NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Agenda
Reliability and Security Technical Committee

June 10, 2020 | 1:00–5:00 p.m. Eastern

Attendees Click Here: Join Webinar

Call to Order

NERC Antitrust Compliance Guidelines and Public Announcement

Introductions and Chair's Remarks

1. **Administrative items**
   a. Arrangements
   b. Announcement of Quorum
   c. Reliability and Security Technical Committee (RSTC) Membership 2020-2023*
      i. RSTC Roster*
      ii. RSTC Organization
      iii. RSTC Charter
      iv. Parliamentary Procedures*
      v. Participant Conduct Policy

Consent Agenda

2. **Minutes* - Approve**
   a. March 3-4, 2020 Critical Infrastructure Protection Committee (CIPC) Meeting*
   b. March 3-4, 2020 Operating Committee (OC) Meeting*
   c. March 3-4, 2020 Planning Committee (PC) Meeting*
   d. March 4, 2020 RSTC Meeting*
3. **State of Reliability Report – Endorse**

Regular Agenda

4. **Remarks and Reports**
   a. Remarks – Greg Ford, RSTC Chair

i. Subcommittee Reports included in agenda package*

b. Report of May 14, 2020 Member Representatives Committee (MRC) Meeting and Board Meeting – Chair Ford

5. **RSTC Action Items Review*** – Information – Vice Chair David Zwergel
6. **MOD-025 White Paper*** – Approve –Shawn Patterson, Chair PPMVTF
7. **Inverter-based Resources Performance Task Force Standards Authorization Requests** – Endorse – Jeff Billo, Co-Chair, IRPTF
8. **Resources Subcommittee Revised Scope*** – Approve – Sandip Sharma, Chair
9. **Security Guideline: BCSI Cloud Encryption*** – Accept – Marc Child, CIPC Chair
10. **Compliance Implementation Guidance: Cloud Solutions and Encrypting BCSI*** – **Approve** – Marc Child, CIPC Chair
11. **Electromagnetic Pulse Task Force Update*** – Information - Chair Aaron Shaw, AEP and Vice-Chair Rey Ramos, Southern Company
12. **RSTC Transition Plan** – Discussion – Chair Ford
    a. Transition Team Activities* – Kayla Messamore, RSTC
    b. Subgroup Organization – Stephen Crutchfield
    c. RSTC 2020 Calendar Review

2020 Meeting Dates	Time	Location	Hotel
September 15, 2020	1:00 to 4:00 p.m.	Converted to a Call/Webex	None
December 15, 2020 December 16, 2020	1:00 to 5:00 p.m. 8:00 a.m. to 12:00 p.m.	TBD – Based on COVID-19 Guidelines	TBD

13. **Technical Committees Update* – Information – Vice Chair David Zwergel**
14. **Forum and Group Reports** – Information
    a. North American Generator Forum – Allen Schriver
    b. North American Transmission Forum* – Roman Carter
15. **Chair's Closing Remarks**
16. **Adjournment**

*Background materials included.

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Antitrust Compliance Guidelines

I. General

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

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

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

II. Prohibited Activities

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

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

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

III. Activities That Are Permitted

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

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

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

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

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

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

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Minutes DRAFT
Critical Infrastructure Protection Committee Meeting

March 3, 2020 | 1:00-5:00 p.m. Eastern
March 4, 2020 | 8:00 a.m.-12:00 p.m. Eastern

Atlanta Marriott Marquis Hotel
265 Peachtree Center Avenue
Atlanta, GA 30303

Call to Order

Chair Marc Child called the meeting to order at 1:00 p.m.

NERC Antitrust Compliance Guidelines, Public Announcement, and Participant Conduct Policy

Introduction and Chair's Remarks

Chair Child welcomed guests including Ken DeFontes, incoming Chair of NERC's Board of Trustees (Board); Greg Ford, incoming Chair of the Reliability and Security Technical Committee (RSTC), and Amanda Sramek from the American Gas Association (AGA), who would make a presentation about the increased interrelationship between providers of electricity and natural gas.

There were approximately 120 attendees, including Critical Infrastructure Protection Committee (CIPC) members, presenters, NERC staff, government representatives, and other interested individuals.

Agenda Items

1. **Administrative Items – Secretary Tom Hofstetter, NERC**
   a. The standard NERC announcements about NERC's anti-trust policies and notice of public meeting were presented. Hotel staff described safety policies and procedures.
   b. Presentations and recognition commemorated the end of the Committee's scheduled activities:

      Chair Marc Child received a plaque and proclamation, thanking him for his service

      Current and all previous CIPC Chairs were recognized with a commemorative t-shirt. In addition, books containing NERC's history were distributed to the chair, vice chairs, previous chairs, and two long-time working group chairs: Larry Bugh, RF, and Paul Crist, LES.

      Chair Child's concluding remarks expressed appreciation to committee members, industry participants, trade groups and associations, and NERC staff for their support and efforts during CIPC's existence.

c. Declaration of CIPC Quorum

Quorum was confirmed with 22 of 24 CIPC members present; there was one proxy: Richard Field represented NRECA on behalf of Robert Richhart.

d. Parliamentary Procedures – In the absence of specific provisions in the CIPC Charter, the committee shall conduct its meetings guided by the most recent edition of Robert's Rules of Order, Newly Revised.

e. Participant Conduct Policy

f. Introductions: See the attached list of meeting attendees

g. CIPC Roster

Consent Agenda* – Approve

2. Minutes*

There were no additions or corrections to the minutes of the CIPC meeting of December 10-11, 2019; they were approved unanimously by a voice vote.

Regular Agenda

3. Remarks and Reports

a. Work Plan Transition* – Chair Child

Chair Child reviewed the status of the CIPC work plan, emphasizing projects and activities that will continue but tracked by the RSTC. It is expected that CIPC's three existing working groups will continue their current activities. New tasks in the 2020 CIPC work plan will be addressed by the RSTC.

b. Election Report: EC At-Large Members—Secretary Hofstetter

An email vote was conducted between meetings to re-elect the sitting CIPC EC members, extending their terms until CIPC was retired. Quorum was reached with the vote and the motion was unanimously approved.

4. Agency Updates

a. Federal Energy Regulatory Commission – Simon Slobodnik, FERC OER

Mr. Slobodnik addressed the recent Notice of Inquiry that is intended to provide FERC with information about virtualization and cloud computing service issues.

b. Department of Energy – No report

c. Department of Homeland Security – No report

d. Public Safety Canada – No report

5. NERC Updates

a. Compliance – Lonnie Ratliff, NERC

Mr. Ratliff discussed ongoing collaborative activities with ERO auditors and CIPC's Compliance Input Working Group (CIWG). Current efforts include a document that maps the CIP Reliability Standards to standards developed by the National Institute of Standards and Technology (NIST).

b. Supply Chain – Howard Gugel, NERC

Mr. Gugel addressed NERC's staff response to the Board concerns about supply chain risks and low impact BES cyber systems. He noted the challenge for staff and stakeholders to understand how to recognize "successful" supply chain security.

c. Standards Development

There were reports from three Standard Drafting Teams that are working on updates to the CIP Reliability Standards. Representatives discussed their respective team's goals, activities, and next steps.

i. 2016–02 Modifications to CIP Standards – Jay Cribb, Southern Co.

Mr. Cribb discussed the challenges and opportunities as three teams seek to work efficiently while avoiding potential conflicts that could result from simultaneous work on the same set of standards. He also highlighted upcoming outreach efforts to industry.

ii. 2019–02 BCSI Access Management* – John Hansen, Exelon

Mr. Hansen provided a project overview and discussed team activities. The most recent ballot had a low approval rate and the team is working on responding to the large number of comments that were received with the votes.

iii. 2019–03 Supply Chain Risks* – Tony Hall, LG

Mr. Hall reminded attendees to vote since there was a ballot currently underway. He also spoke about the approach to issues raised by FERC in a directive regarding supply chain security.

6. Reliability Issues Steering Committee Update (RISC) – Chuck Abell, Ameren

Mr. Abell discussed recent changes that have resulted in a single RSTC representative to RISC as opposed to three representatives who previously represented the three technical committees. He also gave overview of the risk profiles described in the 2019 RISC report and highlighted potential security implications in risks that are not specifically identified as "security."

7. E–ISAC Updates

a. E–ISAC long term plan and highlights; Cyber Security – Sam Chanoski, E-ISAC

Mr. Chanoski provided an overview of security-related issues with actual or possible impact to industry, particularly in the area of cyber security. He also gave an update on recent activities and personnel changes affecting E-ISAC.

b. Physical Security* – Benjamin Gibson, E-ISAC

Mr. Gibson described recent activity identified primarily from reports shared by industry partners, and encouraged attendees to review and update their business continuity plans in light of the escalating concerns about theCOVID-19 pandemic.

c. E–ISAC Physical Security Advisory Group (PSAG) – Michael Bowen, E-ISAC

Mr. Bowen discussed a white paper currently under development that will assist organizations with the development of physical security programs. He also noted the plan to conduct three Design Basis Threat workshops held this year.

8. National Laboratory Updates

a. Oak Ridge National Laboratory – Stacy Prowell, ORNL

Mr. Prowell explained a tool under development that can discover malevolent software that cannot be detected by most forensic tools. He explained the challenges and goals of the effort, highlighting its potential value if it is ultimately adopted by device manufacturers.

b. Argonne National Laboratory – James Kavicky, ANL

Mr. Kavicky focused on ongoing: efforts to improve gas/electric resilience and situational awareness by providing a consolidated view of public gas pipeline information.

c. Idaho National Laboratory – No report

d. Pacific Northwest National Laboratory – No report

9. Research and Development Updates

a. EPRI* – Tobias Whitney, EPRI

Mr. Whitney discussed an EPRI project that is focused on resilient precision navigation and timing (PNT) for the electricity industry, a topic that was addressed by an Executive Order in February 2020. He indicated that the issue poses both operational and cyber security risks.

10. Industry Group Updates

a. CEA: Canadian Legislative Highlights – Doug Currie, Hydro One

Mr. Currie discussed recent CEA security activities and events. The after action report from a recent energy sector tabletop exercise was expected to be published soon, and would include recommendations for improving future exercises.

b. EEI: U.S. Legislative Highlights* – Andrea Koch, EEI

Ms. Koch reviewed recent appointments and position changes in the Department of Energy. She also gave an overview of legislation of interest to industry and discussed the 2021 budget proposal.

c. North American Generator Forum (NAGF)* – No report

d. North American Transmission Forum (NATF)* – Ken Keels, NATF

Mr. Keels summarized the various products and resources available from NATF, some limited to member-only distribution but others available to industry at large. He also discussed outreach activities, especially in the area of supply chain security.

e. EnergySec – Steve Parker, EnergySec

Mr. Parker announced the receipt of a recent grant from the Department of Labor. It will be used to conduct a work based learning program that will provide participants with industry experience and training.

f. American Gas Association – Amanda Sramek, AGA

Ms. Sramek gave an overview of AGA and the scope of its member's responsibilities in light of the increasing interdependence between the electricity and natural gas sectors. She also highlighted deliverables that cross sector working groups are addressing to increase engagement and identify areas where coordination is necessary.

11. Policy Working Group Updates – Chair Jeffrey Fuller, AES Corporation

a. Compliance Input Working Group (CIWG)* – Chair Paul Crist, Lincoln Electric System

i. Cloud Implementation Guidance

(1) Federal Risk and Authorization Management Program (FedRAMP)

(2) Bulk Electric System Cyber System Information (BCSI)

(3) Tabletops

Mr. Crist discussed the CIWG's efforts to develop compliance guidance for cloud computing security, after which Alice Ireland, Tri-State Generation & Transmission Association, provided an overview of two documents being prepared by the BCSI team that she leads. Mr. Crist also addressed the increased collaboration as the CIWG supports ERO Compliance by providing feedback about tools and resources.

12. Operating Security Working Group Updates – Chair Chuck Abell, Ameren

a. Grid Exercise (GridEx) Working Group (GEWG)* – Chair Jake Schmitter, E–ISAC

While providing a summary of the "lessons learned" report, Mr. Schmitter said that GridEx V was the largest GridEx yet, with an estimated 7000 participants. Feedback indicated that participants that collaborated closely with their Reliability Coordinator planning team had the most success and satisfaction from the exercise.

b. Supply Chain Working Group (SCWG)* – Chair Tony Eddleman, NPPD

Chair Eddleman gave an overview of the SCWG's accomplishments in 2019, which included the development and publication of several guidelines as well as a widely distributed "letter to industry" that contained information for industry suppliers. In 2020, more guidelines are expected as well as a webinar series that features discussions about each guideline.

13. Cybersecurity Working Group Updates – Chair Brenda Davis, CPS Energy

a. Security Training Working Group (STWG) – Chair Amelia Anderson, CenterPoint Energy

Ms. Anderson reported that the STWG training event immediately prior to the CIPC meeting focused on supply chain security tools, processes, and recommendations. Nearly 70 attendees participated in that event.

14. Physical Security Working Group Updates – No report

15. Roundtable (Open Discussion)

a. Security outreach working group

Chair Child led discussion about the desire expressed by many attendees to continue the momentum that has been the hallmark of CIPC's efforts, especially as industry has become more aware of the relevant activities of the national laboratories and other partner organizations. Secretary Hofstetter recommended to attendees that they also seek to participate in security activities that are conducted or coordinated by the Regional Entities.

b. Disposition of archived documents

Chair Child discussed plans and options for organizing and archiving CIPC records. While the RSTC's processes are still being developed, CIPC's information will not be lost.

16. Schedule of Important Dates:

CIPC 2020 Event Calendar					
Dates	**Time**	**Event**	**Location**	**Venue**	**Remarks**
June 10, 2020 June 11, 2020	1:00 p.m. – 5:00 p.m. 8:00 a.m. – 5:00 p.m.	RSTC Meeting	Webinar only	N/A	

17. Closing Remarks and Action Items

Chair Child closed the meeting with personal observations about his role with CIPC and tenure as chair, noting the Cooperative Principle of "utilities helping utilities." The full text of his comments is attached.

18. Adjournment: The meeting adjourned at 11:32 a.m. on March 4, 2020

*Background materials included.

Attendees

Attendee	Name	Company
Aaron	Williams	Southern Company
Alice	Ireland	Tri-State Generation & Transmission
Allan	Wick	Tri-State Generation & Transmission
Amanda	Sramek	American Gas Association
Amelia	Anderson	CenterPoint Energy
Andrea	Koch	EEI
Andy	Dodge	Verve Industrial Protection
Anthony	Hall	LG&E and KU Services Company
Benjamin	Gibson	E-ISAC
Benny	Naas	Vectren
Betsy	Williams	IPKeys Power Partners LLC
Bill	McEvoy	OSISOFT
Boyd	Nation	Verve Industrial Protection
Brenda	Davis	CPS Energy
Brian	Allen	NERC
Brian	Hogue	NPCC
Brian	Irish	Salt River Project
Brian	Millard	Tennessee Valley Authority
Brian	Yewell	NextEra
Carla	Kilgore	Tennessee Valley Authority
Charles	Abell	Ameren
Conor	Martin	Arizona Public Service
Damon	Ounsworth	SaskPower
Darrell	Klimitchek	South Texas Electric Cooperative, Inc.
Darren	Nielsen	Guidehouse
Dave	Cates	ACES Power
David	Grubbs	City of Garland
David	Revill	Georgia System Operations Corporation
Donald	Roberts	Southern Company
Doug	Currie	Hydro One Networks
Duane	Davidson	Duke Energy
Dustin	Cornelius	Southern Company Transmission EMS
Edison	Elizeh	Bonneville Power Administration
Elaine	Bell	NYISO
Eric	Byres	aDolus Inc.
Eric	Cardwell	ABB Power Grids
Eric	Howell	SERC Reliability Corporation
Erick	Reynolds	Avigilon
Gilbert	Perez	NextEra
Greg	Ford	Georgia System Operations Corporation

Attendee	Name	Company
Howard	Gugel	NERC
Jake	Schmitter	E-ISAC/NERC
James	McNierney	New York Independent System Operator, Inc.
Jason	Cornwell	Southern Company Services
Jay	Cribb	Southern Company
Jeff	Judy	Entergy
Jeff	Rozek	EY
Jeffrey	Fuller	AES
Jim	Kavicky	Argonne National Laboratory
Jim	McGlone	FERC
Jimmy	Dominguez	Tri-State Generation & Transmission
Jodi	Jensen	Western Area Power Administration
Joe	Doetzl	ABB Power Grids
John	Breckenridge	Evergy
John	Greaves	Southern Company
John	Hansen	Exelon
John	Tracy	Tennessee Valley Authority
Josh	Powers	Southwest Power Pool (SPP)
Josh	Sandler	EY
Joshua	Okoniewski	FERC
Justin	Kelly	SERC Reliability Corporation
Keith	St. Amand	MISO
Ken	Keels	North American Transmission Forum
Kena	Rogers	Entergy
Kenneth	DeFontes Jr	NERC
Krista	Koors	Burns & McDonnell
Larry	Bugh	ReliabilityFirst
Larry	Watt	Lakeland Electric
Lonnie	Ratliff	NERC
Madhava	Utagikar	LCRA
Maggy	Powell	Amazon Web Services
Marc	Child	Great River Energy
Mark	Givens	Entergy
Mark	Henry	Texas RE
Mary	Parker	EnergySec
Masuncha	Bussey	Duke Energy
Matthew	Schwartz	Network & Security Technologies, Inc.
Melissa	Birchler	GE Renewable Energy
Michael	Andrews	AMICO Security
Michael	Bowen	E-ISAC
Michael	Hagee	SERC Reliability Corporation

Attendee	Name	Company
Michael	Sanders	Southern Company
Nacy	Mille	Entergy
Nathan	Shults	Kiewit
Nicholas	Morton	American Electric Power
Patrick	Glunz	Nebraska Public Power District
Paul	Crist	Lincoln Electric System
Peter	Scalici	NPCC
Richard	Field	Hoosier Energy
Roger	Fradenburgh	Network & Security Technologies
Ryan	Carlson	Proven Compliance Solutions
Sam	Chanoski	E-ISAC/NERC
Samantha	Baird	Tennessee Valley Authority
Scott	Crow	FoxGuard Solutions
Scott	Miller	MEAG Power
Scott	Mix	Pacific Northwest National Laboratory
Scotty	Barron	Cooperative Energy
Sharla	Artz	UTC
Sheranee	Nedd	Public Service Enterprise Group
Simon	Slobodnik	FERC
Stacy	Prowell	Oak Ridge National Laboratory
Steen	Fjalstad	MRO
Stephanie	Lawrence	NERC
Steve	Parker	EnergySec
Steven	Briggs	Tennessee Valley Authority
Steven	Dougherty	IBM
Stuart	Brindley	S. J. Brindley Consulting Inc.
Suzanne	Black	ISO-NE
Talha	Siddiqui	aDolus Inc.
Thomas	Peterson	Proven Compliance Solutions
Tobias	Whitney	EPRI
Tom	Hofstetter	NERC
Tom	King	Oak Ridge National Laboratory
Tom	O'Neill	Hydro-Québec
Tony	Eddleman	Nebraska Public Power District
Twila	Denham	EnergySec
Valerie	Agnew	North American Transmission Forum
Veronica	Teer	Kiewit (KTG)
Vivian	Moser	Arizona Public Service Company
Wally	Magda	WallyDotBiz LLC
William	Wenz	AES

Text of Chair Marc Child's Concluding Remarks at the last meeting of the

NERC Critical Infrastructure Protection Committee, March 4, 2020

It has been my great pleasure and privilege to serve as Chair of this amazing group these past four years.

When I took the job my goal was to do half as good a job as Chuck Abell, Barry Lawson, Stuart Brindley, and Kevin Perry. I hope I've succeeded.

As a cooperative I try to abide by the seven cooperative principles, one of which is utilities helping utilities.

So it's no surprise that as Chair I've tried to organize around this notion, and taking it a step further to include the larger ERO, trade groups, research partners and vendors.

Developing and maintaining relationships and friendships, to me, are the very best part of participating in our committee.

To the national labs, I extend my thanks for the good work that you do on behalf of utilities and I'm glad you are able to make the effort to join us here to show off your projects. As member of the RSTC I want to continue to be your interface to NERC, and to the extent you might benefit from that continued relationship.

To our government partners I thank you for the products and initiatives that directly benefit US and Canadian utilities and for sharing them with us every quarter. I know it's not easy to get approval for travel so thanks for jumping through all the hoops to be with us.

To the research partners and trade groups, we recognize that you are membership-driven organizations and your willingness to open up some of your good work is greatly appreciated. Security is a team sport and your organizations are doing amazing stuff.

To the vendors and consultants who attend these meetings I hope that the ability to hear first-hand the utilities challenges for security and compliance is beneficial. You are a valuable part of the reliability ecosystem of the bulk power system. Your willingness to lend your voice to the supply chain efforts is particularly appreciated.

To NERC staff and the E-ISAC, thank you for allowing us this forum. I hope that our efforts have added value to the ERO and their strategic goals.

And to the utility members here today, I hope that our work product has been useful to your security programs and I thank you for your hard work in getting things done. I sincerely hope that you stay engaged in workgroup activities regardless of how those workgroups are managed. Respond to public comment periods, volunteer for guideline drafting teams, and subscribe to as many mailing lists as you can. We don't know exactly what the world under the RSTC will look like a year from now, or five years from now, but you are critical to their success.

As chair as in most elected positions we always reach the point of transition and I want to offer my thanks to those that have provided their help and guidance, and making sure these meetings come off without a hitch.

To Tom - who, by the way, He and Mickey Mantle have a combined 536 home runs during their career (so far)…

...and to Tobias before him, and Sam before him, I want to offer my personal thanks for turning a sausage factory into a Michelin-starred dining experience. The amount of work it takes to make these meetings happen is breath-taking and largely thankless, so I want to rectify that by offering a public thanks.

Please join me in a round of applause for Tom.

And last but not least the quiet competence of our "coordinator extraordinaire" Stephanie without whom we'd all be sitting around wondering how we got here and why. She's very much the Chuck Norris of CIPC:

Steph: She's so tough she has cows grilling steaks for her

Steph: She's so detail oriented she can unscramble an egg

Steph: She's so efficient she can draw a square using only three lines

Thank you Stephanie for cracking the whip and keeping us all on track.

I apologize if this is sounding like a eulogy, as it's not. This is the end of one thing but very much the beginning of another. I would like to implore each of you to continue participating and collaborating with each other, and I look forward to seeing you again under the RSTC umbrella.

…and having said all that I believe I will invoke Chair's privilege and declare the CIPC adjourned.

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Meeting Minutes
Operating Committee

March 3-4, 2020

Atlanta Marriott Marquis Hotel
265 Peachtree Center Ave.
Atlanta, GA 30303

A regular meeting of the NERC Operating Committee (OC) was held on March 3-4, 2020, in Atlanta, GA. The meeting agenda and the attendance list are affixed as **Exhibits A** and **B**, respectively; and individual statements and minority opinions as **Exhibits C** and **D**, respectively. The meeting presentations are posted in a separate file at OC Presentations.

Meeting Highlights

1. The OC approved the revised PS Scope Document. The group is now named the Reliability Training Working Group and will focus on industry-wide training.
2. Hugo Perez provided an update on NERC international discussions including new collaboration with Costa Rica and the Central American power market.
3. Bob Cummings discussed the intricacies of renewable integration and the nuances of implementation.
4. Rich Hydzik provided an overview of the UK Blackout event.

OC Chair David Zwergel convened the meeting at 1:00 p.m. ET on Tuesday, March 3, 2020. Stephen Crutchfield announced that a quorum was present, read the Notice of Public Meeting, Participant Conduct Policy and referred the committee to the NERC Antitrust Compliance Guidelines.

Chair's Opening Remarks

Chair Zwergel welcomed members and observers to the meeting.

Consent Agenda (Item 2)

Chair Zwergel noted that there were no revisions to the December 10-11, 2019 minutes and he requested a motion to approve. Lloyd Linke made the motion to approve the minutes. By consent, the committee approved the minutes of the December 10-11, 2019 meeting.

Chair's Remarks and MRC/Board Report (Items 3a, and 3b)

Chair Zwergel reported on the February 5, 2020 Member Representatives Committee (MRC) Meeting and the February 6, 2020 Board of Trustees (Board) Meeting. Chair Zwergel noted that the main topics were the appointment of the Reliability and Security Technical Committee members and the retirement of two Trustees and the election of three new Trustees.

Stephen Crutchfield reviewed the Reception Agenda.

OC Action Item Review (Item 4)
Stephen Crutchfield reviewed the list of action items and reported that both items are pending ERO approval. The revised action item list is attached as **Exhibit E**.

Operating Reliability Subcommittee (ORS) Status Report (Item 5a)
ORS Chair Chris Pilong summarized the subcommittee's status report which was included in the agenda package. Highlights of the report include:

Key Issues for OC Information:

- The ORS endorsed minor changes to the **ERCOT Reliability Plan.**
- The ORS endorsed minor changes to the **FRCC Reliability Plan**.
- The ORS endorsed minor changes to the **RC West Reliability Plan**.
- The ORS was briefed that as of December 3rd SPP West RC took over RC duties. This completes the RC transitions in the Western Interconnection.
- The Chairs of ORS and RS presented overviews of the activities of their respective Subcommittees at each other's recent meetings. The groups will continue to look at ways to assist each other with their work plans.
- The ORS was briefed on the RSTC election results and the transition plan.
- The ORS was given an update on SAFNR V3.
- The ORS was briefed by the PAS (Maggie Peacock) on recommended M-8 IROL reporting changes. A red-line version will be provided to the ORS for comment. The major changes are to eliminate any margin from the reporting and to extend the exceedance duration for reporting from 10 seconds to 1 minute.
- The ORS was briefed by the EIDSN, Inc. (Jim Schinski) on the efforts to develop a replacement tool for the current RCIS, which is maintained by NERC but will be retired in the near future for EOL reasons. The new tool will be called RCIS 2021. Significant concerns were raised by non-EIDSN member RCs with the retirement of the current RCIS due to the fact of EOP-011 Attachment 1 require the use of the RCIS to notify all RCs of EEA's issued. The Standards should be revised prior to approving retirement of the RCIS to address this concern.
- ORS continues to receive updates from the EIDSN Steering Committee pertaining to the IDC Tool enhancements. Specifically, the **Parallel Flow Visualization (PFV)** project, which is intended to improve the data quality used by the IDC during curtailment of Eastern Interconnection transactions. For next steps, ORS anticipates that OC approval will be sought in early to mid-2020 for go-live of PFV in October of 2020 following additional parallel operations and testing of PFV.
- The group continues to discuss the role of the Interconnection Frequency Monitor. TVA has filled this role in the East for many years. ORS will review the TVA procedure and consider at the May meeting whether the monitoring is providing a reliability value and should continue as is,

be modified, or if it should cease. If it will continue, the ORS will determine a methodology to rotate the responsibility annually, as is done with Time Error and GMD monitoring.

- The ORS discussed efforts currently underway by the NATF in conjunction with several RCs to develop communication protocols for Grid Security Emergencies (GSEs) issued by the DOE. The ORS requested that the ORS executive committee members be added to these discussions to ensure full representation of all Interconnections in the development of these new processes. The ORS will continue to remain engaged and track this effort.

Current Initiatives/ Deliverables:

- ORS has reviewed and discussed the 2020 OC work plan and continues to work items in the plan as prioritized by the OC

Resources Subcommittee (RS) Status Report (Item 5b)

RS Vice Chair Greg Park provided an overview of subcommittee's status report which was included in the agenda package. Highlights of the report include:

Key Issues for OC Information:

- **Review RS Scope Document –** The RS is performing a periodic review of the RS Scope Document. RS review expected in April 2020 with the RSTC approval in June 2020.
- **Review Working Group Scope Documents –** The FWG, IIWG, and RWG began periodic review of their Group Scope with the target approval by RS in April 2020 and RSTC approval in June 2020.
- **Operating Reserve Management Guideline Document–** Periodic review initiated with the target date of December 2020 approval.
- **ACE Diversity Interchange Guideline Document–** Periodic review initiated with the target date of December 2020 approval.
- **Inadvertent Interchange Guideline Document–** Periodic review initiated with the target date of December 2020 approval.
- **Eastern and Western Interconnection Generator Operator 2019 Survey** – The GO Survey submittals for the Eastern and Western Interconnections have been completed and the RS is reviewing the submittal data.
- **Annual BAL-003 Submittals and Frequency Bias Calculations –** The BAL-003 frequency events for the 2019 operating year have been posted to the Balancing Authority Submittal Site. BA submittals are due March 7th with 2020 Frequency Bias Setting calculations due March 24th.
- **NERC State of Reliability Report –** The RS has compiled the necessary data and is beginning the effort to develop the frequency response performance analysis for the 2020 State of Reliability Report.

