer reviews, assistance, training, practices, etc.)

www.natf.net
The NATF shares many common objectives with NERC. To advance these common objectives, and avoid redundant or conflicting efforts, we have undertaken periodic coordination meetings between the senior leadership of both organizations. The last session was completed January 23, 2017 with future meetings in April, July, and October. January agenda topics included:

1. NERC RISC priorities
2. Resiliency / Security
3. NERC data sharing to NATF
4. Equipment Performance Issues
5. Joint HP Conference Status
6. Vegetation Management
7. Misoperation Reduction / Measure Definitions
8. Information Sharing / Compliance Implementation Guidance

Also, given the extremely complex and dynamic nature of the industry currently, the NATF has decided to make certain, specific work-products available beyond the membership. Two noteworthy areas involve recent NATF work on both physical security and modeling.

NATF member subject matter experts (SMEs) have produced high-quality work-products on both of these topics. And, with NATF Board concurrence, we have decided to make selected documents public – to the benefit of the entire industry. Such documents are available via www.natf.net and are listed below.

- NATF TPL-001-4 and Transient Voltage Criteria reference documents
- NATF Modeling Data Request Guide (MOD-032)
- NATF Reference Documents – CIP-014 R1, R4 and R5
- NATF Reference Document – Generator Specifications
- NATF Reference Document – Power Flow Modeling
- NATF Reference Document – Reporting and Verification of Generating Unit Reactive Power Capability for Synchronous Machines

*We plan to make other selected NATF work-products available outside the membership on a case by case basis.*

cc:
NATF: R. Carter, K. Keels, C. Sills, Letter Log
Attachment 1: Selected Program Highlights

**Practices**

**Practices/Products Developed in 2016**
- TPL 001-4 Reference Document*
- Transient Voltage Criteria Reference Document*
- Next Terminal Out Assessment Guide
- Nuclear Plant Interface Requirements Training
- Concept of Operations for Central Security Control Center
- Protection Systems - Automated Testing
- Short Circuit Modeling
- Risk Assessment
- Job Task Analysis Practice
- Instructor Curriculum
- Simulator Training
- HP Roadmap

**Practices/Products in progress**
- DC Trip Circuit Design & Testing
- Arrestor Testing
- Switchyard Risk Evaluation and Mitigation
- Alarm Process Monitor
- Real-Time Data Quality Management
- Vegetation Management Contractor Workforce
- Vegetation Management Easements
- System Protection Coordination
- Protection System Maintenance and Testing
- Situational Awareness
- Power Line Carrier
- Outage Coordination
- SF6 Breaker Power Factor Testing
- Systematic Approach to Training
- System Protection Commissioning

*Open Distribution (public) documents posted to www.natf.net
Training

**Risk Assessment/Internal Controls Webinars**
- Internal Control Framework and Governance
- Risk Assessment
- Internal Control Design and Implementation
- Monitoring and Testing of Internal Controls

**System Protection Webinars**
- Directional Element Settings Practices
- Directional Comparison Blocking Settings Practices

**Training Modules**
- Electrical Transmission Basics
- System Loads, Transmission Facilities, Generation Unit Basics, Relay Applications
- Causal Analysis

**Future**
- Human performance error reduction “Roadmap” and supporting materials
- System protection basics
On Thursday December 8, 2016, the NAGF participated on a WebEx discussing the Generator Event Survey that will be undertaken as a part of the Frequency Response Initiative. The WebEx was hosted by NERC in coordination with Troy Blalock, SCANA. The goal of the WebEx was to inform Generator Owners of the need to ensure they are capable of providing frequency response and to discuss the process for completing the Generator Survey. The NAGF continues to drive the effort to ensure frequency response and has been successful with having members exchange implementation guidance with other members.

The NAGF as a member of the Event Analysis Subcommittee will be leading the review of the Generating Unit Winter Weather Readiness Reliability Guideline. Members of the NAGF Cold Weather Preparedness Working Group will be working with other members of the EAS to review the Guideline and provide feedback on best practices.

The NAGF has begun discussions with EPRI to evaluate opportunities to collaborate on generator cyber security by integrating industry best practices with EPRI research. The discussions are evaluating opportunities to:

- Develop an array of control system reference architectures that could be applied in securing both legacy and future generating sites
- Develop cyber security guidelines for generator control systems
- Create a cyber security strategy and collaboration online exchange site to enhance practices to adapt to new threats