Working Group Updates

- **RS Frequency Working Group (FWG)** – The FWG selected M4 and BAL-003-1 frequency events for the months of September through November 2019, for each interconnection at the January, 2020 RS meeting. FWG also finalized the final list of M4 and BAL-003-1 frequency events for 2019 in preparation of Frequency Bias changes in April 2020.
- **RS Inadvertent Interchange Working Group (IIWG**) – The interconnection inadvertent interchange update continues to show a return to the downward trend after an uptick in Eastern Interconnection (EI) balances through first half of 2019. The EI fast time error trend continues.
- **Reserves Working Group (RWG)** —Additional changes to the voluntary DCS submittal form to accommodate BA and RSG footprint changes were reviewed.
- **Changes in BA Area Footprints** – A change in footprint was discussed for two existing BAs in the MRO region with a target integration in March 2020. In the SERC region in January an existing BA integrated was discussed. Frequency Bias Settings will be recalculated and implemented accordingly.

Quarterly Reviews

- **BA Performance Data** – CPS1/BAAL and DCS data submitted for the 4th quarter of 2019 was reviewed. No significant issues were noted.
- **Time Error –** Time error reports for 4th quarter of 2019 were reviewed. Other than items noted in the IIWG section above, no significant issues were noted.
- **ERS Measures –** Measures 1, 2, 4, and 6 were reviewed. A subteam was formed to perform a periodic review of all ERS Measures and propose recommendations for enhancements and/or modifications.

Interconnection Frequency Performance - performance for all the interconnections was reviewed. No significant issues were noted.

Event Analysis Subcommittee (EAS) Status Report (Items 5c and 5ci)
EAS Chair Vinit Gupta summarized the subcommittee's status report which was included in the agenda package. He highlighted the following topics:

Pending OC Approval Items:

- Request OC approval of the Risks and Mitigations for Losing EMS Functions Reference Document v2.0. John Stephens made a motion to approve. The motion passed without dissent.

Key issues for OC Resolution:

- None at this time

Key Issues for OC Information:

- UK Blackout final report relevant findings and recommendations
- Failure mode and mechanism task force (FFM) has been formed.
- The Monitoring and Situational Awareness Conference will be held September 23rd and 24th in Golden, CO sponsored by National Renewable Energy Lab. An announcement with more conference details and travel information will be sent in early summer.

Current Initiatives/ Deliverables:

- EAS is conducting outreach to drive lessons learned submittals through not only the ERO EA Process but through other occurrences or near occurrences experienced by entities.

Future Initiatives/ Deliverables:

- Review Event Analysis Process document as required
- Recommend need for training in coordination with Personnel Subcommittee (PS)
- Publish lessons learned as required
- Develop Reliability Guidelines
- Identify significant risk and the need for NERC Alerts
- Updates to the OC
- Input to the NERC Performance Analysis Subcommittee's (PAS) annual State of Reliability Report
- Information and recommendations related to the Event Analysis process

External requests to group:

- Outreach and coordination with NATF/NAGF regarding lesson learned usability
  - North American Generator Forum is actively participating in the EAS
- Outreach and Coordination with other NERC groups (PS, PAS, RS, ORS, and PC). Liaisons established with PS and PAS
  - Leadership calls are set up prior to OC meetings
  - Coordinating with PAS on 2018 State of Reliability Report

Internal requests to group:

- None at this time

Personnel Subcommittee (PS) Status Report (Item 5d)

Chair Leslie Sink summarized the subcommittee's status report which was included in the agenda package.

Pending OC Approval Items: New PS Scope Document and name change to Reliability Training Working Group
Key Issues for OC Resolution: None
Key Issues for OC Information: None

The PS is working on the transition of the credential maintenance program for NERC certified operators with the newly formed Credential Maintenance Working Group (CMWG) and the Personnel Certification Governance Committee (PCGC). During the transition, two of the PS committee members have become the chair and vice-chair of the CMWG. The leadership of both the CMWG and the PS have been working together to focus on scope documents, transition plans, transitional dates, overseeing Provider audits, and any required ILA reviews requested by CERP contractors or NERC staff. This is to ensure the industry is not impacted by the changes in scope or responsible working groups.

Industry Outreach

- Outreach and coordination with other NERC groups (i.e. EAS)

Recurring Deliverables of Group

- The review and approval of Continuing Education courses.
- The review and approval of NERC Approved Continuing Education Providers.
- Audits of Continuing Education Providers.
  - The PS completed 10 provider audits in Q4_2019.

NERC Program's Oversight Responsibility for the Group

- Industry oversight of the NERC Continuing Education Program

NERC Document (Non-Reliability Standard) Responsibility for the Group

- Quarterly CE Program Report to PCGC and OC
- Training guidelines, templates and support materials

Continuing Education Program Statistics
Q4_2019 CE program Statistics:

- 191 active providers
- 265 Approved Courses
- 1,365.5 Approved Continuing Education Hours (CEHs)

PS Work Plan 2019-2021

Description	Status	Due
*CE Program Manual 5.0 (Major Revision/Rewrite)	Pending Transition	3/15/20
• Incorporate Manual Feedback		
• Develop & Implement Change Management Plan		
• Release CE Program Manual 5.0		
*Monitor and assess CE Program Manual	Pending Transition	3/15/20
• Industry survey		
• Evaluate		
• Define scope (5.1)		
• Release CE Program Manual 5.0		
**Conduct Level 2 course audits and provider audits	On-going	6/2020
Guidelines	In progress	TBD
Revise Administrative requirements	TBD	TBD
Situational Awareness for the System Operator (ORS now owns this document)	Completed	Q1_2020
Review and Update PS Scope document	Awaiting approval	3/31/20

*These items will transition to the Credential Maintenance Working Group (CMWG)
**Joint responsibility between the PS and CMWG until date noted

Personnel Subcommittee (PS) Revised Scope (Item 6)
Chair Leslie Sink reviewed the revised Scope and renaming of the PS to the Reliability Training Working Group. The purpose of the RTWG is:

> To provide support, expertise, and resources for the Bulk Electric System (BES) training personnel related to the reliable operation of the BES including, but not limited to, any NERC standard containing a training requirement.

The deliverables of the RTWG are:

- Prepare a work plan that aligns with the RSTC work plan.
- Develop and maintain resources to identify and communicate NERC standards that include a training requirement.
- Develop and maintain training guidelines and/or templates to improve BES knowledge to ensure consistent educational programs.
- Provide training recommendations based on Lessons Learned, Reliability Guidelines, Event Analysis Reports and the annual ERO Reliability Risk Priorities Report provided by the Reliability Issues Steering Committee (RISC).

The next steps are to:

- Approve the scope document and Eric Johnson as the new Chair.
- Begin recruiting for membership – membership will be depleted due to the CMWG
- Prepare a new detailed work plan at the same time, begin creating a more detailed work plan and establish that relationship with the other working groups – including new leadership.

A question was asked regarding credential maintenance for operators. This group would not work towards credential maintenance training at first but training providers could have CEH training.

Keith Carman made a motion to approve the new name and scope document. A discussion point was to provide clarification of language needed under the header Resignations, Vacancies and Nonparticipation specifically item #1, change verbiage to clearly state that the resignation/replacement of Chair or V. Chair will be replaced with a 2/3 vote among existing RTWG members and confirmation by the RSTC chair. The motion passed without dissent. Chair Zwergel appointed Eric Johnson as the RTWG Chair.

Joint Meeting Topic Discussion (Item 7)
Chair Zwergel reviewed the Joint Meeting Agenda topics and there was no further discussion from OC members.

Reliability Assessment Subcommittee (RAS) (Item 5e)
John Moura provided an update on RAS activities. John noted that the RAS is an offshoot of one of the original NERC committees and has been assisting with the LTRA and other assessments for 50 years.

Subcommittee Work Plans Recurring Items (Item 8)
ORS – Chair Pilong provided the following work plan recurring items:

Recurring Deliverables of Group

- Provide subcommittee report for the regularly scheduled Operating Committee meetings.

- Endorse new or revised RC Reliability Plans.
- Develop comments on the annual State of Reliability report.
- Review the use of Proxy Flow Gates.
- Review TLR 5 events as requested.
- Review of EEA events.
- Develop comments on Adequate Level of Reliability metrics.
- Provide coordination between the EIDSN IDC Steering Committee and the Operating Committee.

NERC Program's Oversight Responsibility for the Group

- Provide a forum for discussion of operating practices and potential lessons learned.
- Provide a forum for discussion of information technology tools and services that facilitate operational reliability coordination.
- Provide oversight and guidance on aspects of Interchange Scheduling, including Dynamic Transfers, as it applies to impacts on reliable operations.

NERC Document (Non-Reliability Standard) Responsibility for the Group

- Guidelines and Reference Documents

Should the ORS remain a subcommittee? IS there enough work to maintain SC status? Chris believes that the agendas are usually full and the Western RCs meet as a group prior to the ORS meeting. It is beneficial to have RCs know each other and have their contact information for coordination and information sharing, especially during critical operational periods.

RS – Vice Chair Park
Vice Chair Park noted that the RS and the working groups meet for 2.5 days each quarter and the agendas are full. They do work identifying BAL-003 and M4 events. Analyze ERS Measures 1,2,4, and 6.
The following are the reoccurring items that require approval:

Resources Subcommittee – Recurring Approval Items		
List of Items	**Periodicity**	**Comments**
1. Resources Subcommittee Scope	Every three years or as needed	Will need to revise in 2020 to reflect change to RSTC structure
2. Frequency Response Annual Analysis (FRAA)	Annual (September Meeting)	
3. Administering Annual Review of Frequency Bias?	Annual	Don't recall OC Approval – last year, NERC asked for RS approval and OC endorsement (?!)

4. RS Annual Action Plan	Annual (December)	Previously was developed in early January, depends on RSTC preferences for future
5. BAL-SARs	As needed	
Reliability Guidelines		
ACE Diversity Interchange	3 years	Current Version: 12/13/17
Inadvertent Interchange	3 years	Current Version: 12/11/18
Integrating Reporting ACE with the NERC Reliability Standards	3 years	Current Version: 12/12/19
Operating Reserve Management	3 years	Current Version: 12/13/17
Primary Frequency Control - Version 2	3 years	Current Version: 6/4/2019
Reliability Guideline: Generating Unit Operations During Complete Loss of Communications - Version 3	3 years	Current Version: 12/11/18
Reference Document		
1. Time Monitoring	3 years	Current Version: 12/12/19 - ORS has lead, RS supports
2. Balancing and Frequency Control (*new designation*)	3 years	
3. Change in BA Footprint	3 years	Current Version: 4/5/2019 - We need to do revision to match phase 1 BAL-003 prior to it becoming effective
4. Dynamic Transfer Reference Document	3 years	Current Version: 12/12/19 - ORS has lead, RS supports

EAS – Chair Gupta
The EAS has bi-weekly conference calls which helps maintain momentum in developing LL and other EAS work products. The meet the day prior to the OC meeting and have a full agenda.

Group's recurring deliverables:

- EAS continues to manage the ERO Event Analysis Process Document update process as required
- Action oriented Lessons Learned posted on NERC website
- EAS will continue to review and address reliability issues that pose a risk to the BPS and share information with the OC and industry

PS – Chair Sink reported the following recurring items:

1. PS Scope document – this document will be reviewed annually by the PS and updated as necessary. The PS will seek approval if significant changes are made and/or in accordance to the RSTC charter.

2. PS Work plan – this is a living document outlining a set of deliverables and processes the PS will accomplish over a period-of-time. The PS will seek approval at the beginning of each calendar year or in accordance with the RSTC charter.
3. PS Leadership – The current PS scope states the PS leadership will be a two-year term. The PS will recommend officer candidates for the RSTC chair's consideration following a supporting motion. The RSTC chair appoints the PS chair and vice chair.

Reliability Issues Steering Committee (RISC) Status Report (Item 9)
Chair Zwergel noted that the RISC will meet by conference call the week of March 16th to discuss 2020 activities, objectives and risks. Will be looking at RISC enhancement, charter review and begin planning 2021 RISC report at Reliability Summit. Determine how RISC can have input and support RSTC work plan.

Standards Update (Item 10)
Soo Jin Kim, NERC Staff, provided an update on NERC Standards activity. She thanked everyone for their help with standards and active participation in drafting efforts.

Pandemic Preparations and Procedures (Additional Agenda Item)
Chair Zwergel led a discussion of Pandemic preparations and procedures. Current activities include:

- Reviewing plans, specifically the triggers for steps in the plan such as travel ban, work from home, special things to secure operators and their families
- 14-day restriction if you have had contact with anyone with coronavirus or traveled to regions with known issues
- Travel bans implemented or situation monitored to implement a travel ban
- Implemented parts of plans and crisis centers
- Provide more work from home opportunities
- Sanitize work stations at shift change
- Additional hygiene measures
- Making all parties of the plan aware of their roles in the plan
- ISO/RTOs are having conference calls on current activities
- Monitor CDC and state entities
- Reviewing and updating business continuity plan
- Considering restrictions on stakeholder meetings to be via conference call or WebEx only
- International travel ban
- Elimination of control center tours
- Having relief and training shift operators work from home until further notice

- Increase read-only access to SCADA/EMS so that employees can work remotely
- Coordinate and communicate with medical facilities
- Test VPN systems for all employees being remote
- Be vigilant of cyber attacks
- Building a master schedule of meetings and will evaluate whether to hold those in-person by webinar

ORD Discussion (Item 12)
Keith Carman, Tri-State G&T, noted that he sent a summary of past OC ORD discussions to Chair Zwergel and Stephen Crutchfield. They will transfer this to the RSTC and this item is considered closed.

SAFNR Update (Item 13)
Darrell Moore, NERC Staff provide an overview of the SAFNR v3 project which improves NERC's ability to undertake situational awareness activities under Section 1000 of the Rules of Procedures.

International Affairs Update
Hugo Perez, NERC staff discussed international outreach efforts by NERC. We directly support strengthening the reliability and security of the grid throughout North America and are strengthening the relationship with Canadian entities to get a better understand of their perspective. NERC is working with the regions on international issues for their perspective as well. Hugo is traveling to various entities to enhance relationships and help coordinate with those entities. NERC is still coordinating with Mexico although not too much activity due to change in government leadership. We are also coordinating with PNNL on outreach with Costa Rica and the Central American market that includes seven countries.

Renewable Integration/Penetration

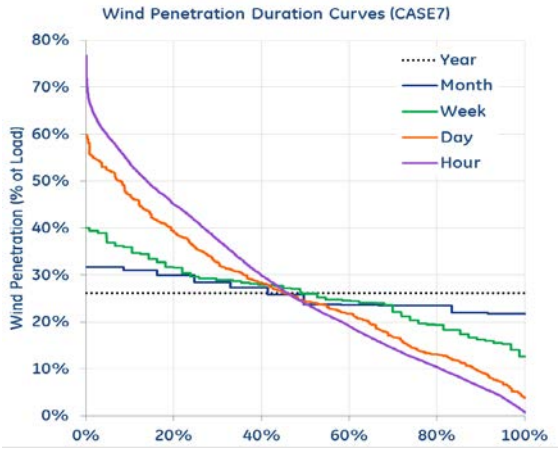
Bob Cummings discussed the intricacies of renewable integration and the nuances of implementation.

- Several mandates for higher penetration
- What is higher penetration?
- Displacement of fossil resources – synchronous generators
  - Lower operating reserves possible
  - Not relying on idling gas turbines to provide primary frequency response
- Presents challenges to system operators due to variability
  - Extremely high ramp rates
  - Often weather dependent
- How can we take advantage of the wonderful capabilities of Inverter-Based Resources
  - Incredible fast frequency response with zero carbon footprint

When does this become a problem?

Only instantaneous penetration counts for operability/stability

- 100% Inverter-based resources (IBR) at any moment
- High IBR at any moment
- Pocket of the system with high IBR
- Outage/event conditions
- Weak grids or far from synchronous generators



HickoryLedge

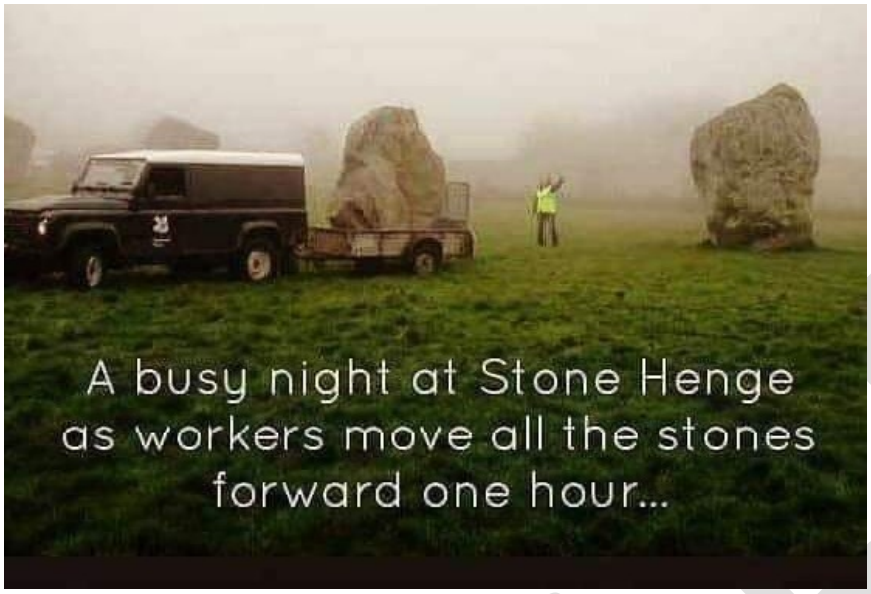
Source: Miller et al; NSPI Renewable Integration Study
http://www.nspower.ca/site-nsp/media/nspower/CA%20DR-14%20SUPPLEMENTAL%20REIS%20Final%20Report%20REDACTED.pdf

Generation Comparison

SDGE

Generation Source	Size (MW)	Capacity Factor	Annual MWh
Natural Gas Plant	10	95%	83,220
Wind	10	30%	26,280
Solar	10	20%	17,520

Generation Source	Size (MW)	Capacity Factor	Annual MWh
Natural Gas Plant	10	95%	83,220
Wind	32	30%	83,220
Solar	48	20%	83,220



The OC adjourned for the day at 4:33 p.m. and resumed at 8:00 a.m. on Wednesday, March 4, 2020.

UK Blackout Report (Item 14)
Rich Hydzik, Avista, reviewed the UK Blackout Report. The key points included:

- Largest planned resource loss was 1000MW (N-1)
- Initiating event was a single phase 400kV fault
  - Normal N-1 transmission event, with successful reclose
  - Two resources were lost due to fault (not expected for this event)
    - Hornsea Wind (737 MW)
    - Little Barford (244 MW)
    - Embedded Generation (DER) (150 MW) - this was expected
    - This is an N-3 event, exceeded 1000MW planned loss
  - Is 1000MW sufficient?
    - The report discusses cost/benefits of increasing reserve requirement
    - Previous decision had been that added reserves were not cost effective
- Hornsea Wind (737 MW)
  - One onshore and one offshore transmission circuit was out of service
  - This resulted in a "weak" system subject to sub-synchronous resonance

  - The correct Dynamic Reactive Compensator response resulted in resonance
  - What analysis would have captured the danger of the "weak" system?
  - Should "weak" analysis be part of the interconnection study process?
- Little Barford (641 MW)
  - ST1C tripped due to a speed signal – why?
  - Steam bypass failed to operate correctly leading to loss of CT1A and CT1B
  - Two issues – speed signal and steam bypass problem
- Embedded Generation (DER)
  - 150 MW lost due to fault – this was expected (vector shift)
  - 350 MW lost due to ROCOF protection when Little Barford ST1C tripped – not expected but proper based on settings
  - ESO calculates DER loss based on vector shift in the operational planning process – this event validated the method
- Reserves
  - Mandatory dynamic reserves over-performed
  - Firm frequency response performed at 74-81%
  - Enhanced frequency response performed at 94%
  - Generally performed well – 88-89% of expected
- Lower Frequency Demand Disconnection
  - Performed as expected
  - Arrested the frequency decline
  - Some loads are sensitive to frequency (trains), different issue

The UK report recommendations included:

- Review the security standards (SQSS) to determine whether it would be appropriate to provide for higher levels of resilience in the electricity system.
- Review the timescales for delivery of the Accelerated Loss of Mains Change Programme to reduce the risk of inadvertent tripping and disconnection of embedded generation.
- In addition to the changes in its first-hour communications processes that the ESO has initiated, there should also be a wider industry review, including BEIS, Ofgem, the ENA and other stakeholders to establish new and enduring communication arrangements for similar events.

The EAS reviewed the event and their findings include:

- Reserve Margin was determined to cover a single contingency or 1000 MW
  - LFDD (UFLS) is likely to operate for losses beyond a single contingency
  - BAL-003 Resource Loss Protection Criteria is based on two largest single contingencies
- Hornsea collector system was in an unusual state
  - Collector system is large and complex
  - Subject to decreased performance depending on state
  - Hornsea operator needed to identify these conditions and operate accordingly
- DER resource loss due to ROCOF and Phase Jump
  - This loss was assumed in operating plans
  - No such planning in US
  - This may increase single contingency loss if initiating event is a fault on a large generator facility (high side of transformer)
    - UK – Phase Shift 6 degrees, ROCOF 0.0125 Hz/sec
    - IEEE 1547-2018 – Phase Shift 20 degrees, ROCOF 0.5Hz/sec (Category 1)
- LFDD scheme may include sensitive loads
  - Scheme operated as expected
  - Airport load was known to be part of LFDD, but still a surprise when it tripped
  - Other loads tripped due to sensitivity to frequency
    - Trains could operate below 49Hz
      - Control system issues resulted in train shutdowns, software upgrade affected restart
    - Ipswich Hospital internal protection operated coincident with lightning strike
      - No interruption to supply
  - Regular review of LFDD to increase awareness and capture load changes

The EAS will discuss creating a Lessons Learned for this event and coordinate with the RTWG to educate operators and others in the industry.

Reliability and Security Technical Committee Update and Transition Plan (Item 15)
David Zwergel, RSTC Vice Chair reviewed the slides from the Joint meeting and requested input from the OC regarding any "missed" items for consideration. The RSTC will discuss this in more detail this afternoon. Comments from the OC:

- Ensure that the RSTC retains detailed discussions similar to the UK Event to help maintain reliability and education in the industry
- Subgroups should provide quarterly updates to the RSTC and alternate in-person updates
- Prioritize in-person updates based on subgroup activities
- Consider updates with subgroup leadership on a more frequent basis than the quarterly updates

Inverter-based Resources Task Force (IRPTF) Items 16, 16a, 16b and 16c)
Allen Schriver, IRPTF Chair, provided an update on IRPTF activities.

Task	Status	Expected Completion
Modeling and Simulations Technical Report	Final Draft Complete	May 2020
White Paper: Fast Frequency Response	Response to PC/OC Comments	March 2020
White Paper: Review of NERC Reliability Standards	Response to PC/OC Comments	March 2020
Technical Report: Energy Transition to Higher Penetration IBR Conditions	Draft underway	December 2020
Reliability Guideline: EMT Modeling and Studies	Draft underway	December 2020
Reliability Guideline: BESS and Hybrid Plant Performance, Modeling, and Studies	Draft underway	December 2020
Technical Report: IBR Impacts to BPS Protection	Draft underway	December 2020
Canyon 2 NERC Alert Follow-Up	Ongoing	Ongoing
IEEE P2800 Monitoring	Ongoing	Ongoing

White Paper – Fast Frequency Response* – Approve. Pete Brandien made the motion to approve the white paper. The motion passed without dissent.

IBR Modeling and Studies Report* – Request OC members review and submit comments to the IRPTF. Darrell Yohnk motioned to approve the document release to the OC and PC for comment. The motion passed without dissent.

Whitepaper - IRPTF Review of NERC Reliability Standards* - Approve. Bill Chambliss made the motion to approve the white paper. The motion passed without dissent. The IRPTF will draft SARs related to this whitepaper and bring them to the RSTC for approval and submission to NERC.

The IRPTF is also working on technical papers and reliability guideline including:

- Technical Report Energy Transition to High IBR
- Reliability Guideline: EMT Modeling and Simulations
- Reliability Guideline: BESS and Hybrid Plant Performance, Modeling, Studies
- Reliability Guideline: IBR Impacts to BPS Protection

The IRPTF will coordinate with the RTWG to have webinars to discuss these documents.

Chair's Closing Remarks (Item 18)
Lloyd Linke, past OC Chair, remarked that the OC has had a long history that has addressed operating issues and established operating practices. In practice, the operating principles were converted to the version 0 standards. In the recent past, the OC has reinvigorated industry participation. Development of the EAS has been invaluable and should continue with the RSTC. He suggested possibly having an events analysis conference to review events and lessons learned. Development of guidelines has been very valuable. Most of the work has been performed in the subgroups and he is pleased that the RSTC is planning to continue that structure.

Chair Zwergel thanked participants and presenters for attending the meeting. He thanked NERC staff for their support and adjourned the OC for the final time.

Next Meeting
This was the final meeting the Operating Committee. The RSTC will meet June 10-11, 2020 with a specific location TBD.

Adjourn
There being no further business before the Operating Committee, Chair Zwergel adjourned the meeting on Wednesday, March 4, 2020 at 9:56 a.m. ET.

Stephen Crutchfield
Stephen Crutchfield
Secretary

NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Minutes Draft
Planning Committee

March 3, 2020 | 1:00 – 5:00 p.m. Eastern
March 4, 2020 | 8:00 a.m. – 12:00p.m. Eastern

Atlanta Marriott Marquis Hotel
265 Peachtree Center Avenue
Atlanta, GA 30303

Call to Order

Brian Evans-Mongeon, Chair, called to order the meeting at 1:00 p.m. eastern. All PC members introduced themselves, followed by introductions of other meeting participants. Mark Olson, Secretary, declared a quorum present.

The Chair recognized that this is the last in-person meeting of the PC. The PCEC has authority in the PC Charter to act between meetings, and PC responsibilities continue through the end of May 2020. Several PC members will continue on as elected members of the RSTC. He also noted that there are no changes to the subcommittee groups or the work plan activities as we prepare for RSTC transition. He extended his thanks and presented members with a small personal gift.

NERC Antitrust Compliance Guidelines, Participant Conduct Policy, and Public Announcement

Mark Olson read the NERC anti-trust guidelines and advised participants as to the public nature of the meeting. He reviewed the NERC Participant Conduct Policy for all attendees.

Remarks and Reports

Leadership Report

The Vice-chair provided the following update from the February NERC Board of Trustees meeting:

> The Board approved nominations to the Reliability Issues Steering Committee (RISC) and Reliability and Security Technical Committee (RSTC). The Member Representatives Committee (MRC) elected Jim Piro to the Board. Outgoing members Fred Gorbet, David Goulding, and Janice Case were recognized. FERC Chair attended and provided remarks, highlighting collaboration between FERC and NERC. The Board adopted revised Reliability Standards requirements from the Risked-Based Registration initiative, as well as PRC-024-2 and TPL-007-4.
>
> The Board approved the EMP Task Force Strategic Recommendations Report. Policy input was solicited on the report prior to the meeting. The recommendations include maintaining the EMPTF under the RSTC, along with priorities for the EMPTF's work.
>
> The Board approved NERC's recommendation to initiate a project to modify Reliability Standard CIP-003-8 to include low-impact BES cyber systems.

The PC Chair highlighted to meeting participants that the agenda included some important discussion items that would take place ahead of action items.

NERC Board Member Ken Defontes expressed his appreciation to the PC for their hard work. He is looking forward to the continued work of the technical committees under the new RSTC organization.

Consent Agenda

The following items were on the consent agenda:

a. December 10-11, 2019 Meeting Minutes – Approve

b. SAR for Applicability of Transmission-Connected Reactive Devices in NERC Reliability Standards – Endorsed by email vote on February 11, 2020

c. White Paper: Inverter-Based Resource Monitoring – Approved by email vote on February 27, 2020

Michael Goggin stated concerns with Item c. He moved to remove Item c from the consent agenda. The motion was seconded. The Chair opened the floor for discussion. Michael Goggin stated his concern that recommendations in the white paper could impose considerable costs on inverter-based resources without demonstrated reliability benefit. Jeff Billo remarked that the IRPTF reviewed the white paper and agreed with it.

The chair called to vote by show of hands the motion to remove Item c from the consent agenda. The motion did not pass.

Gary Brownfield moved to approve the consent agenda. The motion was seconded.
The chair called to vote the motion to approve the consent agenda.

Action: The PC approved the Consent Agenda.

Subcommittee Leadership Reports and PC Work Plan Update

Performance Analysis Subcommittee (PAS)

Maggie Peacock provided an update. State of Reliability Report (SoR) inputs are coming in mid-March. Anticipate technical committee review in mid-April. Board action is targeted for early June, in time for the FERC Technical Committee meeting. PC work plan updates will be reviewed at the PCEC strategy meeting at the end of March.

Reliability Assessment Subcommittee (RAS)

NERC staff delivered the update presentation. Participants discussed the RAS plans for addressing relevant recommendations from the 2019 Long-Term Reliability Assessment (LTRA).

System Protection & Control Subcommittee (SPCS)
Jeff Iler delivered the update presentation. Specific SPCS deliverables are included in subsequent agenda items.

Synchronized Measurements Subcommittee (SMS)
Tim Fritch provided an overview of SMS and current work items as included in the agenda package.

System Analysis and Modeling Subcommittee (SAMS)
Evan Shuvo provided an update on work plan activities as included in the agenda package. Evan noted that LMTF has proposed development of guidance for delayed voltage recovery. SAMS is considering the proposal. PC chair advised participants to refer to the recent PC Update email that included a reference on the NERC Acceptable Models list for information.

Inverter-based Resource Performance Task Force (IRPTF)
Jeff Billo delivered the presentation in the agenda package. He provided details on new work plan additions. Participants discussed the combined SPCS-IRPTF effort to look at IBR and protection systems; a PC member expressed support for this approach, as it helps to get broad solutions for identified reliability issues. Participants discussed the status of IEEE P2800 development efforts. Following the June IRPTF in-person meeting, there will be a high-level EMTF training session.

System Planning Impacts from Distributed Energy Resource Working Group (SPIDERWG)
NERC Staff delivered the update presentation in the agenda package. Participants discussed the work of the coordination group on the terminology task and what that deliverable might look like. NERC Staff said the current draft is a working paper with a table of terms, definitions (with citation), and rationale. Participants discussed the need for short circuit study guidance. The IRPTF-SPCS guidance and the IRPTF Battery Storage/Hybrid Resources guidance will cover this.

Geomagnetic Disturbance Task Force (GMDTF)
Ian Grant delivered the presentation in the agenda package.

Electric-Gas Working Group (EGWG)
Michelle Thiry discussed EGWG plans for three meetings this year, with topics including industry outreach/education, determination of measures of effectiveness, review of measures, and discussion of future organization of the EGWG. The chair reinforced the need for industry follow-up with guideline implementation and assessment of effectiveness.

Committee Discussion Items

Draft White Paper: Review of TPL-001 Standard for Incorporation of DER
The PC Chair observed that the white paper subject matter can extend beyond the BES. He would like to have discussion about the BES definition during the roundtable session of this meeting. Ryan Quint described the background for the white paper as scoped by the SPIDERWG. The SPIDERWG will be reviewing the comments that were provided during the PC review period and develop white paper

revisions and comment responses. Ryan provided an overview of the white paper and the reliability issues that it is intended to address. A reviewer noted that he had a concern that the white paper may not be providing clear enough guidance for a reliability standards drafting team. However, the reviewer generally supports addressing the issues noted in the guideline. Other reviewers noted that solutions to the issue other than standards revisions were available and may be preferred. Another reviewer provided support for standards revisions, however the DER issues that a standard would be addressing were not immediately presenting a reliability issue in all areas. The need for enhancing the standard comes from the changes to the resource mix, which is occurring at varying pace in different areas. Participants discussed thoughts on what steps may be needed in the industry before standards revisions could be effectively undertaken; e.g., maturation of industry best practices. Additional details are in written comments submitted by reviewers during the PC review period. NERC Staff noted the growing interdependence with the distribution system and the need for the ERO and industry stakeholders to think about how to plan and design for this.

Discuss Draft White Paper: Implementation of NERC Standard MOD-025-2

The PC chair provided background on the development and review process to date. Ryan Quint provided a presentation of the technical content in the white paper. A PCEC reviewer remarked that he provided detailed written comments, which included his observation that the burden is on the planner to interpret the results of information provided by generator owners under this standard. A participant observed that the purpose of the standard is not for gathering data; rather, planners understand what to do with the information that is obtained through this standard. A participant indicated that the approved standard can provide information about when a generator capability has degraded, which has been encountered with some older generators. A PC reviewer recommended that PPMVTF develop clearer solutions and include them in the white paper. A participant recommended that the record of standard development for MOD-025 be reviewed for relevant information. A PCEC reviewer expressed a high degree of confidence in the skills of the PPMVTF. NERC staff noted that technical groups have been instructed by NERC and technical committee leadership to limit SARs/white papers to description of the reliability issue (i.e., problem), and to avoid prescriptive solutions (e.g., the PRC-024 SAR).

Reliability Guidelines

BPS Perspectives for Implementing IEEE 1547-2018

Ryan Quint provided a review of the guideline. The PC chair expressed his support for the SPIDERWG's plans to conduct industry webinars on this guideline.

Robert Reinmuller moved to approve the guideline. The motion was seconded.

Action: The PC approved the Reliability Guideline: *BPS Perspectives for Implementing IEEE 1547-2018*

Distributed Energy Resource Data Collection for Transmission Planning

Ryan Quint provided an overview of the draft guideline and described its relationship with the MOD-032 SAR that the PC endorsed in December 2019. Participants discussed the extent to which the guideline was dependent upon change in MOD-032 applicability, and agreed that the technical information in the guideline is valid regardless of revisions to MOD-032. Participants discussed the extent of the issue for

planners across North America (e.g., the varying levels of sophistication needed/used by planning entities to account for DER; relationship of this sophistication with the penetration level of DER in an area). A PC member shared that he believes there is a lot of value in the draft guideline; it will help DPs understand what is needed and why. The PC chair noted that the MOD-032 SAR referred to above is on the March Standards Committee agenda to seek posting for industry comment.

Wayne Guttormson moved to authorize posting. The motion was seconded.

Action: The PC authorized posting the guideline for stakeholder comments.

Fuel Assurance and Fuel-Related Reliability Risk Analysis for the Bulk Power System

The PC Chair provided background on the PC's work plan for fuel assurance as presented to the NERC board in November 2018. Michelle Thiry provided her professional background and experience in the electric power industry as related to electric and gas-supply industry coordination. She described the diverse background of the EGWG. She described some approaches to meeting needs for natural gas fuel supply to electric generation. Approaches can vary based on regional circumstances. Michelle Thiry provided an overview of the guideline. She summarized comments that were received during the posting and discussed the changes that were made along with comment responses. Materials were included in the PC meeting agenda package. The EGWG is identifying opportunities to increase awareness of the guideline with industry stakeholders. A PC member expressed appreciation to the work done by EGWG to produce the guideline and noted its importance. NERC staff advised participants to expect interaction with the U.S. Department of Energy's North American Energy Resilience Model (NAERM) initiative in the future. Mark Lauby noted the importance of this work and the value the guideline provides in showing how fuel risk studies can be performed. He challenged participants to think about the need to define what the expectation should be for acceptable BPS performance. The EGWG vice chair credited the EGWG chair with maintaining the collaborative environment that resulted in this successful guideline.

Devon Tremont moved to approve the guideline. The motion was seconded.

Action: The PC approved the Reliability Guideline: *Fuel Assurance and Fuel-Related Reliability Risk Analysis for the Bulk Power System*.

Items for Approval, Endorsement, Acceptance, or Authorization

White Paper: Fast Frequency Response Fundamentals

Jeff Billo discussed comments received on the white paper and revisions.

Gary Brownfield moved to approve the white paper. The motion was seconded.

Action: The PC approved the white paper.

White Paper: IRPTF Review of NERC Reliability Standards Applicability

Jeff Billo provided an overview of the white paper and discussed comments received from the PC review period. IRPTF revised sections of the white paper based on comments, including removal of FAC-008 issues/recommendations. Jeff reviewed the recommendations for standards revisions contained in the white paper. Participants discussed alternatives to standards revisions that could address some issues in the white paper. FERC staff commented on the material modifications language and invited PC meeting

participants to join in discussions with market stakeholders where the term is also used. FERC staff encouraged participants to consider performance expectations for the new technologies. He expressed interest in what the next steps are when a white paper is approved. Participants discussed challenges with tracking an accumulation of changes that are needed for standards but are not considered a priority (e.g., who would track? How should SARs be created/how many SARs?). Participants discussed how the materially modified term is applied in various planning coordinator areas. With approval of the white paper, the IRPTF will develop four SARs; SPIDERWG will be responsible for the TPL-001 SAR.

Carl Turner moved to approve the white paper. The motion was seconded. The PC chair called for vote by show of hands.

Action: The PC approved the white paper *IRPTF Review of NERC Reliability Standards Applicability*. Negative votes were received from Brian Evans-Mongeon, Joe Sowell, and Patrick Brown.

White Paper: Reliability Gaps in Reliability Standard PRC-019-2 and Proposed Standards Authorization Request (SAR)

Jeff Iler provided an overview of the white paper and SAR and discussed the changes. The PC chair sought clarification on how the PRC-024 provisions for momentary cessation would be aligned with the proposed white paper and SAR. A reviewer noted that the performance expectation is most appropriately addressed in PRC-024, and not PRC-019.

Patrick Brown moved to approve the white paper. The motion was seconded.

Action: The PC approved the white paper *Reliability Gaps in Reliability Standard PRC-019-2*.

Patrick Brown moved to endorse the SAR. The motion was seconded.

Action: The PC endorsed the SAR.

Discussion Topics– Information

IRPTF Modeling and Simulations Technical Report

Jeff Billo provided an overview and noted the importance of this report as a measure to address reliability issues described in the Blue Cut Fire NERC Alert. Participants discussed the potential for a momentary cessation from a generation resource to impact the system over wide areas. Factors include system strength and resource settings if momentary cessation can't be eliminated. Jeff Billo requested reviewers. Gwen Frazier, Kyle Vander Helm, Carl Turner, Wayne Guttormson, Robert Reinmuller, Joe Sowell, Enoch Davies, Charles Hendrix, Rich Kowalski, Bill Allen, and Brian Evans-Mongeon volunteered to review.

Member Roundtable

The PC chair opened the meeting up for roundtable discussions. He asked PC members to discuss their perspectives and thoughts on future committee work to address potential impacts to BPS planning from increasing amounts of generation below BES threshold (DER and sub-transmission).

- Sector 1 (Investor-Owned Utility). A sector representative observed that good coordination between RTOs is helping account for DERs.

- Sector 2 (State/Municipal Utility). A proxy for sector representative observed the challenge that the ISO has in getting data. Utilities often don't understand the ISOs need for data and misinterpret it.
- Sector 3 (Cooperative Utility). A sector representative noted the increasing DER and conventional retirements in his area. The PC work is very good and helpful.
- Sector 4 (Federal or provincial utility / Federal Power Marketing Area). A sector representative indicated his support for the PC's work in DER as it is important to reliably integrating the future generation resource. Transmission service cost is getting more complex. High voltage issues are growing in the area transmission system. Solutions are being developed. Another sector representative observed that the DER work is timely and high quality. They are looking to encourage DER growth in specific areas, as there could be reliability benefits from concentrating DER. Another sector representative commented on the valuable discussions that occurred at this meeting. He stated that the TVA charter encourages economic development in its footprint. They are attracting new industries, and many of them are interested in getting high-percentage renewable energy. He also reported that three 500 kV lines and other transmission assets were damaged as a result of a tornado on March 2, 2020.
- Sector 5 (Transmission-dependent Utility). A sector representative remarked that currently the industry is not efficiently able to work with non-BES assets. Urgent action is needed. He suggested an industry workshop to get industry focus on support for solutions: what documents are needed, what responsibilities need changed in order to get data and information. Mechanisms and responsibilities for getting data are various, and should be discussed to see what is working and what improvements are needed. SPIDER/IRPTF members could be workshop participants. State/federal perspective through a panel would be needed since jurisdictional issues exist. The workshop should also consider the extent of reliability problems associates with integrating both DER and BPS-connected non-BES resources. Consider resource performance in scope of the workshop (not just data). The PC chair suggested the PCEC take this recommendation up at the March 31 executive committee meeting and advise the PC on a proposal. The sector representative went on to call for improving how NERC catalogues and stores Reliability Guidelines to improve visibility. He expressed appreciation to PC colleagues and looks forward to working with all in the RSTC. Another sector representative noted DERs are now increasing in his area. Many members are not DPs so his entity gets data through its working relationships. Because of applicability, standard requirements aren't supportive for data collection as currently written. Another member of this sector shared views on the need to have approaches to scaling and determining which entities or areas are significant in terms of DER penetration for purposes of reliability analysis, assessment, and standards. An approach could be to consider the proportion of DER to area load. He advised of the need to keep reliability at all voltage levels in mind.
- Sector 7 (Electricity Marketer). A sector representative indicated that he is not closely involved with DER matters. However, he agrees that there is a need for urgency across the ERO given the rapid pace of change. Another sector representative indicated that they are studying 10k MW of DER, or about 25 percent of total resources. Every time it is studied they encounter new issues. She remarked that, even in the vertically-integrated utility, it can be a struggle to get the

distribution side to accept grid-friendly measures. She further remarked that, every year, interconnection requirements are being made to correct deficiencies identified. She observed that they have challenges with modeling storage; it is getting more complicated to model and study the system. Engineers love the challenge and she is optimistic about finding solutions.

- Sector 9 (Small end-use electricity customer). Sector representative noted that DER issues are getting visibility in his state of Pennsylvania. End-use costumers are concerned about keeping the lights on, and at the lowest possible cost. Questions are arising about the cost that the local utilities should bear in system upgrades and accommodating DER. Another sector representative indicated his support for the efforts of the PC to address reliability issues. The work supports the end-use customer. He advised colleagues to keep end-use customer load in mind.
- Sector 10 (ISO/RTO). A sector representative noted that the rate of DER deployment in New England is rapid. All DER is behind the meter; much on rooftops. The DER is not controllable. The ISO is working hard on forecasting and supports ERO efforts in that area. The ISO is also challenged with getting good data of DER serving distribution load because it is out of transmission system visibility. He remarked that you cannot model without the data. A reliability concern that he has is the potential for resources to be insufficient to meet demand under a scenario where DER is lost for some reason (e.g., due to momentary cessation), given the decline in BES resources (such as nuclear plant retirements). Another sector representative noted that the focus at his RTO is on getting data. DER penetration is lower in this area.
- Sector 11 (Regional Entities).
  - A sector representative finds the work in DER to be valuable; the RE is working to share info and promote application in the region.
  - A sector representative noted that his RE has several technical subcommittees; the RE recently surveyed industry to understand how DERs are being modeled in the region. He will seek to make information available to interested PC members.
  - A sector representative expressed appreciation for the work of the PC subcommittees. In his region there are 11 GW of Load Modifying Resources, which is a large penetration. He advised participants to keep focus on reliability in the technical groups, as market matters are being addressed in other areas. He is looking forward to further interaction through the RSTC.
  - A sector representative encouraged ongoing review of guidelines, with revisions being made as needed.
  - A sector representative noted that the last DER Forum in their region was held on February 13, 2020. FERC, NERC and a total of approximately 90 entities participated by WebEx and in-person. Main topics were Advanced Metering Infrastructure (AMI) and how to leverage it to improve operator and system visibility, forecasting, and performance. Also NERC presented on SPIDER and IRPTF activities. The next DER Forum will be held on May 14 in Saratoga Springs. The focus of the next forum will be on Interconnection of DER, lessons learned, obstacles to deployment and challenges related to planning, operations, hosting, visibility etc. Presenters will be from New York groups, Joint Utilities of NY, Eversource and Canadian Provincial reps.

Also EPRI will be discussing the various projects underway related to DER deployment such as effective grounding and energy storage. He also stated that NPCC's Version 1 DER Guidance document is under review. A revised version will be posted for industry comment in the second quarter of 2020.

- Sector 12 (State Government Representative). A sector representative reported that they recently revised distributed generation standards in his state. They also completed technical performance requirements for DER in his jurisdiction, taking effect in July. He is proud of the NARUC resolution on adopting IEEE 1547, and believes it is important for reliability. Another sector representative indicated support for NERC's efforts toward DER integration.
- Government Representatives. A FERC staff member noted that the FERC Reliability Technical Conference is scheduled for June 25, 2020. DER topics are included. Another FERC staff member discussed the question during the joint session of the blurring of the lines between planning and operations. He encourages pilot studies, tracking the guideline usage, and other efforts to move forward on addressing reliability impacts of DER. His concerns are that the timelines for implementing solutions can be too slow.
- NERC Staff. John Moura encouraged participants to look at DER penetration in terms of capacity at various instances (not just peak capacity). Mark Lauby expressed his best wishes to all for good health. He dispels any miscommunication that gave an impression that we will be less capable to find solutions in our technical groups—the interaction is inherent in the ERO. He supports ideas to bring people together to find solutions. Mark Lauby noted that some methods for assessing resource adequacy are falling short in the new resource mix. He also noted that NERC Reliability Standards apply to BES, but NERC is responsible for BPS reliability. Assessments and other tools can help. New challenges from cyber, changing weather and associated impacts to changing resource mix are the technical challenges ahead. He encourages continued gathering to solve the problems. He is heartened by the exciting challenges that the PC has been taking on and he looks forward to continuing through the RSTC.

Closing Remarks

The PC Chair commented on the tremendous discussions and outcomes from the meeting. He recognized the superior work of the subcommittees—SPIDER, IRPTF, SPCS, SMS. We are fortunate to be able to work with you and participate in developing and producing solutions for reliability. He advised PC members that they would have some remaining items to act on prior to the PC disbanding at the end of May.

Adjournment

The PC adjourned at 11:40 am eastern, March 4, 2020.

NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Draft Meeting Minutes
Reliability and Security Technical Committee

March 4, 2020

Atlanta Marriott Marquis Hotel
265 Peachtree Center Ave.
Atlanta, GA 30303

Meeting Highlights

1. Trustee Ken DeFontes and Mark Lauby provided opening remarks to welcome the new committee.
2. Chair Ford introduced the Executive Committee consisting of Chair Ford, Vice Chair Zwergel, Marc Child, Rich Hydzik, Christine Hasha, and Robert Reinmuller.
3. The RSTC elected the Nominating Subcommittee consisting of Vice Chair Zwergel, Jodirah Green, Todd Lucas, Sandra Ellis and Wayne Guttormson.
4. The chairs of the OC, PC and CIPC reviewed the existing committee organizations and work plans.
5. The RSTC discussed potential ways to organize the work of the RSTC while incorporating the risks presented in the RISC report.

A regular meeting of the NERC Reliability and Security Technical Committee (RSTC) was held on March 4, 2020, in Atlanta, GA. The meeting agenda and the attendance list are affixed as **Exhibits A** and **B**, respectively; and individual statements and minority opinions as **Exhibits C** and **D**, respectively. The meeting presentations are posted in a separate file at RSTC Presentations.

RSTC Chair Greg Ford convened the meeting at 1:00 p.m. Eastern on Wednesday, March 4, 2020 and led introductions of RSTC members, Observers and NERC Staff. Stephen Crutchfield read the NERC Antitrust Compliance Guidelines and the Notice of Public Meeting. The committee members introduced themselves and Stephen Crutchfield confirmed quorum of the Committee.

Chair Ford invited Trustee Ken DeFontes to provide remarks.
It was an honor to serve on the SET and former Trustee Fred Gorbet and he were pleased with that effort. The Technical Committee (TC) meetings were a little melancholy listening to the closing remarks. This effort is to make our work more efficient and effective. The RSTC has leadership from the TCs and believes the RSTC will be very successful. He thanked everyone for participating and he looks forward to watching us thrive.

Chair Ford invited Mark Lauby, NERC Senior Vice President and Chief Engineer to provide remarks.
Thrilled to be here and excited for our future. Industry is facing transformation. Interdependencies with distribution, gas, and other systems. Electricity is the key driver for all infrastructure. Indusrty and the ERO are good at identifying problems and solving them. It's important to collaboratively identify issues and solve them. This committee is a fundamental part of that effort.

Remarks and Reports (Items 2a, 2b and 2c)
Chair Ford welcomed members and observers to the meeting. In the agenda package, there are a number of documents linked including the RSTC Roster, RSTC Organization, RSTC Charter, Parliamentary Procedures and Participant Conduct Policy. Greg also pointed out the future meeting dates and noted that the meeting locations was yet to be determined.

Brian noted that the Joint session was helpful and suggested that the RSTC consider having something similar. Greg acknowledged that was an idea to consider along with WebEx pre-session for reports or consent agenda items.

Chair Ford encouraged everyone to contribute their ideas to help the RSTC to advance our mission and improve efficiency and effectiveness. The mission of the RSTC is to fold in all of the technical functions into a single group and collaborate with each other to move forward.

Introduction of Executive Committee – Chair Ford introduced the RSTC Executive Committee (EC), which consists of:

Chair Ford, Georgia System Operations

Vice Chair Zwergel, MISO

Marc Child, Great River Energy

Rich Hydzik, Avista

Christine Hasha, ERCOT

Robert Reinmuller, Hydro One

He noted that the EC has participated in one call in an effort to get the RSTC off to a good start. A suggestion was made to put an asterisk by the EC member's names on the RSTC Roster that is posted.

Report of February 5, 2020 Member Representatives Committee (MRC) Meeting and the February 6, 2020 Board Meeting – Chair Ford reported on the February 5, 2020 Member Representatives Committee (MRC) Meeting and the February 6, 2020 Board of Trustees (Board) Meeting. Chair Ford noted that the main topics were the appointment of the RSTC members and the retirement of two Trustees (Fred Gorbet, Janice Case) and the election of a new Trustee (Jim Piro) by the MRC. Supply Chain is an important issue as well as Policy Input. Stakeholders provide input to the board through this effort. MRC will look to this group to provide Policy Input going forward.

Election of Nominating Subcommittee (Item 3)
Chair Ford reviewed the proposed Nominating Subcommittee slate as recommended by the Executive Committee, noting the Nominating Subcommittee consists of the RSTC Vice Chair and four additional committee members. Greg will then request nominations from the floor and there were no additional nomination. He then asked all nominees to leave the room and requested a motion for approval.

Recommended Slate: Vice Chair David Zwergel
Todd Lucas
Wayne Guttormson
Sandra Ellis
Jodirah Green

Marc Child made a motion to approve the slate and it passed without dissent.

Committee Organization Charts (Items 4a, 4b and 4c)
Chair Ford called upon each standing committee chair to provide a review of their current organization charts.

Vice Chair Zwergel, Operating Committee (OC) Chair reviewed the OC organization chart. He noted the focus area for each subgroup. He also noted that the PS was renamed the Reliability Training Working Group by the OC at the meeting yesterday.

Brian Evans-Mongeon, Planning Committee (PC) Chair, reviewed the PC organization. He noted the focus area for each subgroup. The Electric/Gas Working Group was missing from the chart. He also noted that some of the subgroups are nearing the end of their charge and the PC may come to the RSTC with recommendations to disband some subgroups. Peter Brandien asked if the PC is reaching out to other groups such as the NAGF and NATF to avoid duplication of effort. Brian noted that subgroups do reach out and coordinate with other industry groups to collaborate and avoid duplication of effort.

Marc Child, Critical Infrastructure Protection Committee (CIPC) Chair, reviewed the CIPC organization. He noted the focus area for each subgroup. He noted that CIPC is organized in four areas as shown on the org chart. Physical Security Advisory Group (PSAG) and Grid Exercise Working Group (GEWG) are aligned with the E-ISAC and provide updates to CIPC. The Control Systems Security Working Group (CSSWG) was retired last year. The CIPC also participated in Event Analysis process as well.

Since there are errors on the organization chart slides, they will be updated and posted with the agenda package.

Is there a plan going forward for security training? Marc – the CIPC has enjoyed partnerships with National Labs, E-ISAC, and other vendors. Security Training WG should help retain engagement at all levels with the RSTC. When it was brought to the MRC to combine the TCs, one of the comments received was the need to consolidate cyber analysis into bulk power system planning and operations. The RSTC should try to integrate the three committees and ignore silos.

2020 Subcommittee Work Plans (Items 5a, 5b, 5c and 5d)
Chair Ford called on each standing committee chair to provide a review of their current work plan

Vice Chair Zwergel, OC Chair reviewed the OC Work Plan. He noted recurring items and specific work plan items for each subcommittee. A suggestion was made to identify recurring items that Planning or Security people need to be made more aware. The work plans should be updated as well.

Brian Evans-Mongeon, PC Chair, reviewed the PC Work plan document. Part of the design of the work plan is to make this a good reference for all of the subgroups under the PC. It contains links for other references. The PC EC meets monthly to consider additions to the work plan. Transitions with industry require the PC to alter the work plan and deliverables/schedule. It provides an up-to-date work scope and deliverable for the subgroups.

Marc Child, CIPC Chair, reviewed the CIPC Work Plan. He noted that the CIWG and SCWG are the only active CIPC subgroups. The remaining groups were moved to the E-ISAC or disbanded. There are also items in the work plan listed a "new TF". These items need to be addressed by the RSTC.

After the work plans were reviewed, Chair Ford requested a motion for approval of the OC/PC/CIPC work plans to be combined and considered the INITIAL RSTC work plan. This will be refined as the RSTC commences its work and determines prioritization of tasks. The OC, PC and CIPC may edit the work plans, however the changes must be approved by the RSTC. The committees should identify priority items/tasks.

Wayne Guttormson made a motion to approve the work plans. The motion passed without dissent.

RSTC Transition Plan (Items 6a, 6b, 6c, and 6d)
Chair Ford lead a discussion on the proposed RSTC Transition Plan with members and observers. The Executive Committee will review the input received from today's discussion at its March 2020 face-to-face meeting, refine the transition plan as needed, and present an updated transition plan at the June RSTC meeting which will be used as the ongoing working document.

- Consider appointing liaisons/sponsor that are not from the same committee as the work plan (i.e., don't put ops people on ops projects. Cross-pollinate by getting people out of their comfort zone.
- Consider interaction with liaisons and staff and their expectations around project management. The liaison would be more like an executive sponsor while staff continues their role as they do today.
- There may be inter-relationships between subgroups. It may be more beneficial to bring together common subject areas and have a liaison for these "groupings". While RISC should be included, need to consider ERO priorities and strategic plan to the subgroups. Liaison would provide triage function and help with agenda setting for the RSTC.
- Need to consider how task forces will be staffed for emerging issues/work plan items. NERC will be able to post seeking volunteers for such efforts.
- How does the EC and the liaisons contribute to agenda building? Subcommittee leadership? What are the specific roles?
- Consider the terms of RSTC members when assigning liaisons to provide continuity.

- Evaluate the existing subgroups before assigning liaisons due to potential changes in organization/structure.
- Liaisons can bring back recommendations to RSTC for synergies in subgroup work plans.

Chair Ford referenced the Policy Input/Industry Comment Resolution and Tracking document and reviewed the transition plan tracking plan document.

The RSTC should ensure work plans, strategic plan, ERO priorities and RISC report are all coordinated.

Chair Ford reviewed the draft agenda template for regular RSTC meetings.

- Do not need to have in-person report from every subcommittee at every meeting. Want to prioritize work items and consolidate reports to present to the RSTC. Liaisons can facilitate this effort.
- Have a standing "emerging issues" item on the agenda
- Link to RSTC Charter needs to be updated
- EMPTF (new group) will be reporting to the RSTC

Chair Ford referenced the committee calendar that was included in the agenda package. A question was raised regarding travel restrictions that many companies are implementing. NERC will continue to monitor conditions and make decisions whether to cancel a meeting or conduct it via webinar.

Reliability Issues Steering Committee (RISC) Status Report and Coordination (Item 7)
Vice Chair Zwergel provided a RISC update. The RSTC has a representative on the RISC and Vice Chair Zwergel will continue to be a member of the RISC. Vice Chair Zwergel noted that the RISC will meet by conference call the week of March 16th to discuss 2020 activities, objectives and risks. Will be looking at RISC enhancement, charter review and begin planning 2021 RISC report at Reliability Summit. Determine how RISC can have input and support RSTC work plan.

North American Generator Forum (Item 8a)
Allen Schriver provided an update on the activities of the NAGF.

NERC Standard Drafting Teams

- PRC-005
  - Revise PRC-005-6 to clearly delineate the applicability of Protection Systems associated with AVR protective functions.
  - Needs to clearly limit the scope of the AVR protective functions to those elements that open a breaker directly or via lockout or tripping auxiliary relays.

Winterization

- Enhance the process and communications.
- Recognize all plants are a unique design, face different weather challenges and may have low capacity factors.

NAGF Collaboration with NATF

- Supply Chain
  - Collaborating with NATF and other industry organizations to provide a streamlined, effective, and efficient industry-accepted approach to assess supplier cyber security practices to enhance cyber security.
  - Model to reduce supplier burden so efforts with purchasers can be prioritized and entities provided information effectively and efficiently.
  - Resilience
  - NAGF was invited to attend a pilot of the NATF Transmission Resilience Maturity Model (TRMM). NAFG to begin working with the NATF to develop a similar model to be used by GO/GOP's to evaluate their resiliency policies and programs.

NPCC DER

- Work with NPCC DER Forum to identify challenges/opportunities for DER "grid edge" resources installed on the Distribution System, to promote understanding and support reliable integration.

IRPTF/IEEE P2800

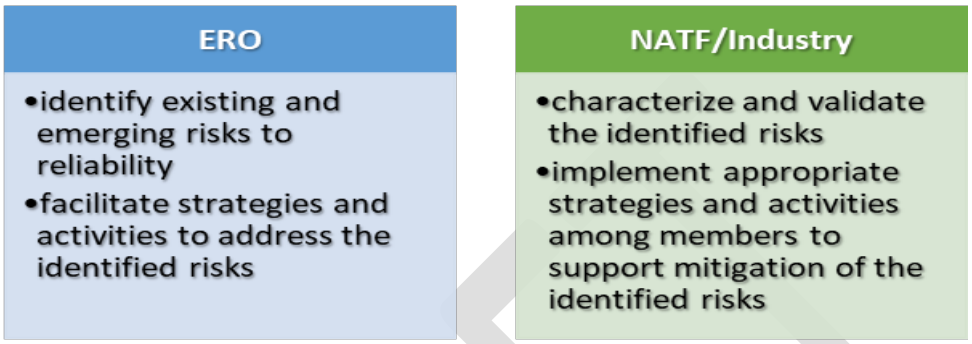
- Technical Report: Energy Transition to High IBR
  - **Goal:** Provide visionary technical report and roadmap of how to manage a BPS with increasing penetration of BPS-connected inverter-based resources.
- Reliability Guideline: EMT Modeling and Simulations
  - **Goal:** Provide industry with clear guidance and recommendations for use of EMT models and performing EMT simulations.
- Reliability Guideline: BESS and Hybrid Plant Performance, Modeling Studies
  - **Goal:** Provide industry with clear guidance and recommendations for battery energy storage and hybrid plant performance, modeling, and studies.

North American Transmission Forum (Item 8b)
Roman Carter provided an update on the activities of the NATF. Please see slides for details.

NATF Revised MOU Focus/Role

- NATF-NERC Memorandum of Understanding (April 2019)

- Advance mutual objectives and collaboration
- Leverage respective and collective strengths
- Minimize duplication of effort
- Respective roles:



NATF Solution Provider

- NATF is pre-qualified organization to submit Implementation Guidance under the NERC BOT Compliance Guidance Policy
- NATF Implementation Guidance submitted to date:
  - CIP-014-2 R1 Physical Security Risk Assessment (March 2017) – ERO Endorsed
  - MOD-033-1 Methodology Reference Guide (March 2017) – ERO Endorsed
  - CIP-014-2 R4 Evaluating Potential Physical Security Attack (Sept 2017) – ERO Endorsed
  - CIP-014 R5 Physical Security Plans (Sept 2017) – ERO Endorsed
  - CIP-010-3 Software Integrity and Authenticity (November 2017) – ERO Endorsed
  - CIP-013-1 Implementation Guidance - Reliance on Independent Assessments (April 2019) – ERO Endorsed
  - CIP-005-6 Vendor Remote Access Guidance (December 2019) – Proposed

NATF Ongoing ERO Collaboration

- NATF-EPRI-NERC Resiliency Summits
  - NATF-EPRI host since 2013
  - NERC joined in 2019
- NATF-EPRI-NERC Planning and Modeling Workshops
  - Joint effort since 2017
- Electric Power Human Performance Improvement Symposium

  - Collaborating since 2017
- RF and SERC "Pilot" Facility Rating and Supply Chain

NATF is in collaboration with RF and SERC regarding Facility ratings and Supply Chain

NATF Resilience Activities

- NATF-EPRI Resilience Summits
  - Conducted annually since 2013
  - Recently included NERC as co-sponsor
- Webinar series for members
  - Physical security measures for substations
  - Insider threat and protection of communication systems
  - Incident command structure, emergency response, and post-event preparation
  - Spare equipment strategies and programs for substation equipment
  - Planning for system resiliency (future)

Chair's Closing Remarks and Adjournment (Item 9)
Chair Ford thanked participants and presenters for attending the meeting. He appreciates the input and participation and looks forward to more input and growth. As work plans are consolidate, things will become clearer.

Mark Lauby expressed his thanks and noted that the meeting was productive and he looks forward to our continued progress.

There being no further business before the Reliability and Security Technical Committee, Chair Ford adjourned the meeting on Wednesday, March 4, 2020 at 4:36 p.m. Eastern.

Next Meeting
The RSTC will meet June 10-11, 2020 with a specific location TBD.

Stephen Crutchfield
Stephen Crutchfield
Secretary

NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Compliance Input Working Group Update

Chair Brent Sessions, Western Area Power Administration
Reliability and Technical Security Committee Meeting
June 10, 2020

RELIABILITY | RESILIENCE | SECURITY




Cloud Encryption Team
Alice Ireland Lead

- Cloud Encryption Team
  - Completed final drafts of “Security Guidelines BCSI Cloud Encryption” and “Cloud Solutions and Encrypting BCSI”
  - Submitted for review by the Reliability and Security Technical Committee (RSTC)/Critical Infrastructure Protection Committee (CIPC) on May 12, 2020
  - Currently waiting for feedback from the review team

BCSI in the Cloud Table-Top
Brent Sessions Lead

- BCSI in the Cloud Table-top exercise
  - Western Area Power Administration (WAPA) has a test environment set up using MS Azure
  - Reliability Standard Audit Worksheets (RSAWs) and evidence ready for assessment team on May 18, 2020
  - Participants are WAPA, Western Electricity Coordinating Council (WECC), Midwest Reliability Organization (MRO), NERC, and Microsoft
  - Exercise scheduled for May 21, 2020
    - Remote
  - Deliverables include lessons learned for evidence, RSAWs/narratives, and the assessment process itself
    - Set up future table-top exercises for success
  - Exercise was completed on May 21, 2020
    - Working on consolidating notes from all groups to prepare lessons learned.
    - The team considered this to be a very successful activity

BCSI in the Cloud Table-Top
Brent Sessions Lead

- BCSI in the Cloud Table-top exercise
  - Deliverables include lessons learned for evidence, RSAWs/narratives, and the assessment process itself
    - Set up future table-top exercises for success

Evidence Request Tool
Pat Boody Lead

- CIP Evidence Request Tool (ERT) v4.0/v4.5/v5.0 Annual Review/Updates
  - The ERT Review team met on Tuesday, May 12 from 2:30 – 3:30 p.m. Eastern to review the suggestions for change and comments for consideration (currently at 25 pages).
  - Meeting 2 took place from Thursday, May 14 from 3:15–5:15 p.m. Eastern
  - Meeting 3 took place Friday, May 15 from 3:15-4:15 p.m. Eastern
  - Feedback was due to NERC Compliance on Friday, May 15, 2020

NERC CIP-CSF Mapping
Keith St. Amand Lead

- NERC CIP Standards Mapping to Cybersecurity Framework (CSF) Update
  - Initial Task Force meeting completed
  - On track to complete May Program “Design” deliverable
  - Next major goal – team agreement on DRAFT Document structure/format and Self-Assessment tool approach deliverables

Joint FERC/NERC Whitepaper Review – Tony Hall Lead

- Joint FERC/NERC Whitepaper
  - First review of report has occurred, team has reviewed and made some selective changes
  - Team reviewed the work and is consolidating comments and suggested changes
  - Team is on target to have the review completed well before the deadline of May 31, 2020

Administrative Updates
Brent Sessions CIWG Chair

- Administrative Updates
  - NERC Extranet working area for sub-teams
    - SharePoint
    - Non-public working area for collaboration and ease of information access
    - Access determined by sub-team chairs
    - Dashboard approach
      - Calendar, key announcements, and meeting materials
      - Tasks w/timeline
    - File organization w/tagging and views
    - Sub-team chairs/co-chairs as contributors
    - Designed for active participants on sub-teams

Administrative Updates
Brent Sessions CIWG Chair

- Administrative Updates
  - Sub-team approach working
    - Currently 4 sub-teams are active
    - Deadlines are being met
    - Team leads are effective in facilitating the groups
  - Ongoing objective to expand participation in this group
    - Better information for calls for volunteers
  - Access has been set up in SharePoint extranet site
  - Assessing new tools such as survey and photo library
  - Potential public website for key CIWG information
  - Excellent support from Stephanie Lawrence

Administrative Updates
Brent Sessions CIWG Chair

- Administrative Updates
  - Clarify and strengthen role CIWG plays in NERC
    - Looking at input/output processes between RTSC and CIWG
  - Ongoing input from the team on ways to continually improve
  - Meetings
    - Next monthly conference call – 2:00 p.m. Eastern | June 11, 2020
      - Subgroup calls as needed
    - Regular monthly WebEx calls are held on the second Thursday of every month at 2:00 p.m. Eastern

Questions and Answers

Agenda Item 4a.i
RSTC Meeting
June 10, 2020

NERC Operating Committee
Sub-group Status Report

Group: Event Analysis Subcommittee (EAS)

Purpose: The Event Analysis Subcommittee is a cross-functional group of industry experts that will support and maintain a cohesive and coordinated event analysis (EA) process across North America with industry stakeholders. EAS will support development of lessons learned, promote industry-wide sharing of event causal factors and assist NERC in implementation of related initiatives to lessen reliability risks to the Bulk Electric System.

Last Face-to-Face Meeting: March 2, 2020 **Location:** Atlanta, GA
Duration: 1/2 Day

Next Meeting: June 9, 2020 **Location:** Conference Call

Duration: 2 hours

Conference Calls: 2nd and 4th Monday of every month from 11:00 a.m.-12:00 p.m. Eastern

Chair: Vinit Gupta – ITC Holdings
Vice-Chair: Ralph Rufrano - NPCC

Pending OC Approval Items:

- None at this time

Key issues for OC Resolution:

- None at this time

Key Issues for OC Information:

- The EAS has published three new lesson learned since the March 2020 OC meeting.
- The EAS formed a team to review the UK Blackout Report for potential lessons learned to share with industry.
- The revised Data Exchange Infrastructure and Testing Requirements Compliance Implementation Guidance was approved by the OC to submit to the ERO for Compliance Guidance.
- The September 2020 Monitoring and Situational Awareness Conference is under consideration by the EMSWG to possibly be rescheduled for next year or be held via WebEx.
- The EMSWG conducted an industry webinar on April 29th to review the latest changes and revisions to the approved version 2.0 of Risks and Mitigations for Losing EMS Functions

Reference Document and to answer questions. The webinar presentation and streaming video are posted on the NERC website.

- The EAS has reviewed and provided comments to the 2020 State of Reliability report.
- EAS has a team working on updating the Generating Unit Winter Weather Readiness Reliability Guideline.

Current Initiatives/ Deliverables:

- EAS is conducting outreach to drive lessons learned submittals through not only the ERO EA Process but through other occurrences or near occurrences experienced by entities.

Future Initiatives/ Deliverables:

- Review Event Analysis Process document as required
- Recommend need for training in coordination with Personnel Subcommittee (PS)
- Publish lessons learned as required
- Develop Reliability Guidelines
- Identify significant risk and the need for NERC Alerts
- Updates to the OC
- Input to the NERC Performance Analysis Subcommittee's (PAS) annual State of Reliability Report
- Information and recommendations related to the Event Analysis process

External requests to group:

- Outreach and coordination with NATF/NAGF regarding lesson learned usability
  - North American Generator Forum is actively participating in the EAS
- Outreach and Coordination with other NERC groups (PS, PAS, RS, ORS, and PC). Liaisons established with PS and PAS
  - Leadership calls are set up prior to OC meetings
  - Coordinating with PAS on 2018 State of Reliability Report

Internal requests to group:

- None at this time

Group's recurring deliverables:

- EAS continues to manage the ERO Event Analysis Process Document update process as required
- Action oriented Lessons Learned posted on NERC website
- EAS will continue to review and address reliability issues that pose a risk to the BPS and share information with the OC and industry

Any NERC Programs Oversight Responsibility for the Group:

- No

Any NERC Document (non-Reliability Standard) Responsibility for the Group:

- ERO Event Analysis Process Document

NERC Reliability and Security Technical Committee
Sub-group Status Report

Group: Operating Reliability Subcommittee

Purpose: The Operating Reliability Subcommittee (ORS) assists the NERC Reliability and Security Technical Committee (RSTC) in enhancing Bulk Electric System (BES) reliability by providing operational guidance to the industry; by providing oversight to the management of NERC-sponsored information technology tools and services which support operational coordination and by providing technical support and advice as requested.

Last Meeting: May 5, 2020 **Location:** WebEx
Duration: 1 Day

Next Meeting: Sept. 9-10, 2020 **Location:** Salt Lake City, Utah (Hosted by WECC)
Duration: 1 Day

Chair: Chris Pilong – PJM
Vice-Chair: Jimmy Hartmann - ERCOT

2020 Initiatives

We continue to focus on regular review, update, and communication of Guidance Documents and Reference Guides within our area of responsibility. We also continue to prepare for implementation of the IDC PFV, following the ongoing parallel operations. Throughout 2020, we will be monitoring the transition/retirement of the RCIS and the additional tools being developed by the EIDSN for RC use.

Items for RSTC Approval:

- None

Key Issues for RSTC Information:

- The ORS endorsed minor changes to the PJM Reliability Plan.
- The ORS endorsed minor changes to the MISO Reliability Plan.
- The ORS endorsed minor changes to the TVA Reliability Plan.
- The Chairs of ORS and RS presented overviews of the activities of their respective Subcommittees at each other's recent meetings. The ORS and RS are looking at ways to better coordinate the review of frequency events, with the ORS receiving more detailed updates and information from the existing RS analysis performed.

- The ORS was briefed on the RSTC March 4 meeting highlights and the transition plan.
- The Synchronized Measurement Subcommittee (SMS) provided the ORS with an overview of the SMS activities and the work that they are doing in the area of Oscillation Detection and Analysis. The group has mainly been focused on Oscillation Analysis utilizing PMUs, and inverter based resource monitoring and is looking to become more involved with the Operations aspect of PMUs and oscillation detection. The SMS and ORS discussed opportunities for the SMS and ORS to work more closely together, including an option to have the SMS report to the ORS as a Working Group in the future.
- The ORS members shared their current practices, responses and operational impacts related to COVID-19.
- The ORS continues to discuss the potential retirement of the real time Frequency Monitor role. This is a role TVA has held in the Eastern Interconnection since 2005. The group will vote in September to retire or maintain the role.
- The ORS received an update from the NATF on the industry effort to ensure Grid Security Emergency (GSE) communications to control rooms and control room leadership is in place. The ORS Executive Committee is part of this effort. The ORS will continue to remain engaged and track this effort.
- The ORS reviewed and endorsed changes to the RCIS Reference Document, which provides guidance to RCIS users for posting of informational messages.
- The ORS continues to receive updates from the EIDSN Steering Committee pertaining to the IDC Tool enhancements. Specifically, the Parallel Flow Visualization (PFV) project, which is intended to improve the data quality used by the IDC during curtailment of Eastern Interconnection transactions. For next steps, FERC will need to approve the proposed NAESB standards revisions before PFV can be put into production. There is no known timeline for when this approval will be made.
- The ORS continues to receive updates from NERC regarding the new SAFNR version 3, including the new functionality and roll out plan for the RCs to gain access. The ORS will continue to monitor and provide feedback on the new tool as it is further developed.

Current Initiatives/ Deliverables:

- ORS has reviewed and discussed the 2020 OC/RSTC work plan and continues to work items in the plan as prioritized by the RSTC
- Recurring Deliverables of Group
- Provide subcommittee report for the regularly scheduled Reliability and Security Technical Committee meetings.
- Endorse new or revised RC Reliability Plans.
- Develop comments on the annual State of Reliability report.
- Review the use of Proxy Flow Gates.
- Review of EEA events.
- Develop comments on Adequate Level of Reliability metrics.

- Provide coordination between the EIDSN IDC Steering Committee and the Reliability and Security Technical Committee.

NERC Program's Oversight Responsibility for the Group

- Provide a forum for discussion of operating practices and potential lessons learned.
- Provide a forum for discussion of information technology tools and services that facilitate operational reliability coordination.
- Provide oversight and guidance on aspects of Interchange Scheduling, including Dynamic Transfers, as it applies to impacts on reliable operations.

NERC Document (Non-Reliability Standard) Responsibility for the Group

- Guidelines and Reference Documents

NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

NERC Planning Committee Work Plan

Final Work Plan for Reliability and Security Technical Committee Transition

May 2020

RELIABILITY | RESILIENCE | SECURITY




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Table of Contents

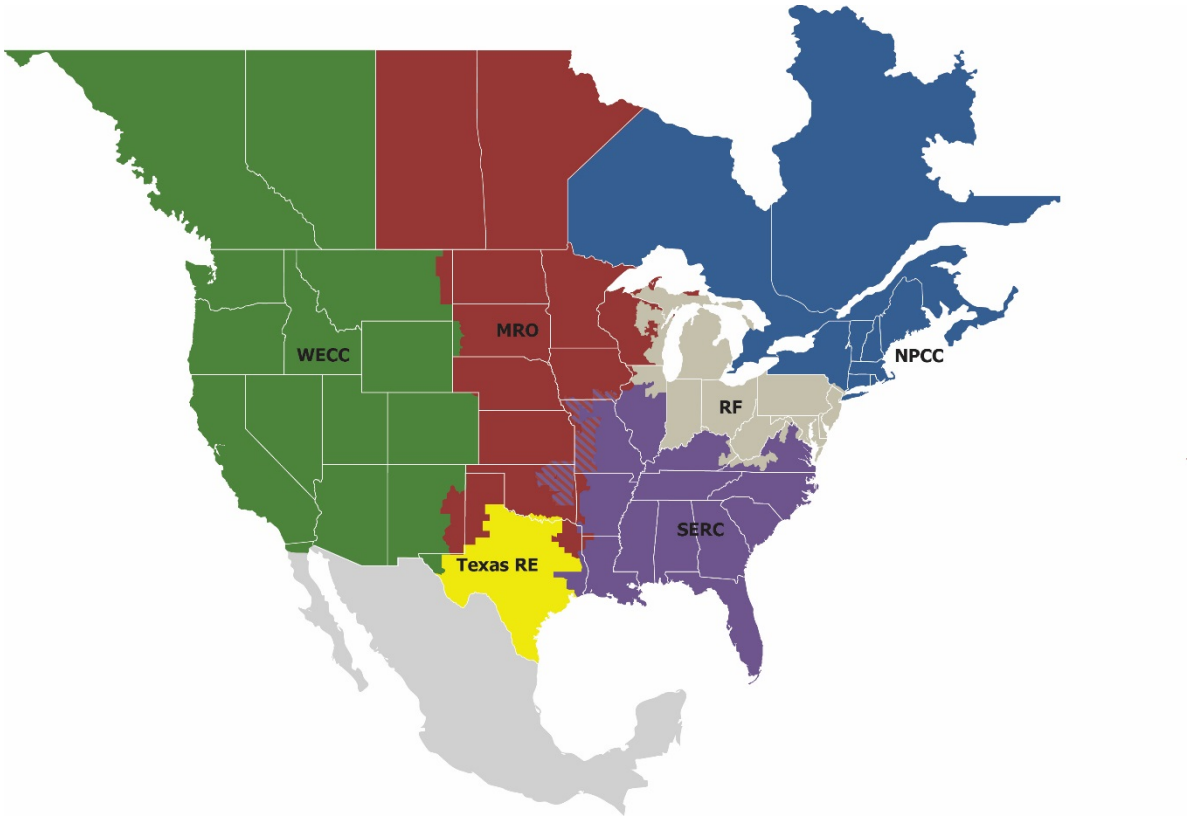
Preface

Electricity is a key component of the fabric of modern society and the Electric Reliability Organization (ERO) Enterprise serves to strengthen that fabric. The vision for the ERO Enterprise, which is comprised of the North American Electric Reliability Corporation (NERC) and the six Regional Entities (REs), is a highly reliable and secure North American bulk power system (BPS). Our mission is to assure the effective and efficient reduction of risks to the reliability and security of the grid.

Reliability | Resilience | Security

Because nearly 400 million citizens in North America are counting on us

The North American BPS is divided into six RE boundaries as shown in the map and corresponding table below. The multicolored area denotes overlap as some load-serving entities participate in one Region while associated Transmission Owners/Operators participate in another.



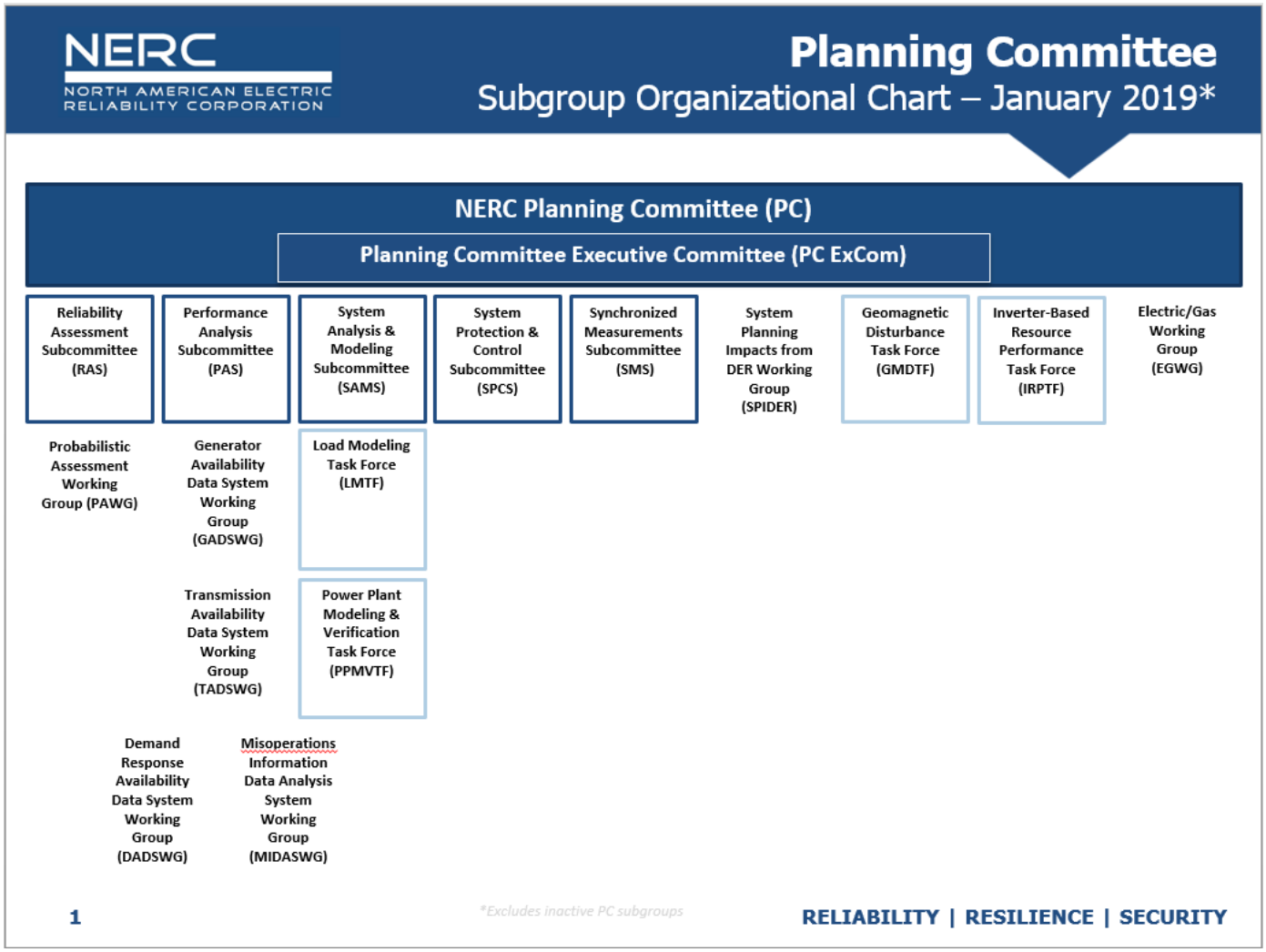
MRO	Midwest Reliability Organization
NPCC	Northeast Power Coordinating Council
RF	ReliabilityFirst
SERC	SERC Reliability Corporation
Texas RE	Texas Reliability Entity
WECC	Western Electricity Coordinating Council

PC Meeting Schedule

NERC Calendar

Meeting / Conference Call	Date / Time	Objectives / Goals
PC Executive Committee Web Meeting	January 27, 2020	December meeting follow-up Planning Session for March Meeting Agenda
PC Executive Committee Web Meeting	February 14, 2020	December meeting follow-up Planning Session for March Meeting Agenda
PC Meeting Atlanta	March 3, 2020 1:00-5:00pm (LT) March 4, 2020 8:00am-12:00pm (LT)	Final Meeting of the PC
PC Executive Committee Strategic Web Meeting	March 31, 2020	PC Work Plan Detailed Review and RSTC transition coordination
Reliability and Security Technical Committee (RSTC) Meeting TBD	June 10-11, 2020	First Regular Meeting of the RSTC

PC Subgroup Organization Chart



PC Subgroup Work Plan

Reliability Assessment Subcommittee (RAS)

Website: RAS **Chair**: Lewis De La Rosa (12/2019) **NERC Lead**: Bill Lamanna
Hierarchy: Reports to PC **Vice-Chair**: Anna Lafoyiannis (12/2019) **Scope Update**: December 2018

#	Task Description	Risk Profile(s)	Strategic Focus Area(s)	Target Completion	Requested Action	Status
1	2020 Long-Term Reliability Assessment	1, 2, 3	1, 2, 3, 4	4Q-2020	Endorse Link to Schedule	Data requested from NERC Regions. Anticipate RSTC review in September 2020.
2	2020 Summer Reliability Assessment	1, 2, 3	1, 2, 3, 4	2Q-2020	Endorse Link to Schedule	Data requested from NERC Regions. PC, OC, and RSTC reviewed in May 2020. Publication in June.
3	2020-2021 Winter Reliability Assessment	1, 2, 3	1, 2, 3, 4	4Q-2020	Endorse	Data request will be sent to regions in August 2020. Anticipate RSTC review in October 2020.
4	Review and provide input to NERC Staff (Advanced System Analytics and Modeling) on NERC Study of Resource Adequacy and Transmission Deliverability	1,3	1, 2, 3	TBD	Information	NERC Staff is studying this issue and working with RAS for industry technical input. RAS and PAWG have provided feedback to NERC on study scope. Opportunities to provide input to NERC staff on analysis and results are anticipated as study progresses.
5	Measure 6 Analysis White Paper documenting the results of screening analysis to identify areas with changes in their load patterns or their resource mix that could impact ramping and flexibility needs over time	1,3	1, 2, 3	Q2-2020	Information	RAS reviewed at April 2020 meeting. White Paper is being finalized for posting on the RAS website.

Probabilistic Assessment Working Group (PAWG)

Website: PAWG **Chair**: Andreas Klaube (1/2019) **NERC Lead**: JP Skeath
Hierarchy: Reports to RAS **Vice-Chair**: Alex Crawford (9/2019) **Scope Update**: December 2016

#	Task Description	Risk Profile(s)	Strategic Focus Area(s)	Target Completion	Requested Action	Status
1	Data collection approaches and recommendations technical report Develop a technical report that describes industry approaches and best practices for probabilistic	2, 3	1, 2, 3	Q3-2020	Approve	Initial draft developed. Current progress indicative of group knowledge.
2	Long-Term Reliability Assessment Enhancement Pilot Study to look at screening approaches to supplement off year probabilistic scenarios.	3	1, 2, 3	Q4 2020	Information	At end of work product, recommendations for adoption in 2021 LTRA to be made to RAS.
3	2020 Probabilistic Assessment – Base Case Develop 2020 probabilistic assessment for the LTRA.	3	1, 2, 3	Q4-2020	Information	Updated schedule was reviewed at joint PAWG-RAS meeting in April 2020. Base ProbA to be in conjunction with 2020 LTRA.
4	2020 Probabilistic Assessment – Scenario Case Develop 2020 probabilistic assessment for the LTRA	3	1, 2, 3	Q1 – 2021	Approve	Regional risk scenarios approved by RAS. Sensitivity scenarios to be complete in Q1 2021. Tracking updates on methods.

5	Perform periodic Scope Review	NA	NA	Q2 2020	Approve	RAS approved the revised scope. It contains minor updates from previous scope. NERC staff will provide to RSTC for approval.

Performance Analysis Subcommittee (PAS)

Website: PAS **Chair**: Maggie Peacock (09/2018) **NERC Lead**: Margaret Pate
Hierarchy: Reports to PC **Vice-Chair**: Brantley Tillis (09/2018) **Scope Update**: March 2019

#	Task Description	Risk Profile(s)	Strategic Focus Area(s)	Target Completion	Requested Action	Status
1	Support development of 2020 State of Reliability Report (SoR)	1-4 (2019)	1, 2, 5, 6	Q2 2020	Endorse	In execution
2	Review NERC Reliability Indicators webpage	3,4	1,5	Q3-2020	None	Ongoing improvements.
3	Conduct detailed assessments that integrate analytic data trend insights regarding resilience under severe weather conditions, identifying preventable aspects for BPS reliability.	2019 RISC Profile 2	1, 2, 3	TBD	Information	In execution phase. Working to identify cause codes. Sub group formed for both PAS and RAS. PAS obtained data and provided analysis in the 2019 SOR. RAS includes questions in the LTRA narrative request. In addition, updated seasonal assessments include weather-related risks.
4	Review proposed new metrics	1-4 (2019)	5	Q3 2020	Approve	In initiation phase - Pilot metric on severity of transmission outages under development.
5	Define the process for the annual metric review	1-4 (2019)	5	Q1 2021	Approve	On hold until Q3. Process to be developed.

Generating Availability Data System Working Group (GADSWG)

Website: GADSWG **Chair**: Leeth DePriest (01/2018) **NERC Lead**: Jack Norris
Hierarchy: Reports to PAS **Vice-Chair**: Steve Wenke (01/ 2018) **Scope Update**: September 2018

#	Task Description	Risk Profile(s)	Strategic Focus Area	Target Completion	Requested Action	Status
1	*NERC RoP* GADS Section 1600 Data Reporting to collect and analyze GADS data: • Conventional - relevant design data and enhanced event reporting • Wind - connected energy storage and event reporting • Solar - plant configuration, performance and event data as well as equipment outage detail	3, 4	1, 5	Q2 - 2021	Endorse	Draft will be finalized at the end of 2020.
2	GADS Wind Data Reporting: Implement mandatory wind reporting	3, 4	1, 5	Ongoing	None	On-track for completion of phased-in mandatory reporting status in 2020.

Transmission Availability Data System Working Group (TADSWG)

Website: TADSWG **Chair**: Dan King (6/2019) **NERC Lead**: Margaret Pate
Hierarchy: Reports to PAS **Vice-Chair**: John Idzior (6/2019) **Scope Update**: September 2018

#	Task Description	Risk Profiles(s)	Strategic Focus Area(s)	Target Completion	Requested Action	Status

1	Investigation of transmission-connected reactive devices (e.g., STATCOMS / SVCs) and their impact on the system; reviewing reactive device information to be collected; likely section 1600 data request.	3,4	1,5	Q4 2020	None	Initiation phase - Engaged with the Canadian Electricity Association, CEA, to understand their data collection process.

Demand Response Availability Data System Working Group (DADSWG)

Website: DADSWG **Chair**: TBD **NERC Lead**: Donna Pratt
Hierarchy: Reports to PAS **Vice-Chair**: TBD **Scope Update**: June 2018

#	Task Description	Risk Profile(s)	Strategic Focus Area(s)	Target Completion	Requested Action	Status
1	Research availability of DADS data from other sources to see if there is continued unique reliability value in current collection method.	3, 4	1, 5	Q1 2021	None	Planning phase

Misoperations Information Data Analysis System Working Group (MIDASWG)

Website: **Chair**: Brian Kasmarzik (03/2020) **NERC Lead**: Rachel Rieder
Hierarchy: Reports to PAS **Vice-Chair**: Thomas Teafatiller (03/2020) **Scope Update**: June 2018

#	Task Description	Risk Profile(s)	Strategic Focus Area(s)	Target Completion	Requested Action	Status
1	Review approved Section 1600 data request and, if appropriate, develop revisions in accordance with NERC Rules of Procedure	4, 5	3, 6	Q4 2021	Endorse	Planning phase - MIDASWG developing subgroups to determine if changes to Section 1600 are necessary.
2	Evaluate potential need to develop new or revised defined terms to support Misoperation data reporting	4, 5	3, 6	Q1 2021	Information	Planning phase
3	Evaluate additional misoperations calculations for a more comprehensive alternative to the current Misoperation Rate calculation that is currently used.	4, 5	3, 6	Q1 2021	Information	Initiated

Electric - Gas Working Group (EGWG)

Website: EGWG **Chair**: Michelle Thiry (01/2019) **NERC Lead**: Thomas Coleman
Hierarchy: Reports to PC **Vice-Chair**: Todd Snitchler (03/2019) **Scope Update**: June 2019

#	Task Description	Risk Profile(s)	Strategic Focus Area(s)	Target Completion	Requested Action	Status
	Development of Reliability Guideline in progress.	1	2,3	Q1 2020	Approve	Complete. Guideline approved and posted.
1	Tasks will be determined by EGWG during upcoming meetings (April – October); EGWG is developing activities to support industry outreach, measures of effectiveness, and identification of additional areas of focus.	1	2,3	TBD	TBD	Provided general outline for three future EGWG meetings during the PC meeting in March 2020.

System Analysis & Modeling Subcommittee (SAMS)

Website: SAMS **Chair**: Hari Singh (06/2018) **NERC Lead**: Jessica Harris

Hierarchy: Reports to PC **Vice-Chair**: Evan Shuvo (06/2018) **Scope Update**: December 2016

#	Task Description / *Deliverable*	Risk Profile(s)	Strategic Focus Area(s)	Target Completion	Requested Action	Status
1	Node-Breaker Planning Model Representation *Support advancement of node-breaker representation in planning models and alignment between planning and operations cases. Perform small scale pilot projects for future implementation of wide-scale construction of planning base case with full node breaker capability.*	2, 3	8, 9	Ongoing	Information	Ongoing; multi phase effort underway. Scope document is posted on SAMS page.
2	Modeling Notifications *Developing Modeling Notifications, creating industry announcements and educational webinars on notifications*	2, 3	9	Ongoing	None	SAMS anticipating model notifications from tracked topics: • Frequency calculations in stability simulations • Generator capability data for modeling
3	NERC Acceptable Models List *Maintain and document for industry list of 'approved models' for powerflow and dynamics; periodic updates to list based on industry advancements.*	2, 3	9	Ongoing	Information	On-track; SAMS reviewed and approved the latest updates. Current version posted is October 31, 2019.
4	Generator Protection Model Implementation and Benchmarking: Implement and benchmark GP3 l new dynamic model in all commercial planning software tools per PCPMTF recommendations	2,3	8,9	Q4-2020	Information	On track; GP3 Model Implementation in Commercial Software Tools Status: PowerWorld - Implemented in Ver. 20, released Nov. 2018 PSLF - Implemented in Ver. 21.06, released Jan. 2019 DSATOOLS - Implemented and released in April 2019 with version 19 PSS/E - Estimated completion by Fall 2020
5	Case Creation Practices (MOD-032-1) for Interconnection-Wide Models *Review and assessment of practices (e.g., generation dispatch, demand response, firm transfers, demand levels) to identify areas for improvement or consistency.*	2, 3	8,9	Q4-2020	Information	On track. SAMS is considering what deliverable to propose to RSTC (webinar, report, other)
6	White Paper: Clarification of "Load Loss" terminology Prepare technical brief for diverse audience (regulators & industry executives) Task was assigned by PCEC following PC roundtable discussion/input from IOU sector representative at December 2017 PC meeting	2, 3	8	Q4-2020	Approve	SAMS is finalizing white paper.
7	Whitepaper: Review of Transient Voltage Recovery and Voltage Dip Criteria *Prepare a document on review of transient voltage criteria with the updated composite load model and other modeled updates.*	1-Grid Transformation (2019)	8	Q3 2021	Approve	PCEC agreed to work plan item in May 2020. SAMS to coordinate on LMTF for kick-off meeting.

Load Modeling Task Force (LMTF)

Website: LMTF **Chair**: Dmitry Kosterev **NERC Lead**: Olushola Lutalo
Hierarchy: Reports to SAMS **Vice-Chair**: **Scope Update**: December 2016

#	Task Description / *Deliverables*	Risk Profile(s)	Strategic Focus Area(s)	Target Completion	Requested Action	Status
1	Load Model (Software) Benchmarking	2, 3	9	Ongoing	None	Phase 1 complete--all major software vendors benchmarked composite load model successfully; Additional work on track: beginning implementation and benchmarking of composite load model with DER component and single phase motors.
2	Robust (Default) Data Sets *Default datasets to support utilities seeking guidance on reasonable load model parameters (e.g., starting point or no other data available)*	2, 3	9	Complete	None	Complete.
3	System Impact Assessment *Utility members sharing experience of load modeling and studies; user forum for sharing lessons learned.*	2, 3	8, 9	Q3-2020	None	On-track; ongoing information sharing.
4	Dynamic Load Modeling in Real-Time Stability Analysis *Assessment of industry practices for use of dynamic load models for real-time or operations planning studies*	2, 3	8, 9	Q4-2020	None	Delayed due to higher priority topics; Survey released to LMTF members; follow-up and compilation is next step.
5	Progressive Protection System Modeling *Testing and studying progressive tripping, reconnection, and stalling modeling approach for improved model performance*	2, 3	9	Q4-2021	None	Require modular implementation first (task 10). longer-term goal; beta testing being performed by multiple software vendors.
6	Improved Single-Phase Motor Model	2, 3	9	Q2-2021	None	make model available to software developer for implementation (task 8 is a prerequisite)
7	Improved Three-Phase Motor Model	2, 3	9	Q2-2021	None	On-track, make model available to software developer for implementation (task 8 is a prerequisite)
8	Efficient Data Format & Model Management *New data format to modularize dynamic load models*	2, 3	9	Q1-2021	None	Beta testing being performed by multiple software vendors. PSLF and Powerworld already capable, PSS/E will need major version release (Verion 35)
9	Modeling Notifications: Composite Load Model Benchmarking. Develop composite load model benchmarking notification to share with industry the completion and usability of the models across all major software platforms.	2, 3	9	Q1-2021	None	TBD
10	Load Composition Analysis (e.g, Buildings, end uses)	2,3	9	On-going	None	On-track; ongoing information sharing.
11	Power Electronics Load, adjustable drive (VFD, ECM) electric vehicle charger models	2,3	9	On-going	None	On-track; ongoing information sharing.
12	Load Model Data Management Tool	2,3	9	Completed	None	Complete
13	Perform Periodic Scope Review Review approved scope and revise as needed. Provide revised scope to PCEC via SAMS for approval.	PC Charter	PC Charter	Q4 2020	Approval	Not started.

Power Plant Modeling & Verification Task Force (PPMVTF)

Website: PPMVTF **Chair**: Shawn Patterson **NERC Lead**: Ryan Quint
Hierarchy: Reports to SAMS **Vice-Chair**: **Scope Update**: May 2016

#	Task Description / *Deliverable*	Risk Profile(s)	Strategic Focus Area(s)	Target Completion	Requested Action	Status
1	Power Plant Model Review *Review NERC acceptable list of models for power plants, provide guidance to development of list*	2, 3, 4	8,9	Ongoing	No	Ongoing
2	Reliability Guideline: MOD-032-1 Generator Data Requests *Develop technical guidance material for MOD-032-1 data requests and sharing; in response to NAGF letter seeking guidance*	2,3	8,9	Q3 2020	Approve	Moved back date to Q3 2020
3	White Paper: Generator Reactive Capability – Testing, Data, and Coordination *A white paper to address the activities relating to MOD-025-2, PRC-019-2, and MOD-032-1 related to testing, coordination, and modeling generator capability; a review of the applicable standards and the effectiveness of those standards in achieving the expected reliability outcomes.*	2, 3	4, 9	Q1 2020	Approve	PC reviewers provided comments through Feb 18; PC discussion held at March PC meeting.
4	Modeling Notification: Frequency Calculations in Stability Studies	1, 2, 3	9	TBD	Information	TBD
5	Modeling Notification: Generator Capability data for Stability Studies	1, 2, 3	9	Q4 2020	Information	Tabled; seeking next steps on MOD-025 white paper first.
6	Perform Periodic Scope Review Review approved scope and revise as needed. Provide revised scope to PCEC via SAMS for approval.	PC Charter	PC Charter	Q1 2020	Approval	Complete. Revised scope approved at January PCEC meeting

System Protection & Control Subcommittee (SPCS)

Website: SPCS **Chair**: Jeff Iler (12/2019) **NERC Lead**: Jule Tate
Hierarchy: Reports to PC **Vice-Chair**: Bill Crossland (12/2019) **Scope Update**: June, 2017

#	Task Description	Risk Profile(s)	Strategic Focus Area(s)	Target Completion	Requested Action	Status
1	PRC-019 Implementation Guidance	2, 3, 4	8	TBD	Endorse	PC reviewers assigned at September PC meeting. SPCS is addressing comments.
2	Standards Authorization Request (SAR): PRC-023-4 – Transmission Relay Loadability	1, 2, 4	2, 4	TBD	Endorse	Reviewers assigned at December 2018 PC Meeting. SPCS is reviewing comments and determining next steps.
3	SAR and Technical Analysis Report: PRC-019-2 – Coordination of Generating Unit or Plant Capabilities, Voltage Regulating Controls, and Protection.	1, 2, 4	2, 4	Q1-2020	Endorse	Complete. PC approved the white paper and endorsed the SAR at the March PC Meeting.
4	Protection System Commissioning Lessons-Learned *Errors in protection design documents and/or failure to employ effective commissioning testing practices can lead to protection system misoperations. SPCS will review and revise (as necessary) the 2014 lessons-learned document and conduct industry outreach to increase awareness of the revised lessons-learned.*	1 (2019)	8	Q4 2020	Endorse	PCEC reviewed the proposal in Feb 2020.
5	IBR Impacts to BPS Protection Systems *Transmission protection practices and systems will need to adapt to the changing nature of the grid. SPCS will develop a technical report on the impacts that BPS-connected inverter-based resources can and are having on BPS protection systems. The report will be coordinated with NERC Inverter-Based Resources Performance Task Force (IRPTF), as needed, to bring*	1 (2019)	2	Q1 2021	Endorse	PCEC reviewed the proposal in Feb 2020.

	protection and inverter experts together. The intent of the technical report is to provide a framework, roadmap, and technical guidance for industry to tackle this challenge.					
6	PRC-024-3 Implementation Guidance *Due to changes in PRC-024-3 the Implementation Guidance will require updating to help entities demonstrate compliance with the revised standard.*	1 (2019)	8	TBD	Endorse	PCEC reviewed the proposal in Feb 2020. Technical Committee endorsement will be sought following regulatory approval of the revised standard.

System Planning Impacts of Distributed Energy Resources Working Group (SPIDERWG)

Website: SPIDERWG **Chair**: Kun Zhu (September 2019) **NERC Lead**: Ryan Quint, JP Skeath

Hierarchy: Reports to PC **Vice-Chair**: Bill Quaintance (July 2018) **Scope Approved**: December 2018

#	Task Description	Risk Profile(s)	Strategic Focus Area(s)	Target Completion	Requested Action	Status
Modeling Subgroup *(Co-Leads: Irina Green, CAISO; Mohab Elnashar, IESO)*						
M1	**DER Modeling Survey** *Perform industry survey of SPIDERWG members regarding use of DER planning models in BPS studies, dynamic load models and DER modeling guidelines.*	1, 2	2, 3	Q3-2020	No	Survey results currently being analyzed by SPIDERWG team to develop short assessment on findings from survey. To be presented to RSTC.
M2	**Reliability Guideline: DER Data Collection for Modeling** *Guideline providing recommendations and industry practices for the mandatory and optional DER data to be collected by the Reliability Coordinator as well as on how, where, and when to gather such data.* • *Review the documentation of existing data collection techniques and processes that has been developed by the industry.* • *Recommendations for DER data collection technique suitable for various study types.* *Recommendations for the DER data complexity requirements based on DER penetration levels*	1, 2	2, 3	Q3 2020	Yes	Currently developing responses to industry comments. Expected completion in June 2020. *(High priority task for SPIDERWG)*
Verification Subgroup *(Co-Leads: Michael Lombardi, NPCC; Mike Tabrizi, DNV-GL)*						
	Reliability Guideline: DER Performance and Model Verification *Reliability Guideline covering aggregate DER model verification, including recommended measurement practices, executing model verification activities, model benchmarking, relation to MOD-033 activities, and conversion of data sources for verification.*	1, 2	2, 3	Q4-2020	Yes	On track – draft guideline in development. Timeline moved back slightly based on prioritization of SPIDERWG. *(High priority task for SPIDERWG)*
V2	**Reliability Guideline: DER Forecasting Practices and Relationship to DER Modeling for Reliability Studies** *Guidance providing how forecasting practices are linked to DER modeling for reliability studies. DER forecasting practices are important for accurately representing the correct amount and type of DER, particularly at an aggregate level representation for BPS studies.*	1, 2	2, 3	Q1-2021	Yes	On track; early stages of development.

Studies Subgroup *(Co-Leads: Peng Wang, IESO; Mohab Elnashar, IESO)*						
S1	**Reliability Guideline: Bulk Power System Planning under Increasing Penetration of Distributed Energy Resources** *Guideline providing recommendations and industry practices for performing planning studies considering the impacts of aggregate DER behavior.* • *Review and documentation of existing study approaches currently used by industry, development of findings and recommendations from these studies incorporating DER.* • *Review and highlight of DER study practices and known DER impacts from various entities around the world.* • *Guidelines on how to incorporate and represent DER in planning studies for potential reliability issues, such as selection of study scenarios with system gen/load conditions, and different approaches to incorporate DER in different types of studies.* • *Guidelines on study assumptions and approaches considering single-phase installation of DER; consideration of co-simulation tools and techniques.* • *Guidelines on types of reliability issues encountered with high DER penetration and potential solutions to these issues.* • *Recommended practices and approaches for reporting gross load, net load, and DER tripping/reconnection as part of simulation results.*	1, 2	2, 3	Q4-2020	Yes	Progressing. Completion moved to Q4 2020. *(High priority task for SPIDERWG)*
S2	**White Paper: Review of TPL-001 Standard for Incorporation of DER** *White paper dicussing technical review of NERC TPL-001-5, and development of any recommendations pertaining to consideration and study of DER impacts to the BPS.*	1, 2	2, 3, 4	Q2-2020	Yes	PC Reviewers provided comments in January 2020. Draft white paper was discussed at the March PC meeting. *(High priority task for SPIDERWG)*
S3	**Recommended Simulation Improvements and Techniques** *Guidance (white paper) to software vendors on tools enhancements for improved accounting and study of aggregate DER.*	1, 2	2, 3	Q3-2020	Yes	Completion date moved back – needs input from S1 and S4.
S4a	**Reliability Guideline: Recommended Approaches for Developing Underfrequency Load Shedding Programs with Increasing DER Penetration** *Guidance on how to study UFLS programs and ensure their effectiveness with increasing penetration of DER represented.*	1, 2	2, 3	Q4-2020	Yes	Split into two guideline related to specific frequency or voltage subject.

S5	**White Paper: Beyond Positive Sequence RMS Simulations for High DER Penetration Conditions** *Considerations for high penetration DER systems and the need for more advanced tools (e.g., co-simulation tools) for studying DER impacts on the BPS.*	1, 2	2, 3	Q4-2020	Yes	On track.
Coordination Subgroup *(Co-Leads: Clayton Stice, ERCOT; Jimmy Zhang, AESO)*						
C2	**Reliability Guideline: Communication and Coordination Strategies for Transmission Entities and Distribution Entities regarding Distributed Energy Resources** *Develop recommended strategies to encourage coordination between Transmission and Distribution entities on issues related to DER such as information sharing, performance requirements, DER settings, etc.*	1, 2	2, 3	Q1-2021	Yes	In early stages of development; scoping activities for relatively short/focused guideline in the works; considering breaking into near- and long-term guidance.
C3	**Educational Material to Support Information Sharing between Industry Stakeholders** *Develop material to educate industry stakeholders on practices, recommendations and technical work developed by other industry organizations.*	1, 2	2, 3	Ongoing	No	Changed to ongoing task; ongoing work in other groups needed first.
C5	**Coordination of Terminology** *Review of existing definitions and terminology and development and coordination of new terms, for consistent reference across sub-groups.*	1, 2	2, 3	Ongoing	No	Tracking use of terminology within SPIDERWG discussions.
C6	**NERC Reliability Standards Review** *White Paper reviewing NERC Reliability Standards and impacts of DER.*	1, 2	2, 3, 4	Q4-2020	Yes	On track *(High priority task for SPIDERWG)*
C7	**Tracking and Reporting DER Growth** *Coordinated review of information regarding DER growth, including types of DER, size of DER, etc. Consideration for useful tracking techniques for modeling and reliability studies.*	1, 2	2, 3	Ongoing	No	In monitoring and data collection stage.

Geomagnetic Disturbance Task Force (GMDTF)

Website: GMDTF **Chair**: Emanuel Bernabeu (12/2017) **NERC Lead**: Mark Olson
Hierarchy: Reports to PC **Vice-Chair**: Ian Grant (12/2017) **Scope Update**: December 2016

#	Task Description / *Deliverable*	Risk Profile(s)	Strategic Focus Area(s)	Target Completion	Requested Action	Status
1	Final Report on NERC GMD Research Work Plan tasks; Upon completion of research deliverables, the task force will review, comment, and provide an assessment of the research results and outcome *Assessment Reports.* Plan includes topics listed below (1a – 1i)	3, 7	2, 8	Q1-2020	Information	FERC accepted NERC's GMD Research Work Plan in FERC Order No. 851. EPRI project addresses all GMD Research Work Plan objectives. EPRI report publications are listed below (1a-1h). Final reports for all tasks completed in April 2020. GMDTF will review and develop recommendations for ERO.
1a	Task 1: Benchmark GMD Event analysis. *The research activities under this task consist of performing further research and analysis on the use of spatial averaging in defining benchmark GMD events that entities use when conducting the GMD Vulnerability Assessments required by the TPL-007 standard.*	3, 7	2, 8	Q1-2020	Information	Technical report summarizing database of extreme GMD events released in June 2019: https://www.epri.com/#/pages/product/3002016832/ Final report of benchmark event analysis and spatial averaging in EPRI released in April 2020.
1b	Task 2: Latitude scaling analysis. *The research activities under this task include evaluating the latitude scaling factors in Reliability Standard TPL-007, including using existing models and developing new models to extrapolate, from historical data, the potential scaling of a 1-in-100 year GMD event on lower geomagnetic latitudes.*	3, 7	2, 8	Q1-2020	Information	Technical report released April 2020. Interim report released: https://www.epri.com/#/pages/product/3002016885/
1c	Task 3: Improve Earth Conductivity Models. *The research activities under this task consist of activities to improve the accuracy of existing earth conductivity models for GIC studies.*	3, 7	2, 8	Q1-2020	Information	EPRI Report published January 2019: Use of Magnetotelluric Measurement Data to Validate/Improve Existing Earth Conductivity Models Product ID# 3002014856 Additional technical reports on validation of GIC models and non-uniform geoelectric field modeling released April, 2020.
1d	Task 4: Study Geoelectric Field Orientation for Transformer Thermal Impact Assessment. *This task will develop an approach for applying the benchmark geoelectric field time series to individual transformers in thermal impact assessments. The research activities under this task will consist of: 1) evaluating the existing approach used to perform transformer thermal assessments; and 2) developing alternative methods of applying the benchmark geoelectric field time series to individual transformers to represent worst-case hot-spot heating conditions in transformer thermal impact assessments.*	3, 7	2, 8	Q1-2020	Information	Technical report released April 2020.

#	Task Description / *Deliverable*	Risk Profile(s)	Strategic Focus Area(s)	Target Completion	Requested Action	Status
1e	Task 5: Analyze 75 A per Phase Criterion Used In Transformer Thermal Assessment. *Research for this task will analyze the 75A/phase TPL-007 criterion used for transformer thermal impact assessments. The work will:* • *re-examine the screening criteria and if needed, an alternative criterion will be developed; and* • *study tertiary winding harmonic heating and determine if this affects the thermal screening criteria.*	3, 7	2, 8	Q1-2020	Information	1 of 2 Reports Complete: EPRI Report Published December 2019: Transformer Thermal Impact Assessments for DC Withstand Capability: Examining the Impacts of Geomagnetically Induced Current (GIC) on Transformer Thermal Performance: 3002017708 2 of 2 Reports released April 2020.
1f	Task 6: Support NERC Section 1600 Data Request *The activities under this task consist of developing the necessary guidance, technical guidelines, and solutions to support a request for data or information under Section 1600 of the NERC Rules of Procedure for the collection of existing and new GIC data and magnetometer data. The purpose of this data collection is to respond to FERC's Order No. 830 directive to collect GMD monitoring data and to make that data publically available.*	3, 7	2, 8	Q3-2020	Information	EPRI Support ongoing. Data Reporting Program is addressed in task 2.
1g	Task 7: Calculate Ground Model Scaling Factors (Beta-factors). *The activities under this task are focused on calculating earth conductivity scaling factors (beta factors) as necessary to meet the needs of the industry. This includes the following: benchmark of electric field estimation results against available scientific and industry algorithms; production of beta factor averages over improved 1D regions; and determination of beta factor ranges from differences in magnetic field orientation, spectral content, and 3D contributions.*	3, 7	2, 8	Q1-2020	Information	EPRI Report Published January 2019: Tool Evaluation and Electric Field Estimate Benchmarking Results Product ID# 3002014853 Report with calculated Beta factors released April 2020.
1h	Task 8: Improve Harmonics Analysis Capability. *The activities under this task consist of developing harmonics analysis guidelines and tools for entities to use in performing system-wide assessment of GMD-related harmonics.*	3, 7	2, 8	Q1-2020	Information	Complete. EPRI released beta-version of a software application for wide-area GMD-related harmonics analysis in January 2019. An update was published in December 2019: 3002014854 The tool is available to the public free of charge. A report describing the tool and functionality was published in December 2019: 3002017447
2	Develop a Data Reporting Instruction for entities to collect and report GIC and magnetometer data as specified in the ROP Section 1600 Data Request	3, 7	2, 8	Q2-2020	Information	PC Review January 14 – February 14, 2020. GMDTF discussed comments at February GMDTF meeting. Response to comments and revised draft is being finalized at NERC. NERC IT staff is developing the data reporting application for implementation before year-end 2020.
3	GIC Monitoring and Magnetometer Data Collection Assessment; recommend how NERC should assess and report on the degree to which industry is following Section 1600 Data Request	3, 7	2, 8	Q3-2020 (process)	Information	Process will be included in the DRI.

#	Task Description / *Deliverable*	Risk Profile(s)	Strategic Focus Area(s)	Target Completion	Requested Action	Status
	and guidance for GIC monitoring. (Guidance for GIC monitoring was developed by the GMD Standards Drafting Team as part of revisions to TPL-007). (Ref P. 88) *Plan for reviewing GIC data*					
4	Analyze data from GMD events collected under the GMD Data Request and other necessary information to further understand GIC effects on BES facilities. Summarize observations, including observations on GIC modeling.	2018 RISC Profile 7	2	Q4-2020	Information	Activity is from 2018 RISC Report. Requires implementation of the Sect 1600 data request.
5	Perform Periodic Scope Review Review approved scope and revise as needed. Provide revised scope to PCEC for approval.	PC Charter	PC Charter	Q4 2020	Approval	GMDTF reviewedscope at the February 2020 meeting. Approved scope is valid through the completion of the GMD Work Plan and the establishment of the GMD Data Collection program. GMDTF and NERC Staff will develop recommendation for new scope or disbandment in Q4 2020.

Inverter-Based Resource Performance Task Force (IRPTF)

Website: IRPTF **Chair**: Al Schriver **NERC Lead**: Ryan Quint; Rich Bauer

Hierarchy: Reports to PC and OC **Vice Chair**: Jeff Billo **Scope Update**: June 2017

#	Task Description	Risk Profile(s)	Strategic Focus Area(s)	Target Completion	Requested Action	Status
1	Modeling and Simulations Technical Report *Findings, recommendations, and experiences modeling and studying inverter-based resources; information from NERC Alert data collection; generation interconnection studies; IRPTF stability studies*	1, 2, 3	2, 3	Q2 2020	Approve	Complete. PC reviewers assigned at March PC meeting. PCEC approved in May.
2	*Canyon 2 NERC Alert Follow Up – Modeling and Simulation* *Follow up work with entities to ensure accurate and appropriate models are being used for local and interconnection-wide studies and base case creation. Engagement with MOD-032 Designees, Planning Coordinators, Transmission Planners, and Generator Owners to ensure accurate modeling. Follow up with the proposed changes and execution of those changes.*	1, 2, 3	2, 3, 6	Ongoing	None	Regular updates on industry progress to address modeling issues identified in Canyon 2 Fire disturbance NERC Alert. Coordinating with WECC SMAG.
3	*IEEE p2800 Monitoring and Support* *Monitor and support the activities of IEEE p2800, and provide technical expertise and input as requested.*	1, 2, 3	2, 3	Ongoing	None	Ongoing, as needed.
4	White Paper: Fast Frequency Response Fundamentals and BPS Reliability Needs *Short white paper to provide recommended terminology and definitions for discussing fast frequency response, low inertia systems, and other relevant concepts. In coordination with other NERC groups and CIGRE/IEEE activities.*	1, 2, 3	2, 3	Q1 2020	Approve	Complete. PC approved March 2020.
5	White Paper: Coordinated Review of NERC Reliability Standards, and Applicability and Clarity of Standards to Inverter-Based Resources *A cursory review and documentation of potential standards that could be improved or strengthened to add clarity and consistency for inverter-based resources.* *White Paper is approved. PC authorized development of SARs.*	1, 2, 3	2, 3, 4	Q1 2020	Approve	PC approved at the March 2020 PC meeting. PC authorized IRPTF to develop corresponding MOD, PRC, VAR, and FAC SARs. IRPTF will coordinate with SPIDERWG for TPL SAR.
6	**Review IRPTF Scope** *Develop revised scope document that reflects current group activities*	1, 2, 3	2, 3	Q4 2020	Approve	Revised scope developed and provided to NERC PC and OC for approval. PC leadership is recommending RSTC consider IRPTF scope as part of its technical committee review.
7	Technical Report: Energy Transition to Higher Penetrations of Inverter-Based Resources *Develop a technical report outlining a roadmap to ensuring BPS reliability under increasing penetration of inverter-based resources; discussion of issues and possible solutions to these issues.*	1, 2, 3	2, 3	Q4 2020	Approve	PCEC agreed with new work proposal December 2019.
8	Reliability Guideline: EMT Modeling and Studies *Positive-sequence models are utilized to represent generator resources in typical dynamic stability tools used by power system engineers in various studies. However, these models contain certain simplifications for inverter-based resources (IBRs) that may lead to erroneous results under certain system conditions (e.g., low system strength). The reliability guideline will provide guidance on when and how an entity should be performing EMT*	1, 2, 3	2, 3	Q4 2020	Approve	PCEC agreed with new work proposal December 2019.

	analysis. This reliability guideline will build off of the previously developed reliability guidelines by IRPTF.					
11	Reliability Guideline: Battery Energy Storage and Hybrid Plant Performance and Modeling Battery storage systems are increasing in size and number. Further, use of hybrid resources is increasing. There is lack of guidance and expertise on how to model and simulate these types of new resources in interconnection studies and planning assessments. The IRPTF will develop a reliability guideline that outlines recommended practices.	1, 2, 3	2, 3	Q4 2020	Approve	PCEC agreed with new work proposal December 2019.

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Reliability Assessment Subcommittee

Status Report

Lewis De La Rosa, RAS Chair

Reliability and Security Technical Committee Meeting

June 10, 2020

RELIABILITY | RESILIENCE | SECURITY




Reliability Assessment Subcommittee
Outline

Summary

- 2020 Summer Reliability Assessment
- 2020 Long-Term Reliability Assessment and Probabilistic Assessment

2020 SRA

- Draft reviewed by PC, OC, and RSTC in May
- Publication in early June

Findings

- Sufficient capacity resources are expected to be in-service for the upcoming summer
- Maintenance and preparations for summer operations impacted by pandemic
  - Important to continue monitoring progress of efforts to prepare staff and equipment
- Protecting critical electric industry workforce during the COVID-19 pandemic remains a priority for reliability and resilience
- Late-summer wildfire season in western United States and Canada poses risk to BPS reliability

2020 Long-Term Reliability Assessment Development

Date	Milestone
June 22	Assessment Areas submit Preliminary Data and Narratives
June 26 – July 8	RAS Peer Review
July 14 – 16	RAS Meeting
July – August	Report Drafting
September 15	NERC Staff and RAS leadership present preliminary findings to RSTC
September 17 – 30	RSTC review draft report
October	RSTC Endorsement Vote
November	NERC staff provides LTRA to the NERC Board

2020 Probabilistic Assessment

- RAS and Probabilistic Assessment Working Group (PAWG) are conducting the biannual Probabilistic Assessment (ProbA)
- ProbA complements the LTRA by providing additional probabilistic resource adequacy statistics
  - Loss of Load Hours (LOLH)
  - Expected Unserved Energy (EUE)
- Base case and regionally-derived risk scenarios are examined
- Results are included in the 2020 LTRA
  - Detailed results and scenario analysis are reported separately in early 2021
- ProbA and LTRA analysis supports ERO objectives for assessing energy adequacy (ERO Enterprise Priorities Focus Area 2)

Agenda Item 4a.i
RSTC Meeting
June 10, 2020

NERC Operating Committee
Sub-group Status Report

Group: Resources Subcommittee

Purpose: Status Update

Last Meeting:	April 22-23, 2020	**Location:**	Online via WebEx
Duration:	8 hours		
Next Meeting:	July 21-23, 2020	**Location:**	Montreal, Quebec
Duration:	2.5 Days		
Chair:	Sandip Sharma – ERCOT		
Vice-Chair:	Greg Park - NWPP		

Items for RSTC Approval:

- **Review RS Scope Document**:

  The RS is seeking RSTC approval of a revised RS Scope. The revision is intended to align the scope document with the new structure under the RSTC. The RS reviewed and approved the revised scope at the April 2020 RS meeting.

Key Issues for RSTC Information:

- **Periodic review**
  1. **Operating Reserve Management Guideline Document–** Periodic review continues with the target date of December 2020 approval.
  2. **ACE Diversity Interchange Guideline Document–** Periodic review continues with the target date of December 2020 approval.
  3. **Inadvertent Interchange Guideline Document–** Periodic review continues with the target date of December 2020 approval.
  4. **Integrating Reporting Ace with the NERC Reliability Guideline –** Periodic review continues and will be coordinated with the **Operating Reserve Management Guideline**.
- **Eastern and Western Interconnection Generator Operator 2019 Survey** – A draft report was presented at the April 2020 RS meeting summarizing the governor response of Generators that participated in the survey. RS members will continue to finalize the report and perform data validiation.

Working Group Updates

- **RS Frequency Working Group (FWG)** – At the April 2020 RS meeting, the FWG selected M4 and BAL-003-1 frequency events for the months of December through February

2020, for each interconnection.

- **RS Inadvertent Interchange Working Group (IIWG**) – The Eastern Interconnection inadvertent interchange update continues to show a return to the downward trend after an uptick in balances through first half of 2019. The EI fast time error trend continues.

  The Western Interconnection inadvertent interchange showed slight uptick during the Q1 2020. Root cause analysis will be conducted if the uptick of inadvertent interchange continues.

- **Reserves Working Group (RWG)** —reviewed the quarterly DCS submittal from BAs.

Quarterly Reviews

- **BA Performance Data** – CPS1/BAAL and DCS data submitted for the 1st quarter of 2020 were reviewed. No significant issues were noted.
- **Time Error –** Time error reports for 1st quarter of 2020 were reviewed. No significant issues were noted.
- **ERS Measures –** Additional refinements in analysis and possible additional sub-measures are being considered. The RS will continue this discussion into its July RS meeting.
- **Interconnection Frequency Performance** - Performance for all four interconnections were reviewed. No significant issues were noted.

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Supply Chain Working Group Update

Chair Tony Eddleman, NPPD
Reliability and Security Technical Committee Meeting
June 10, 2020

RELIABILITY | RESILIENCE | SECURITY




Discussion Topics

- Completed Webinars – Main Focus of the Working Group
- 2020 Work Plan

Completed Webinar Series on Security Guidelines

- **Supply Chain and Risk Considerations for Open Source Software**
  - Monday, March 23, 2020
    - 131 Attendees
  - Team Lead: George Masters, Schweitzer Engineering Laboratory, Inc.
- **The Supply Chain Cyber Security Risk Management Lifecycle**
  - Monday, March 30, 2020
    - 40 Attendees; Technical Issue with Webinar Link (Many joined by phone only, but WebEx doesn't count them in its records)
  - Team Lead: Tom Alrich, Tom Alrich LLC
- **Vendor Identified Incident Response Measures**
  - Monday, April 6, 2020
  - 119 Attendees
  - Team Lead: Steven Briggs, TVA

Completed Webinar Series on Security Guidelines

- **Secure Equipment Delivery**
  - Monday, April 13, 2020
    - 155 Attendees
  - Team Lead: Wally Magda, WallyDotBiz LLC
- **The Vendor Risk Management Lifecycle**
  - Monday, April 20, 2020
    - 166 attendees
  - Team Lead: Tom Alrich, Tom Alrich LLC
- **Procurement Language**
  - Monday, April 27, 2020
    - 180 Attendees
  - Team Lead: Dan Wagner, WECC

Completed Webinar Series on NERC Advisory Sessions & Security Guidelines

- **Frequently Asked Questions: Supply Chain – Small Group Advisory Sessions**
  - Monday, May 4, 2020
    - 171 Attendees
  - Brian Allen, NERC
- **Supply Chain Security Guidelines on Provenance**
  - Monday, May 11, 2020
    - 160 Attendees
  - Team Lead: David Steven Jacoby, Boston Strategies International
- **Supply Chain Risks Related to Cloud Service Providers**
  - Monday, May 18, 2020
    - 171 Attendees
  - Team Lead: Brenda Davis, CPS Energy

2020 Remaining Work

- Finalize Security Guideline
  - Procurement Language – work has continued
    - Team Lead: Dan Wagner, WECC
- Additional short-papers based on feedback from existing work products (NERC CIPC Work Plan)
- Considerations for GMD EMP purchasing (NERC CIPC Work Plan)

Questions and Answers

Synchronized Measurements Subcommittee (SMS)

Website: SMS
Hierarchy: Reports to RSTC
Chair: Aftab Alam
Vice-Chair: Tim Fritch
NERC Lead: Ryan Quint
Scope Update: March 2019 (being revised with ORS)

#	Task Description	Risk Profile(s)	Strategic Focus Area(s)	Target Completion	Requested Action	Status
1	**Technical Report: Methods for Analyzing and Mitigating Forced Oscillations** *Technical report to address potential reliability impacts from natural and forced oscillation events; guidance on how RCs and TOPs can determine the quantities to be monitored, thresholds to be monitored, and the corresponding mitigation actions for consistency in developed operating procedures and mitigation plans.*	1 (2019)	8	Q4 2020	Approve	On track. Development underway.
2	**Oscillation Disturbance Analysis Template** *Creation of a template for reporting, tracking, and analyzing oscillation events.*	1 (2019)	8	Q3 2020	Information	New task.
3	**Oscillation Analysis – April 2020 Hydro Plant Forced Oscillation Event** *Forced oscillation event on April 28, 2020*	1 (2019)	8	Q4 2020	Information	New task, upon identification of oscillation event.
4	**Oscillation Analysis – NYISO Oscillation Event** *Oscillation events on April 7 and April 17, 2020*	1 (2019)	8	Q4 2020	Information	New task, upon identification of oscillation event.

NERC Reliability and Security Technical Committee
Action Items
Dated: June 10, 2020

March 2018 Meeting Action Items (carry-over from OC)					
OC meeting and item number	**Assignment**	**Description**	**Due Date**	**Progress**	**Status**
1803-05	EAS	TOP-001-4, Requirements R20 and R21	September 2018	March 2018 - The EAS will review R20 and R21 as requested to clarify "redundant and diversely routed" language as well as testing requirements. June 2018 – The EAS is working to develop guidance for these requirements. December 2018 – The EAS provided a status update. The team is working to address issues and concerns raised by industry. March 2019 – The document will be provided to the OC for a two week comment period. If the comments are relatively minor, we would include the document with the RS documents as part of the e-mail ballot. The ballot for this document will be to post for a 45-day comment period. June 2019 – The OC endorsed the Compliance Implementation Guidance for submittal to the ERO for approval. September 2019 – The DEIRTF revised the guidance based on ERO feedback. The revised guidance was approved by the OC and submitted to the ERO for approval. May 2020 – The DEIRTF received feedback from the ERO and made some requested revisions to the Guidance. The revised document was sent to the OC for an electronic ballot to approve	In Progress pending ERO final approval

				the revisions and resubmit for ERO approval. The ballot passed and the revised document was resubmitted for ERO approval.	
1803-06	RTAQTF	TOP-010 and IRO-018 requirements about data quality	September 2018	March 2018 – The RTAQTF will develop documentation (Compliance Guidance or similar) to address RTA quality as identified in TOP-010, R3 and the associated IRO-018 requirement. December 2018 – The team continues to develop Implementation Guidance to address quality. The team is targeting the March 2019 OC meeting for approval. March 2019 – The RTAQTF is about 80% done with a draft Compliance Implementation Guidance document. The TF plans to provide a draft version to the NERC OC for review in April/Early May for potential endorsement by the OC at the June meeting. June 2019 – The OC endorsed the Compliance Implementation Guidance for submittal to the ERO for approval. The RTAQTF Guidance was endorsed by the ERO on March 11, 2020.	Closed
March 2020 Meeting Action Items					
OC meeting and item number	**Assignment**	**Description**	**Due Date**	**Progress**	**Status**
2003-01	Tina Buzzard	Add asterisks or notes to indicate executive Committee and Nominating Subcommittee members to the RSTC roster posted on the web page.	June 2020	A revised roster was posted on the RSTC web page with color codes representing the Executive Committee and Nominating Subcommittee members.	Closed
2003-02	Stephen Crutchfield	Update OC, PC and CIPC Organization Charts to correct errors.	June 2020	Rather than update the former committee organization charts, a composite RSTC organization chart was created and posted on the RSTC web page.	Closed

2003-03	Stephen Crutchfield, Mark Olson, Tom Hofstetter, Tina Buzzard	Update RSTC Work Plan and identify recurring items such as report approvals, guideline review, etc. Select "best practices" of each committee and standardize processes. Organize Work Plan with separate areas for recurring/on-going items.	September 2020	The RSTC Transition team is reviewing and refining the work plans of each subgroup and will present to the full RSTC for approval.	In Progress
2003-04	Marc Child, Tom Hofstetter, Stephen Crutchfield	Review CIPC Work Plan and assign items listed as "new TF" to an existing subgroup or recommend creation of a new subgroup.	September 2020	The RSTC Transition team is reviewing and refining the work plans of each subgroup and will present to the full RSTC for approval.	In Progress
2003-05	Stephen Crutchfield, Mark Olson, Tom Hofstetter, Tina Buzzard	The OC, PC and CIPC may edit the work plans, however the changes must be approved by the RSTC. The committees should identify priority items/tasks.	September 2020	The RSTC Transition team is reviewing and refining the work plans of each subgroup and will present to the full RSTC for approval.	In Progress
2003-06	RSTC Executive Committee and Transition Team	The Executive Committee will review the input received from today's discussion at its March 2020 face-to-face meeting, refine the transition plan as needed, and present an updated transition plan at the June RSTC meeting which will be	September 2020	The RSTC Executive Committee and Transition Team members has met weekly to discuss and refine the transition plan. The team developed a more robust transition plan and reviewed the OC, PC, CIPC subgroup organization and work plans and are developing a recommendation for the RSTC's consideration. This item is on the June 10 meeting agenda.	In Progress

		used as the ongoing working document.			
2003-07	Stephen Crutchfield	Coordinate with NATF and NAGF regarding reports to the RSTC.	June 2020	Stephen has contacted Al Schriver and Roman Carter to coordinate reports and topics for RSTC meetings. This coordination will continue for all RSTC meetings.	Closed

NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

White Paper: Implementation of NERC Standard MOD-025-2

NERC Power Plant Modeling and Verification Task Force (PPMVTF)
July 2019

Executive Summary

The purpose of MOD-025-2 states that verification and data reporting activities of GOs regarding generator (and synchronous condenser) active and reactive power capability testing are performed "to ensure that accurate information on generator gross and net Real and Reactive Power capability and synchronous condenser Reactive Power capability is available for planning models used to assess Bulk Electric System (BES) reliability." However, in most cases, the test data should not be directly used for transmission planning modeling purposes.[1]

Reaching the reactive power capability limits, particularly the excitation system over-excitation (OEL) and under-excitation (UEL) limiters, during operation is a fairly rare event during quasi-steady state and dynamic events.[2] Therefore, historical operational data might help the verification of the active power capability of the unit, but might not contain a single event (ever) where the equipment reached its limits regarding reactive power capability. While MOD-025-2 includes the option for using historical operational data, this operational data is typically insufficient for verifying reactive power capability (i.e., likely only capturing one of the four data points required to verify per MOD-025-2).[3] Therefore, this white paper is focused on the staged verification testing aspects of MOD-025-2 for synchronous machines.[4]

The major issue with staged verification testing is that the generator reactive power capability may not be fully demonstrated; rather, other constraints such as generator terminal voltage, plant auxiliary bus voltage,[5] or system operating voltage limits prevent reaching the generator reactive power capability. Alternatively, even if the machine reaches its limits, the reactive power output during testing will not be as much as at nominal voltage unless calculations are performed to adjust the capability to nominal voltage. While it is suggested in Attachment 1 of MOD-025 that engineering analysis be used to adjust the data to account for the effects for voltage, it is not required. Therefore, if the staged verification test values are reported and used in planning studies (as stated as the intent of MOD-025-2), the generating unit reactive

[1] Data from MOD-025 staged verification testing should only be used in the rare instances where actual generator capability limits (including limiters) are reached at rated voltage during the test procedures.

[2] The overexcitation limiters have inverse-time or definite-time limits associated with limiter settings. For example, the OEL in most systems will allow the unit to exceed the unit capability curve within the rotor winding short-time thermal requirements outlined in IEEE C50.13. In particular, the short time duration limits are not related to quasi-steady state conditions and are not the purpose of staged verification testing in MOD-025.

[3] For this reason, most generating facilities will use staged testing for the purposes of meeting the requirements of MOD-025-2.

[4] Note that inverter-based resources will face similar issues related to reaching voltage limits that may prohibit staged verification testing from reaching actual plant reactive capability.

[5] Typically the auxiliary buses are not represented in the transmission planning models. Further, bus voltage limits are modeled or monitored separately from generator capability. Unexpected tripping of a generating unit caused by auxiliary limits is generally not considered acceptable, and should be explicitly reported and addressed as part of any MOD-025 staged verification testing. In the current version of MOD-025-2, this is not a requirement and does not need to be reported.

capability will be underestimated (perhaps severely). For this reason, the activities that GOs are taking to meet compliance obligations for MOD-025-2 are not serving the intended purpose of the standard.

It is therefore recommended that a Standard Authorization Request (SAR) be developed, and a Standard Drafting Team (SDT) be created, to address the issues described in this white paper related to MOD-025-2. The PPMVTF is of the opinion that the existing MOD-025-2 standard should be either (i) altered or (ii) withdrawn and replaced with a new standard entirely.[6] The changes needed to MOD-025-2 are to prevent inaccurate data from being used to represent generating resources (and synchronous condensers) in the planning models. The PPMVTF believes that there is value in performing the staged verification tests since they can uncover unexpected limiting factors; however, the PPMVTF agrees that the data acquired during MOD-025-2 testing may not be directly usable to represent the actual capability of the machine in power system models, and that the tests do not generally accomplish the stated purpose of the standard.

Background

The curves on a generator capability diagram are depictions of the thermal limits of the rotor, stator, and stator end iron at generator rated voltage (and various pressures (e.g., hydrogen, if hydrogen-cooled) and temperatures) at given generator active and reactive loading conditions. To prevent damage due to the automatic voltage regulator response, the exciter is equipped with automatic limiters (i.e., underexcitation limiter (UEL) and overexcitation limiter (OEL)). The capabilities of the generator as set by the OEL and UEL are typically supplied as part of MOD-032-1 submittals and represent the active and reactive power capabilities at rated generator terminal voltage.[7] This information is also made available from the activities performed in PRC-019. To manipulate reactive power output of a generator for MOD-025-2 data collection, either the local transmission system voltage or the generator terminal voltage must be varied. As it may often be infeasible to sufficiently alter local

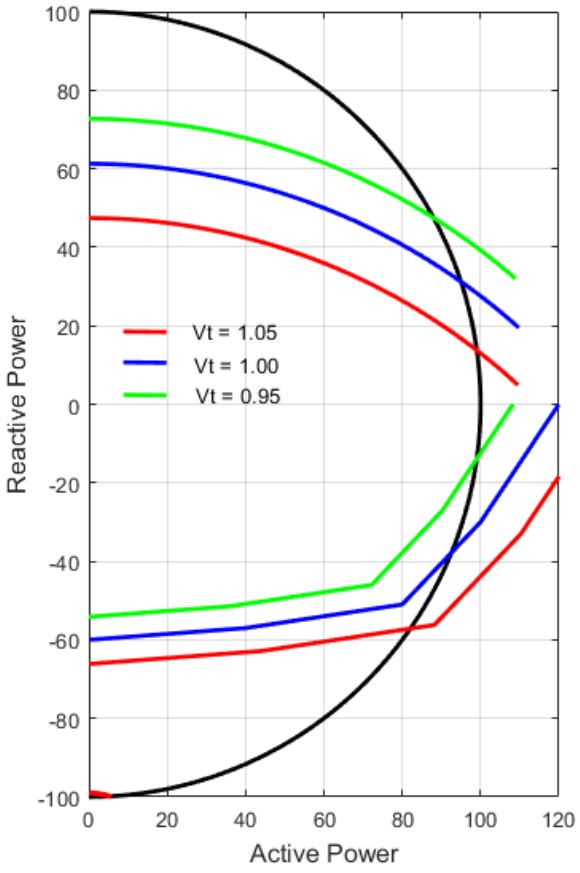


Figure 1: Generator Capability Sensitivity to Terminal Voltage

[6] A minority opinion is that MOD-025-2 should be withdrawn and not replaced with another standard.
[7] Sometimes these curves can be provided by the manufacturer at different terminal voltage values.

transmission system voltage for such a test,[8] the test is generally conducted by varying the generator terminal voltage. Based on the short circuit strength of the system at the generator interconnection, this could result in a significant increase or decrease in generator terminal voltage during testing. As illustrated in Figure 1, the generator *composite* capability (including the OEL and UEL) may be dependent on generator terminal voltage.

If MOD-025-2 data is collected by raising and lowering generator terminal voltage (from a starting point near the rated value) to reach the reactive capability limit of a generator (e.g., as determined by an OEL and UEL),[9] the reactive power limit will change with terminal voltage if the OEL or UEL are the limiting factors during the test.[10] The net reactive power production and absorption when the machine is operating at the excitation limiter setting during the test can be significantly less than the generator would provide at the same limit but under rated voltage conditions. As shown in Figure 2, the targeted reactive power capability operating test points are shifted with the changing voltage, and less reactive power is achieved.

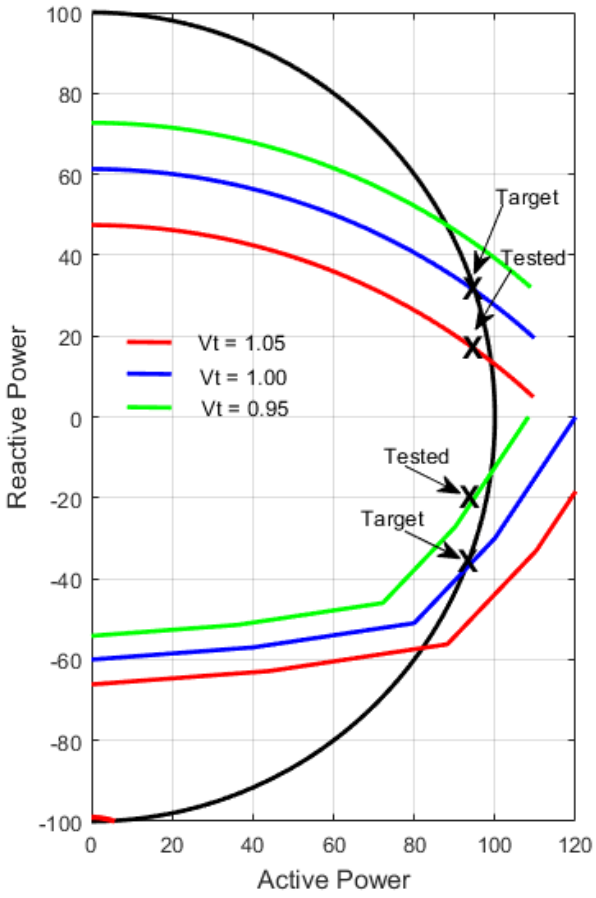


Figure 2: Reactive Capability – Test versus Target Limits

[8] Note that the transmission system voltage limits are usually defined by a voltage schedule provided by the Transmission Operator, and must be adhered to by the GO per their established policies and NERC Reliability Standards.
[9] As a point of interest, the OEL by most manufacturers is set to 102-105% of field current full load and the capability curve is reached before limiter action.
[10] Note that if other limits are reached (e.g., voltage limits), then the test is stopped regardless of whether the capability curve or the OEL/UEL are reached.

If the machine is operating up against the limiters but has not reached the estimated reactive power output displayed on the capability curves, then an engineering analysis can be done to calculate the power output that would result if the terminal voltage was at the rated value. Figure 3 shows an example of this.[11]

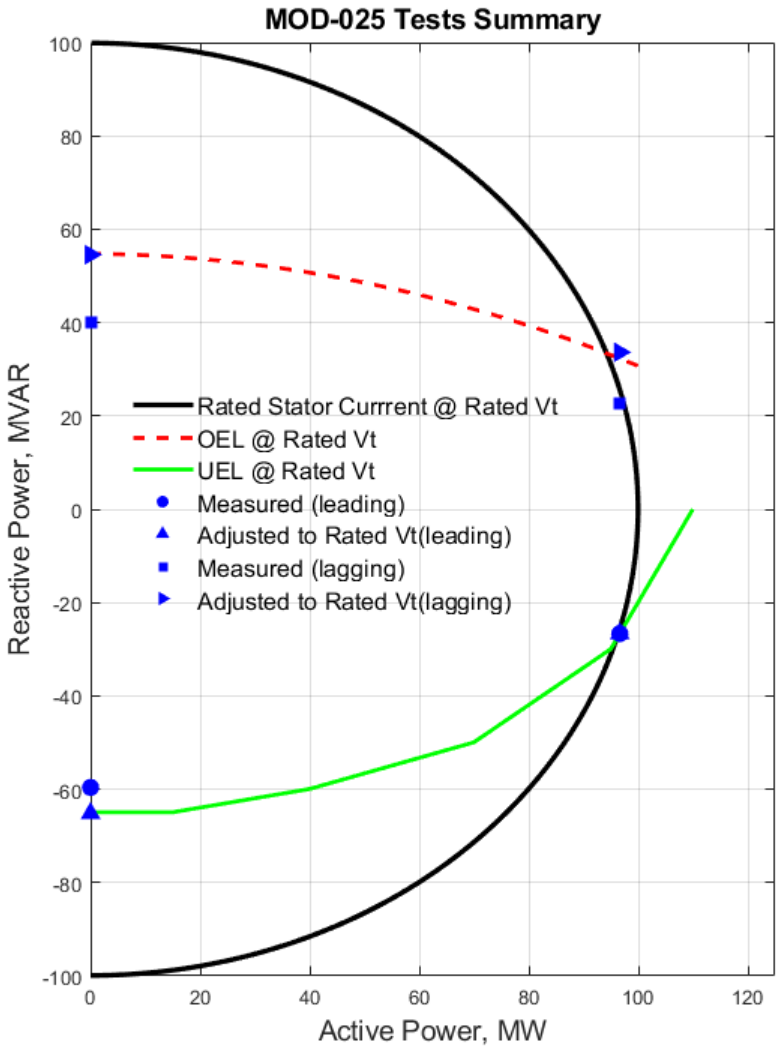


Figure 3: Calculation of Limits at Nominal Voltage

In this case, the voltages were adjusted until the OEL and UEL were reached. The tested values of voltage, active power, reactive power, and field current were used to recalculate the generator output if voltages were adjusted to the rated value. The capability curves are then verified by test and accurate for studies. Since testing is most often conducted by changing the terminal voltage, it is possible to reach a reactive power output where restrictions will apply before the actual generator capability limit is reached. In this case, the demonstrated test values will underestimate the reactive capability of the generator. A detailed

[11] This does not consider if any auxiliary equipment limits or other voltage limits prohibit the test from reaching the limiter settings or machine capability, which is a limitation of the current MOD-025-2 standard.

discussion can be found in the NERC *Reliability Guideline: Power Plant Model Verification and Testing for Synchronous Machines*.[12]

The reactive capability of a generator is used to maintain transmission system voltages within the acceptable operating range, by supplying reactive power to the system when voltage is too low, and absorbing reactive power when voltage is too high. Currently, commercial load flow software does not account for the relationship between voltage and generator reactive power limits. The software considers a fixed value for reactive power capability that is not dependent on generator terminal voltage. The most common practice is to use capability values for rated terminal voltage (from the composite D curve) as shown by the blue curve in Figure 2. Using the tested values in MOD-025-2 at off-nominal voltage may underestimate the capability of the machine (severely, in some cases). This is illustrated by the red curve in Figure 2 for the over-excited region. This leads to pessimistic[13] data used in transmission planning studies.[14] TPs and PCs should ensure that the appropriate capability data is used in planning models; this data could come from PRC-019 information (if it were required) or could come from MOD-032 data submittals, not from MOD-025 staged verification testing capability data that may or may not represent actual realistic limits used in planning models.

Pre-test adjustments may be required to collect a more accurate raw data that better reflect the steady-state generator capabilities. An example of pre-test adjustments is to utilize other generating units within the same plant or in close electric proximity to withdraw reactive power from the transmission system during reactive power injection testing of the generating unit under test, and vice versa. Another example is to coordinate the time of test with the Transmission Operator to allow for some transmission system adjustments (possibly an abnormal system voltage level or reactive devices such as capacitor banks in the local area switched on to absorb some of the reactive power produced by the unit under test). While these types of system adjustments may facilitate MOD-025-2 testing of a unit, they could also represent a reliability concern (i.e., voltage excursion) if the generating unit under test were to trip.[15] If pre-test adjustments are not achievable, engineering analyses can be performed to modify the collected raw test data to reflect more accurate generation capabilities or use in planning models. An example of engineering analyses is to scale the rated rotor current curve or OEL curve to reflect rated voltage. Although engineering calculations can be used in some cases to reflect the test data to rated voltage capability limits, this is not a mandatory task (nor always usable) per MOD-025-2.

[12] Refer to Figure 3.10 of the NERC *Reliability Guideline: Power Plant Model Verification and Testing for Synchronous Machines* for another example of impacts of terminal voltage on generator reactive capability. Refer to Appendix D for a detailed description on MOD-025-2 testing and calculation examples: https://www.nerc.com/comm/PC_Reliability_Guidelines_DL/Reliability_Guideline_-_PPMV_for_Synchronous_Machines_-_2018-06-29.pdf

[13] Pessimistic or overly restrictive generator reactive capability modeled in planning cases could lead to BPS reactive power deficiencies, which could lead to unnecessary system upgrades.

[14] Both overly optimistic and overly pessimistic models and modeling assumptions have their challenges regarding reliability studies. Optimistic assumptions and models may miss potential reliability issues or performance violations; pessimistic assumptions and models can lead to additional investments that may not be necessary (leading to additional costs to ratepayers or to GOs). Neither situation is ideal and efforts should be made to develop reasonably accurate models for each element of the BPS.

[15] Therefore, based on experience performing MOD-025-2 testing, generally the Transmission Operator will not be amenable to significant modifications to scheduled voltages for the purposes of MOD-025-2 testing (to ensure reliable operation).

Furthermore, it is very common during staged verification testing for external constraints such as generator terminal voltage or auxiliary plant bus voltage limits to limit the test prior to reaching the excitation limiters or machine capability. This makes any correction to nominal voltage not possible for determining the true generator reactive capability limits. This is a significant issue with the concept of "engineering analysis" and should be address in a future revision to the standard.

Therefore, the only generator capability information that should be submitted for planning models to assess BPS reliability is that defined on the generator rated terminal voltage and as reported in accordance with MOD-032-1. MOD-032-1 does not require validation or measurements to verify the accuracy of the capability curves; however, there may be simpler and more effective means of performing some form of data submittal verification (e.g., comparison with PRC-019 reports) than performing MOD-025 tests that do not provide the necessary data to perform such verification.

Note 1 and Note 2 of Attachment 1 of MOD-025-2 acknowledge that the data collected in accordance with the standard will often not conform to the rated voltage generator capability diagram, and will thereby not result in the verification of the actual generator reactive power capability. Since the stated purpose of MOD-025-2 is to ensure the accuracy of generator capability information for planning models, there is a conflict between MOD-025-2 and MOD-032-1 if it is interpreted that data collected in accordance with MOD-025-2 should be used to set limits in the planning models. This should not be the case, and has led to industry confusion, and potentially inaccurate modeling. MOD-032-1 is the standard for reporting this data and should use the actual expected composite capability curve limits (generator capability curve and associated OEL and UEL) in the models.

Some of the benefits of performing the testing in MOD-025-2 include, but are not limited to, those listed below. These are provided here as reference to the operational benefits, although it is noted that these do not support the development of planning models (the stated purpose of MOD-025-2).

1. Identification of previously unknown trips or limiting conditions, such as: motor control center undervoltage relay trips, underrated GSUs, overlooked auxiliary motor voltages, operation of cooling systems below rating (e.g., hydrogen pressure set to levels below rated capability curves), etc. Once understood, plants can take action to eliminate or mitigate potential issues from these by correction of settings, provisions of alarms, training, operational procedures, etc.
    a. However, there are no requirements in MOD-025-2 for correcting those limiting factors nor notification of the unexpected limits (if they cannot be corrected) to the TP/PC or TOP/RC. Correcting any unexpected trip issues (specifically for Protection System tripping) would be performed under PRC-019; however, there are no requirements in PRC-019 to report this information to the TP, PC, TOP, or RC.
2. While NERC PRC-019-1 (and to an extent PRC-024-2) requirements have improved coordination of relays to prevent unexpected trips, there is no replacement for actual testing of units to reasonable limits to ensure that no possible default setting, incorrectly operating relays, etc. will occur when needed. Note such trips have been found, along with identifying incorrect relay, meter, and readings.

3. Allowing plants to better understand their operations (e.g., reactive power output). During testing site personnel who often do not deal with or significantly understand reactive power output are permitted to see how the unit can operate under such conditions so that they are better prepared in case of grid critical conditions.

MOD-025-2 Statistical Results and Analysis

The following statistical data was compiled for analysis by a large utility at the completion of the MOD-025-2 July 1st, 2019 deadline. As described below, the information collected shows that MOD-025-2 does not meet its intended objective for demonstration of the generators' reactive capability. Where possible, adjacent unit(s) were utilized to aid the unit under test in obtaining its reactive capability. The generation mix consisted of nuclear, coal, natural gas, hydro, solar, wind, and biomass units. Transmission voltages were allowed to vary within a maximum range[16] during testing per regional transmission policies.

Figure 4 shows that 897 tests were performed on 261 generators. Less than 10% of the tests demonstrated the generators reactive "D curve" capability,[17] due to various limits encountered during the tests. Not one generator successfully achieved its "D curve" reactive capability and UEL limiter for all tests. Figures 5 and 6 categorize the results by test. Although slightly better results were achieved in reactive power production, the results fall short of the desired objective. Figures 7 and 8 summarize the limiting factors for each test category. In all cases, the generator terminal voltage limits were the predominant limiting factor, followed by the AVR UEL, station service auxiliary bus voltage limits,[18] and transmission system voltage limits.

[16] Those ranges were typically +/- 1 kV for 115kV, +/- 2kV for 230kV and +/- 4kV for 500kV system voltages.
[17] Tests that encountered field current limits could qualify as achieving the actual capability so long as engineering calculations are performed as described in Figure 3.
[18] For entities that are not vertically integrated, identification of optimized station service tap settings and other operational constrains are more common. However, these are not related to verification of generator capability (the purpose of MOD-025-2).

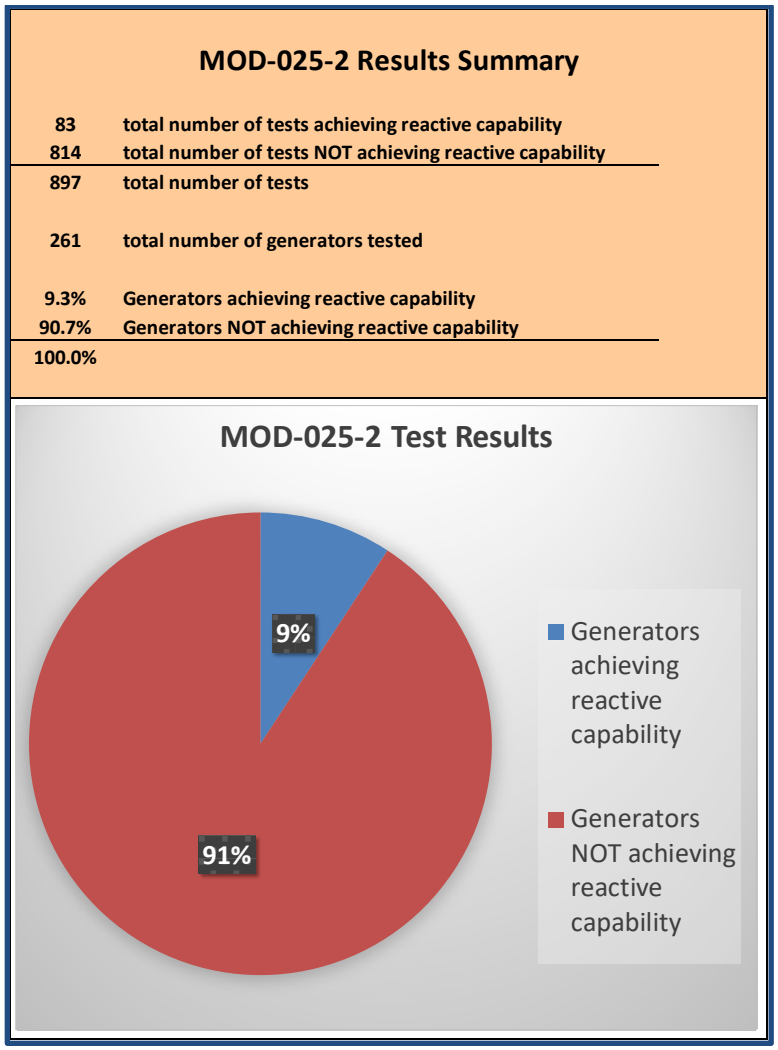
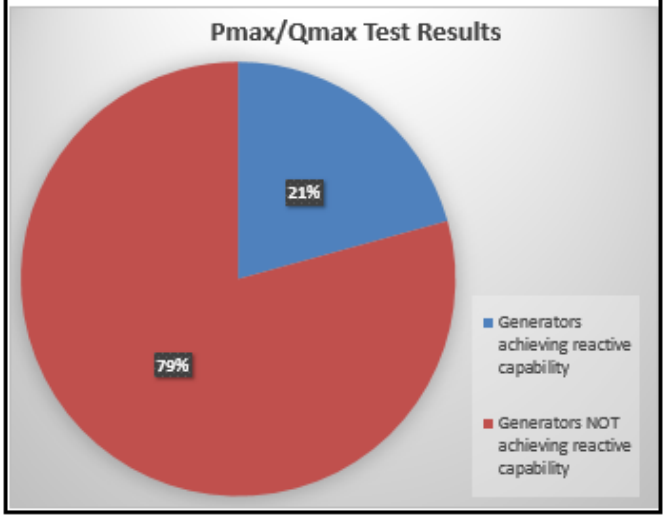


Figure 4: Summary of MOD-025-2 Testing

Test results summary for Pmax/Qmax		
54	Generators achieving reactive capability	20.7%
207	Generators NOT achieving reactive capab	79.3%
261	total units	100.0%



Test results summary for Pmax/Qmin		
3	Generators achieving reactive capability	1.2%
239	Generators NOT achieving reactive capabilit	98.8%
242	total units	100.0%

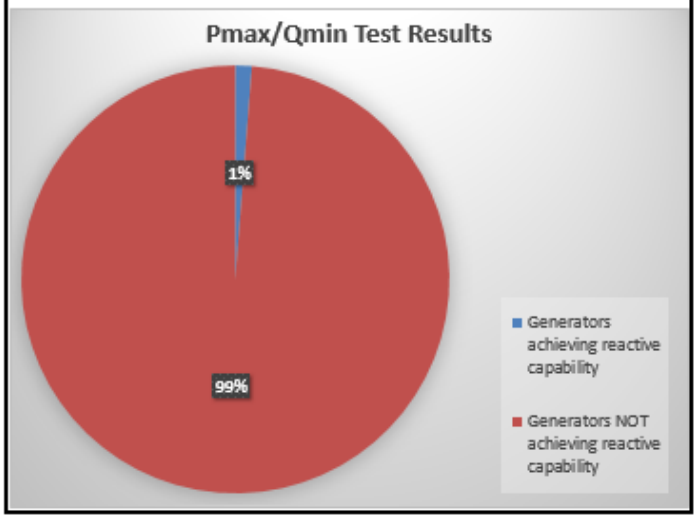
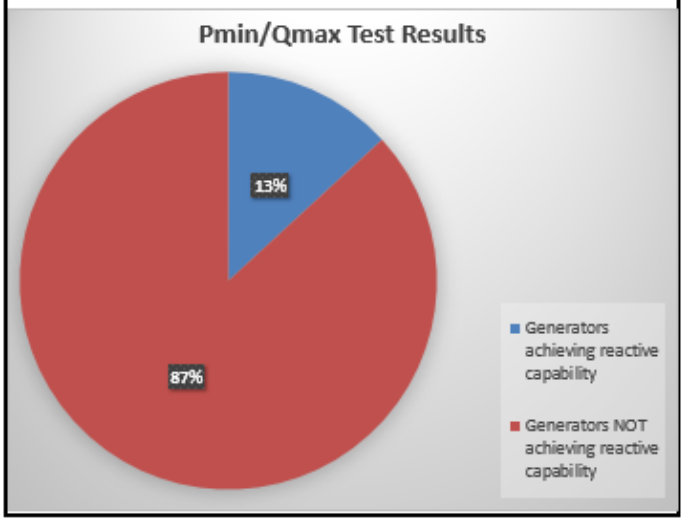


Figure 5: Pmax / Qmax and Pmax / Qmin Test Results

Test results summary for Pmin/Qmax		
26	Generators achieving reactive capability	13.2%
171	Generators NOT achieving reactive capabil	86.8%
197	total units	100.0%



Test results summary for Pmin/Qmin		
0	Generators achieving reactive capability	0.0%
197	Generators NOT achieving reactive capabi	100.0%
197	total units	100.0%

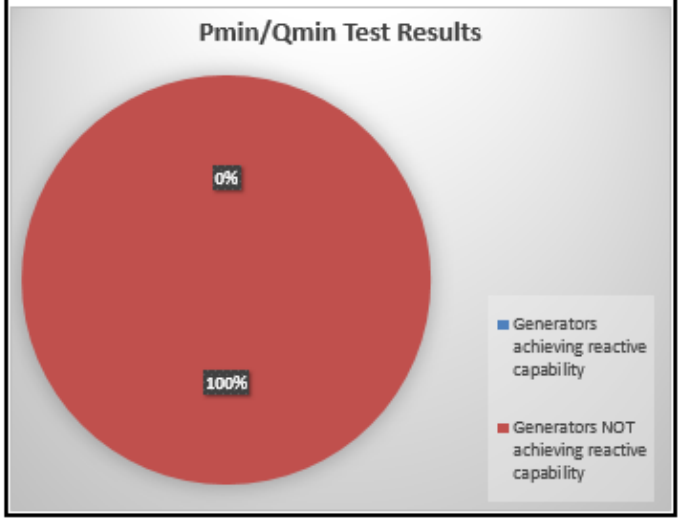
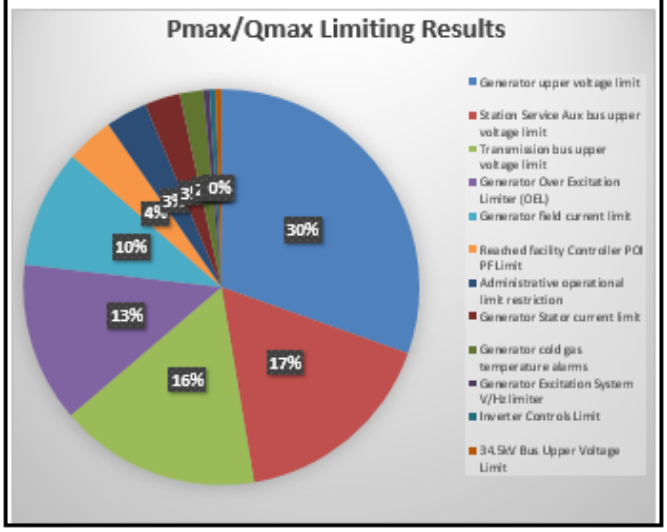


Figure 6: Pmin / Qmax and Pmin / Qmin Test Results

Test results summary for Pmax/Qmax in descending order

63	Generator upper voltage limit	30.4%
35	Station Service Aux bus upper voltage limit	16.9%
34	Transmission bus upper voltage limit	16.4%
27	Generator Over Excitation Limiter (OEL)	13.0%
20	Generator field current limit	9.7%
8	Reached facility Controller POI PF Limit	3.9%
7	Administrative operational limit restriction	3.4%
6	Generator Stator current limit	2.9%
4	Generator cold gas temperature alarms	1.9%
1	Generator Excitation System V/Hz limiter	0.5%
1	Inverter Controls Limit	0.5%
1	34.5kV Bus Upper Voltage Limit	0.5%
207	check	100.0%



Test results summary for Pmax/Qmin in descending order

106	Generator lower voltage limit	44.4%
87	Generator Under Excitation Limiter (UEL or MEL)	36.4%
15	Generator Stator current limit	6.3%
14	Transmission bus lower voltage limit	5.9%
8	Station Service Aux bus lower voltage limit	3.3%
8	Administrative operational limit restriction	3.3%
1	Unit tripped	0.4%
239	check	100.0%

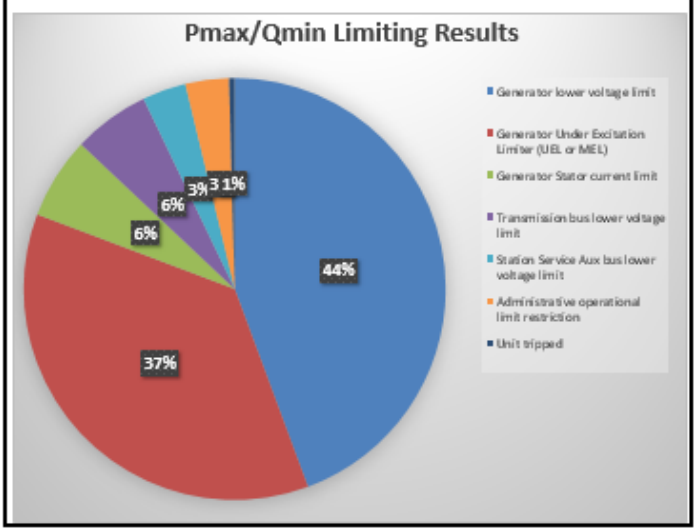


Figure 7: Pmax / Qmax and Pmax / Qmin Test Limiting Factors[19]

[19] Tests that encountered UEL or MEL, as well as those reaching the generator stator current limit could qualify as achieving the actual capability so long as engineering calculations are performed (although this is not required in MOD-025-2).

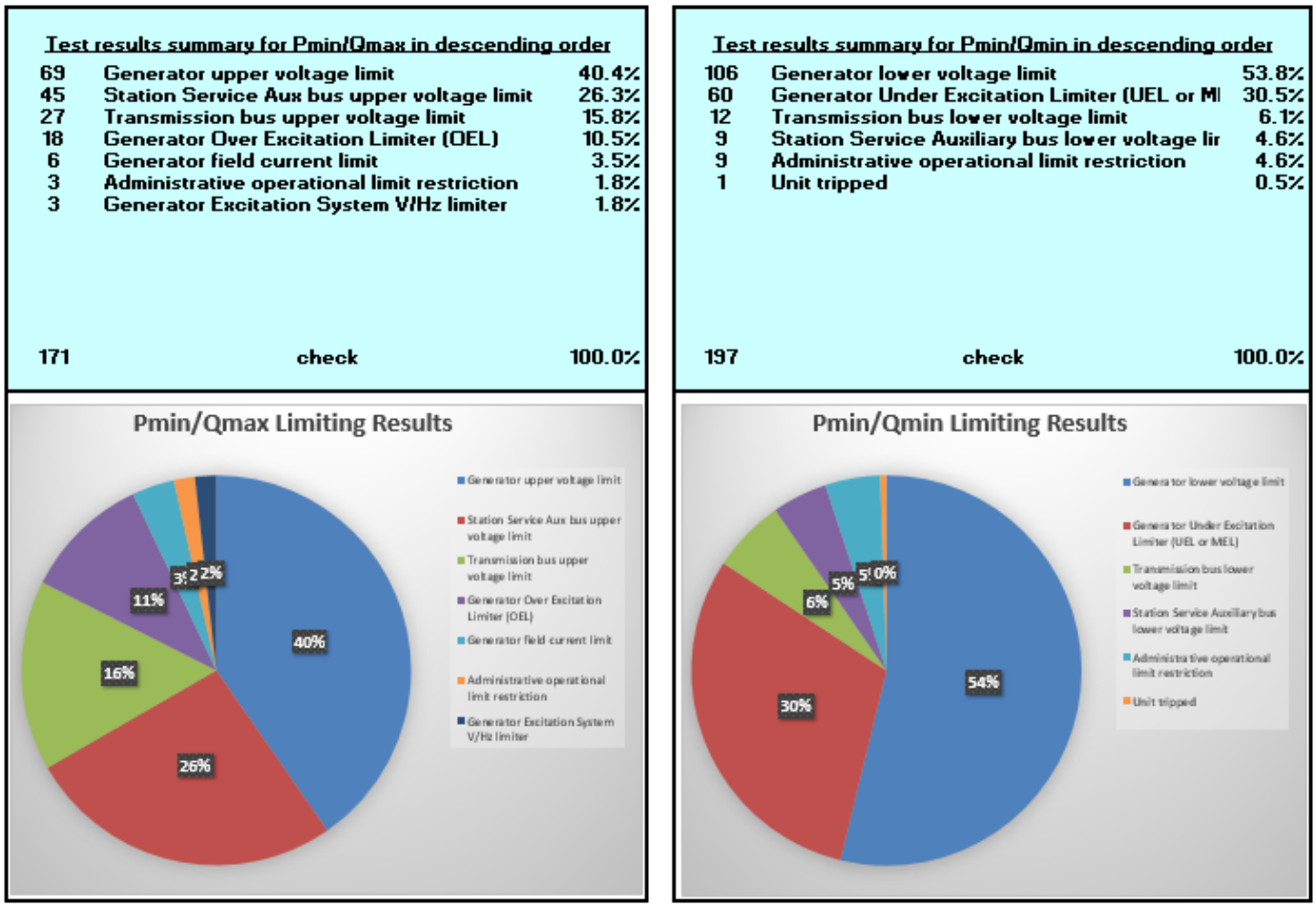


Figure 8: Pmin/Qmax and Pmin/Qmin Test Limiting Factors[20]

[20] Tests that encountered UEL or MEL, as well as those reaching the generator stator current limit, could qualify as achieving the actual capability so long as engineering calculations are performed (although this is not required in MOD-025-2).

MOD-025-2 Cost Results and Analysis

As with all NERC Reliability Standards, costs and cost effectiveness are critical factors. This is particularly important with respect to whether the standard is serving its intended purposes in the first place. Figure 9 summarizes the personnel costs associated with performing MOD-025-2 testing for 261 generators for one GO.[21] Not captured is the forgone cost of shifting the optimization of generation fleet assets due to minimum load testing requirements. Anytime a baseload generator is restricted in output, its output is often replaced with a generator that has a higher cost per MWh to operate.

GOs are required to perform capability testing per MOD-025 every five years for each applicable generating resource. This has proved useful in identifying unexpected or unknown operating limits within the plant; however, it has not proved effective for gathering modeling data as the purpose of the standard states. Therefore, this five year time horizon is not serving its intended purpose and should be re-evaluated to more accurately and effectively gather the data needed for planning models. As stated, this data may be more readily and accurately available from PRC-019 reports (if they were made available to the TP and PC). An SDT should explore alternatives to gathering this data, weighing the costs associated with performing staged tests.

Personnel costs to support NERC MOD-025-2 testing

Department	Personnel	Scope of Work (SOW) Responsibilities	Hours	Cost	Notes
ERO - Support	Principal Engineer	Coordinate testing schedule with applicable enties, prepare test procedures, prepare test report forms, prepare unit electrical limits	5001	$550,063	Hours were determined as constituinting 60% of the ERO engineers annual worked hours of 2000 hours over the 5.5 year
Electrical Field Support	Lead Site Engineer	Assist plant operations in performing tests and gathering data for submission to the ERO Support group	1680	$184,800	Hours were determined as 2 hours travel to and from plant site, 2 hours for Pfl/Qmax and 1 hour for all other tests.
	Sr. Engineer	Assist plant operations in performing tests and gathering data for submission to the ERO Support group	1680	$161,280	Hours were determined as 2 hours travel to and from plant site, 2 hours for Pfl/Qmax and 1 hour for all other tests.
Bulk Power Operations	Principal Engineer	Perform transmission system stabilities studies for risk assessment to system when performing the tests	897	$98,670	Hours were determined per category of test. 1 hour used as base.
Fleet Optimization	Project Manager	Schedule units for test and arrange alternative generating resource to cover for minimum loading testing. Schedule units that are not	224	$24,668	Hours were determined per category of test. 0.25 hours used as base.
Transmission Planner	Principal Engineer	Evaluate MOD-025-2 reported test results	112	$12,334	Hours were determined per category of test. 0.125 hours used as base.
Plant Operations (local or remote)	Plant Operator	Perform necessary tasks to operate generator for tests	1158	$97,272	Hours were determined as 2 hours for Pfl/Qmax and 1 hour for all other tests.
		Total Hrs	**10752**	**$ 1,129,086**	**Total Cost**
		Total Tests	**897**	**$ 1,259**	**Cost per test**
		Total Generators	**261**	**$ 4,326**	**Cost per generator**

Figure 9: MOD-025-2 Personnel Cost Analysis

[21] Anecdotally, other entities report substantially higher costs per unit for completing MOD-025-2. This data reflects one entity, and may not be representative of the average costs across all GOs.

Recommendation

Raw data collected as part of testing performed for MOD-025-2 should not be directly used for representing generating resources (or synchronous condensers) in system planning study models. The NERC PPMVTF recommends that the existing MOD-025-2 standard be either 1) altered, or 2) withdrawn and replaced with a new standard entirely.[22] The NERC PPMVTF recommends that a SAR be developed, and a SDT be created to address these issues with MOD-025-2. This white paper does not provide prescriptive solutions to these issues, yet lays out the reliability issues clearly and concisely. Further, Appendix D of the NERC Reliability Guideline on Power Plant Model Verification and Testing[23] provides technical examples as to why MOD-025-2 testing activities lead to data not suitable for planning models. An NATF reference document[24] is also available to describe testing activities. These industry reference materials, in conjunction with this white paper, serve as useful references for a future SDT to address these issues.

Changes are needed to MOD-025-2 to prevent inaccurate data from being used to represent generating resources (and synchronous condensers) in the transmission planning models. The PPMVTF believes that there is value in performing the tests since they can uncover unexpected limiting factors; however, the PPMVTF agrees that the data acquired during MOD-025-2 testing should not be directly used to represent the actual capability of the machine in power system models. Further, any unexpected limitations to reactive capability are not required to be addressed following testing, and that data is not required to be provided to the TP/PC or TOP/RC for situational awareness of these limitations (if they cannot be corrected). Therefore, the tests do not generally accomplish the stated purpose of the standard.

NERC PPMVTF recommends that a future SDT also consider the challenges that will be faced by inverter-based resources related to staged verification testing. These challenges are expected to be similar to those outlined in this paper.

[22] A minority opinion in NERC PPMVTF is that MOD-025-2 should be withdrawn and not replaced with another standard.
[23] https://www.nerc.com/comm/PC_Reliability_Guidelines_DL/Reliability_Guideline_-_PPMV_for_Synchronous_Machines_-_2018-06-29.pdf
[24] https://www.natf.net/docs/natf/documents/resources/planning-and-modeling/natf-reference-document-reporting-and-verification-of-generating-unit-reactive-power-capability-for-synchronous-machines.pdf

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NERC MOD-025 Discussion

NERC Power Plant Modeling and Verification Task Force

Shawn Patterson, NERC PPMVTF Chair

RSTC Meeting

June 10, 2020

RELIABILITY | RESILIENCE | SECURITY




MOD-025-2 Overview

Standard MOD-025-2 — Verification and Data Reporting of Generator Real and Reactive Power Capability and Synchronous Condenser Reactive Power Capability

A. Introduction

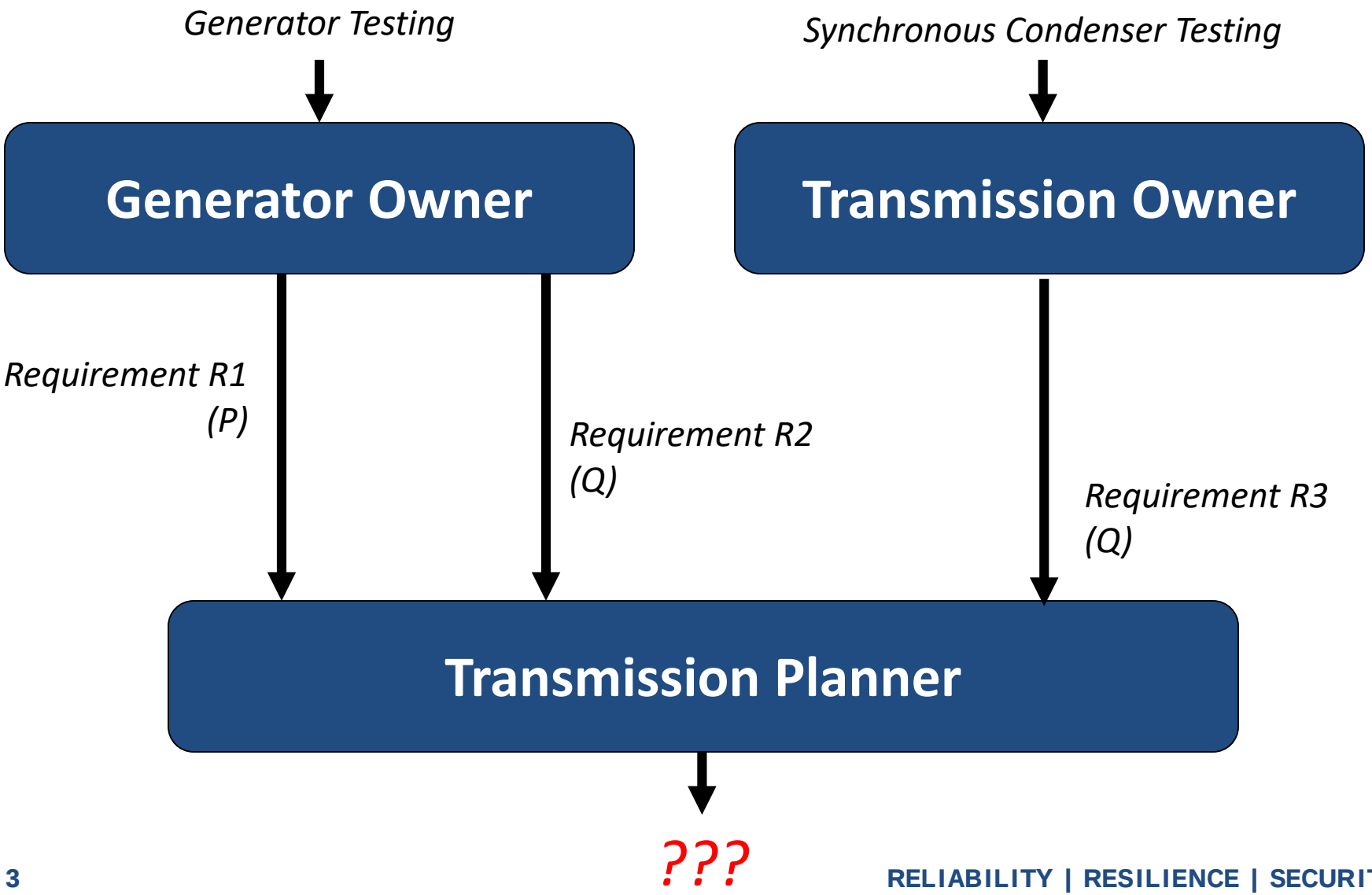
1. **Title:** Verification and Data Reporting of Generator Real and Reactive Power Capability and Synchronous Condenser Reactive Power Capability

2. **Number:** MOD-025-2

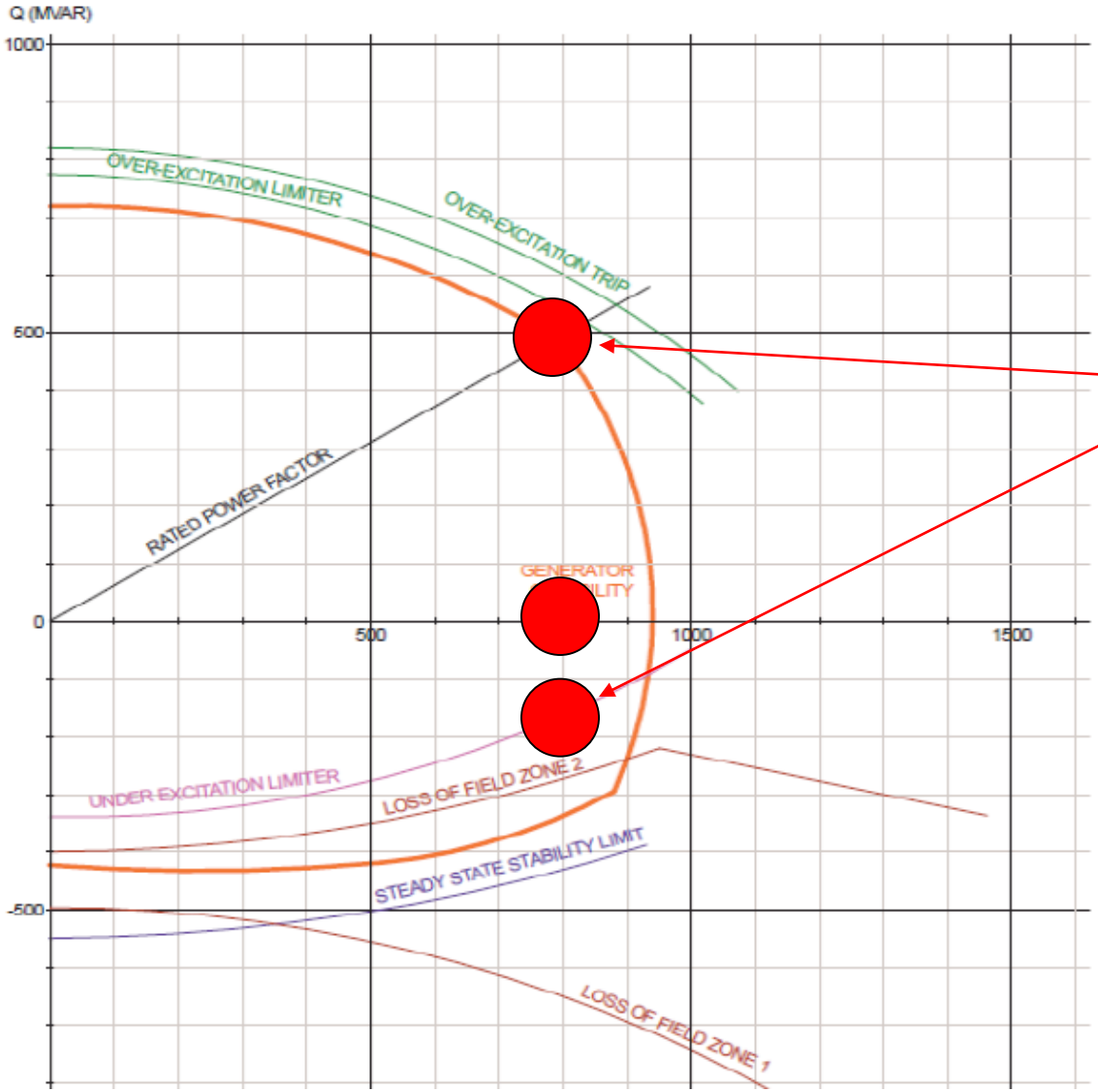
3. **Purpose:** To ensure that accurate information on generator gross and net Real and Reactive Power capability and synchronous condenser Reactive Power capability is available for planning models used to assess Bulk Electric System (BES) reliability.

*"To ensure that **accurate information** is available **for planning models**"*

MOD-025-2 Data Flow



MOD-025-2 Testing



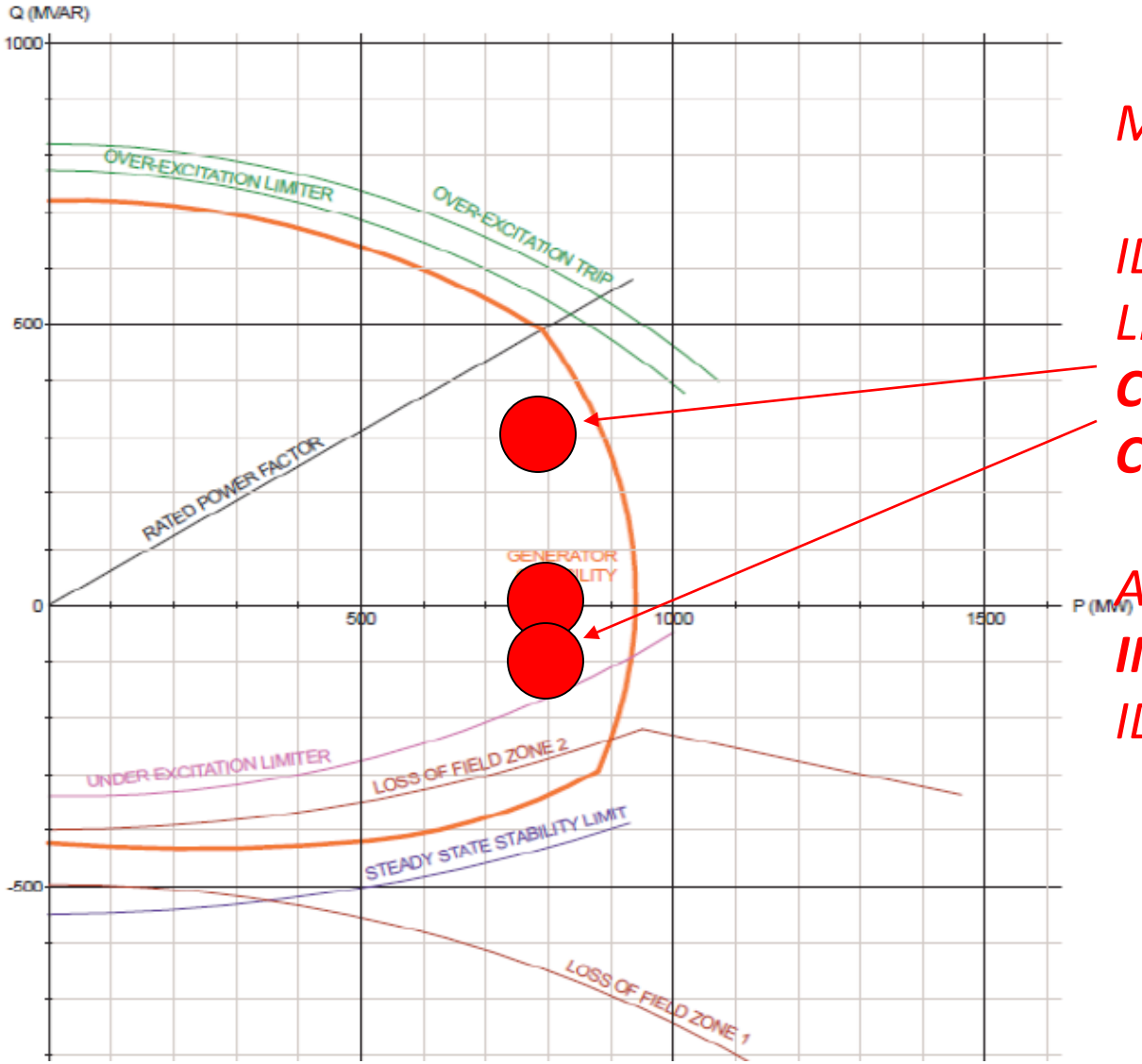
Find "Qmax" and "Qmin"

This does not typically happen…

Voltage limitations OFTEN prohibit these points from being reached.

FURTHER… the OEL and UEL are voltage-dependent

MOD-025-2 Testing



MOD-025:

IDENTIFY Qmax AND Qmin LIMITS ***UNDER THE CURRENT OPERATING CONDITIONS***

AND REPORT THOSE ***INCORRECT*** *LIMITS, AS IDENTIFIED IN TESTING*

Planning Models

"So as a Transmission Planner, what do I do with the capability testing data collected…?"

- **CORRECT ANSWER**

DO NOT USE IT WITHOUT SUBSEQUENT ANALYSIS

MOD-025-2 Purpose

"So what is the purpose of MOD-025-2?"

As is, not much

SOME ARGUE THAT IT'S LIKELY LED TO INCORRECT PLANNING MODELS

Requested Action

- A PPMVTF white paper has been reviewed by the PC, and all comments have been addressed
- The PPMVTF is requesting RSTC approval of the white paper
- The PPMVTF is requesting RSTC authorization to draft a SAR based on the the white paper to revise MOD-025:
  - In accordance with the NERC Rules of Procedure, Appendix 3A, Standard Processes Manual, the SAR will be provided to NERC Staff for review and verification that all required information is present. The completed SAR and white paper will then be submitted to the Standards Committee with a request for authorization to post for a 30-day comment period.

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Questions and Answers

Response to Comments

PPMVTF MOD-025 Gaps White Paper
April/May 2020

Overview of PC and OC Reviewers

The PPMVTF received comments from two PC reviewers: Carl Turner and Rich Kowalski.

PC Discussion Comments

A PCEC reviewer remarked that he provided detailed written comments, which included his observation that the burden is on the planner to interpret the results of information provided by generator owners under this standard. A participant observed that the purpose of the standard is not for gathering data; rather, planners understand what to do with the information that is obtained through this standard. A participant indicated that the approved standard can provide information about when a generator capability has degraded, which has been encountered with some older generators. A PC reviewer recommended that PPMVTF develop clearer solutions and include them in the white paper. A participant recommended that the record of standard development for MOD-025 be reviewed for relevant information. A PCEC reviewer expressed a high degree of confidence in the skills of the PPMVTF. NERC staff noted that technical groups have been instructed by NERC and technical committee leadership to limit SARs/white papers to description of the reliability issue (i.e., problem), and to avoid prescriptive solutions (e.g., the PRC-024 SAR).

Carl Turner Comments

Some big picture thoughts.

1. In general I agree that we need to be clear that we can't directly use any old MOD-025 staged verification test and plug the values into planning models.
    a. I am of the opinion that task ought to be done following the task force's recommendation of conducting additional analysis (extrapolating/normalizing the verification results), but I believe that analysis needs to be assigned to the TP/PC and not the GO, so if others agree with that, the recommendation needs to be made clearly in the document. Otherwise we will generate a requirement for GO's that they are wholly unequipped to handle (in my opinion).
    b. I'm not sure if I've made up my mind where this task belongs.
        - PPMVTF agrees that there are significant issues with the current approach of leaving this calculation (extrapolation/modification) as an option for reporting testing values. This leads to confusion when the data is received by TPs and PCs. While these calculations are not precluded by the standard from being performed, they are optional and are likely not performed by the GO since the GO does not have the expertise to perform these types of calculations. Further, in the cases where voltage limits or other operating limits are hit during testing, the calculation methods (e.g., temperature sensitivity) cannot be used to extrapolate tested values to values that should be used in planning models. Therefore,

requiring TPs/PCs to perform these calculations will lead to issues with standard implementation. Further, multiple TPs/PCs have stated that they do not modify data provided by equipment owners since the TP/PC does not own the equipment; therefore, they discourage from making modifications to submitted MOD-025 testing data at will to reflect data needed for base cases (i.e., seasonal variations in active and reactive capability).

- PPMVTF does not believe that solutions should be defined in this white paper, and continues to support the position that a Standard Drafting Team can utilize existing materials (this White Paper, the existing NERC Reliability Guideline Appendix D on MOD-025,[1] and the NATF Reference Document as technical materials related to challenges with testing. None of these materials are a viable alternative to address the withstanding gaps with the standard regarding staged verification testing data not being suitable for use in planning models.

2. I am concerned about the "goal" here. Several times throughout the document we state that we are trying to reach the OEL/UEL. While that might be a nice, altruistic thought, I believe industry (especially GOs) was aware from day 1 that we would not be able to actually hit D-curves of machines during ~~a real event~~ testing. That's why the standard doesn't set a mark for how much capability is "acceptable". Rather, we seek to find what the limiting elements are, and if we find unexpected ones that we can remove (to widen capability), we do so (as a good engineering practice, not standard mandated).

   - PPMVTF agrees with this comment with a slight modification as shown above. These points are highlighted through the White Paper. PPMVTF believes that testing activities provide some value, particularly around identifying unexpected limitations within the generating facility; however, the staged verification tests do not necessarily provide the data needed by TPs and PCs in their planning models (which is the stated purpose statement of the MOD-025 standard). Testing conditions artificially limit the ability of the machine to provide its full capability (which would be modeled in planning models). The approved NERC Reliability Guideline Appendix D on MOD-025 provides a detailed description of these limitations in staged verification testing.[2]

   - The standard specifically states that active and reactive limits are to be reached. In practice, these limits are OEL/UEL limits or the unit capability curve,[3] so this claim is not "altruistic" in nature. In reality, we rarely hit these limits in staged verification tests because other limits (e.g., voltage limits) are reached first. So, to the point made, the main outcome of staged verification testing is NOT to define reactive capability limits used in planning models; rather, it is to identify limiting elements within the facility (which is not the stated purpose of the standard, and has minimal relation to modeling).

[1] https://www.nerc.com/comm/PC_Reliability_Guidelines_DL/Reliability_Guideline_-_PPMV_for_Synchronous_Machines_-_2018-06-29.pdf
[2] https://www.nerc.com/comm/PC_Reliability_Guidelines_DL/Reliability_Guideline_-_PPMV_for_Synchronous_Machines_-_2018-06-29.pdf
[3] The OEL is not always set right inside the curve of the machine. Often, the pick up on these is set to 102 to 105% of amps field full load as a standard practice by excitation system equipment manufacturers.

- During testing, the electrical machine is not operating in a condition where the unit can fully be capable of providing its full capability since BPS bus voltages are within expected limits. Conditions where full capability would be needed are on the edges of stressed normal conditions or during abnormal (contingency) conditions. These types of conditions do not occur during testing, and therefore impose artificially lower reactive power limits.

3. Related to my comment above, I have a real problem with our graphics that show the D-curve changing with voltage. This does not jive with IEEE-C50.13 and C50.14, and it doesn't jive with the way people have been doing FAC-008. To confirm this, I contacted Brush electric's chief generator design engineer, and he confirmed for me that the generator manufacturers design the machine to achieve rated MVA through the entire range of 0.95 to 1.05 pu voltage. That is, the MVA rating doesn't change, but the designed allowable temperature rise does (I'm paraphrasing but happy to send their exact response). I've asked for some clarification as to whether this applies to all three areas of the D-curve, but at minimum it applies within the rated PF region (stator winding thermal rating).

   - The points made here are generally valid and the PPMVTF appreciates these points being made so that additional clarifications can be made in the White Paper. Generator stator (thermal) limits include margins in terminal voltage, as mentioned in the comment and discussed with Brush engineer. However, this is beside the point regarding MOD-025 staged verification testing, and verification of the *composite* capability curve which includes the OEL and UEL. The OEL (even with a constant field current limit) and UEL limits do limit overall machine reactive capability significantly based on terminal voltage and therefore do affect the *composite* capability curve that is tested for MOD-025 staged verification test purposes. Further, the *composite* D-curve (e.g., stator current limit, OEL/UEL) of some units are dependent on other technical factors such as ambient temperature that are not reflected in a test performed at any one given time of the year.
   - PPMVTF is making modifications to some of the figures and text describing those figures that further explains these points.
     a. All of that to say, if we are recommending that we extrapolate/normalize the staged verification to reflect a more accurate capability, we had better check our methodology against what the machines are actually capable of. Also note, many machines are normally operated with terminal voltage that is not at nominal. I am not sure I'm clear on whether we need to adjust for this or not, given Brush's response to me. I need to ponder.
   - See responses to above comments for clarification to this point as well.

4. I'm on the fence about our best path forward here. I am concerned with how many PCs/TPs have been directly adopting the MOD-025 results, but as Rich pointed out, there were already many documents out there that discussed the expectation that the staged verification results would not be directly usable without extrapolation/normalization, including the NATF document. If we are really seeking to get to representation of the OEL/UEL or the D-curve itself, do we need any verification at all? That is, if we are not going to accept real variations in machine capability that

result from variations in grid conditions, then we don't need to test and we also don't need to extrapolate/normalize the test results.

- PPMVTF believes that the points made here further support the White Paper and its conclusions and emphasize the need for substantial revisions to MOD-025. PCs and TPs are either ignoring the MOD-025 verification test results provided by the GO (therefore there is no connection between MOD-025 and planning models) or PCs and TPs are using the exact values provided by GOs from MOD-025 staged verification testing (which presents inaccurate information entering the power flow base cases). Both of these situations lead to no useful information being presented and utilized by the TPs and PCs for the purposes of improving planning models. The NATF reference document discusses the calculation process, and the NERC Reliability Guideline Appendix D on MOD-025 further provides detailed examples of the challenges with calculation methods. These cannot be relied upon to address the underlying issues of inaccurate data being provided to the TP or PC for the purposes of running reliability studies. PPMVTF believes a Standard Drafting Team can use the materials presented to explore the most effective and efficient path forward, and that PPMVTF should not provide prescriptive solutions for the Standard Drafting Team. Many members of the PPMVTF will likely nominate themselves to serve on the Standard Drafting Team, further ensuring continuity of these discussions.

I am still feeling like we should make some improvements, but I don't feel like we have clear consensus on a path forward. I'm happy to participate in any conversations we need around this. Again, I appreciate the work of the task force. There are a lot of people on there that I respect greatly.

- As mentioned, PPMVTF believes that the path forward is to lay out the reliability issues with the MOD-025 standard, as presented in the White Paper. A Standard Drafting Team can use all available information to develop a solution to the identified issues. Developing a prescriptive solution to a standard revision is not in the purview of PPMVTF.

NERC-White Paper -
MOD-025 Testing - 2

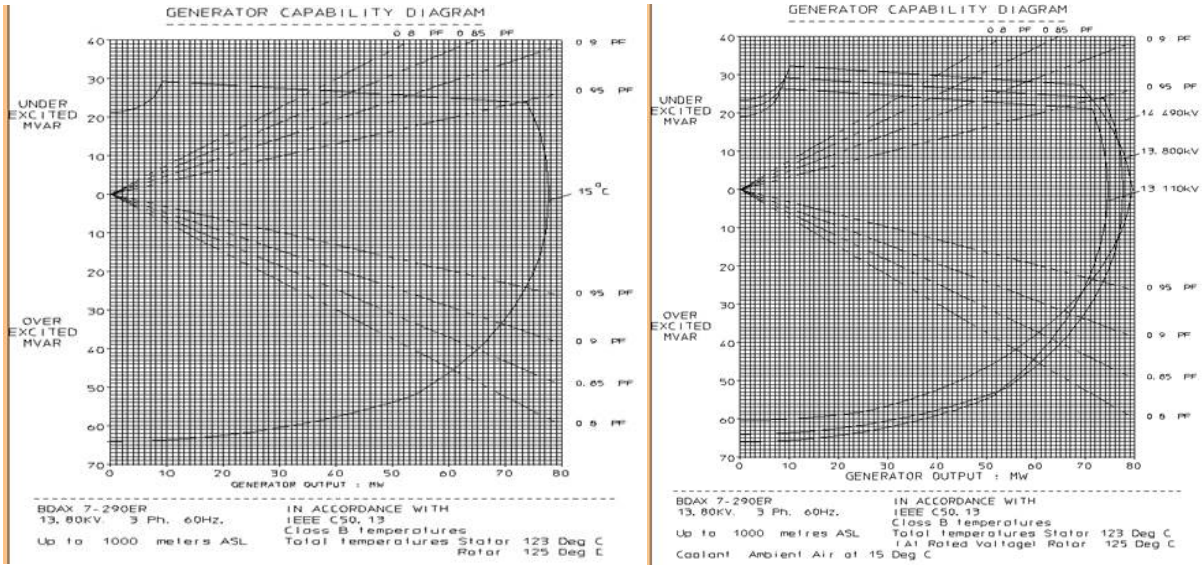
Following up my note yesterday, I got further clarification from talking with Brush's chief engineer regarding the C50.14(/C50.13) question. They explained that the "three curve" (e.g. range of ratings represented/bounded by curves) rating is an option if a customer requests it and that this method respects the insulation class temperature. So I'll say that my statement in my comments that the three curve representing is "not in accordance with C50.14" was not accurate – this is allowed, but is not very common, in my understanding. Interestingly, since the latest C50.13 version is much newer than the latest C50.14, there is a bit more discussion on this in C50.13 (you likely already knew this). Effectively, the single D-curve, which every GO I know (not that I know everyone) uses, contemplates accelerated loss of insulation life at the curve limits when voltages or frequencies are off-nominal. Nonetheless, since pretty

much no machines operate at those limits continuously, I don't know that this is much of a risk, and I've not heard of any GO's using the multi-curve rating.

- See responses to above comments regarding C50.14/13 IEEE standard and MOD-025 verification testing points.

Furthermore, Brush provided me the examples below, which clarify my question to them – the "single rating/curve" applies to all three areas of the curve (note they are not parallel, which is certainly interesting). Hence, if an entity is using the single curve, it would not appear to be necessary to voltage-normalize the results – only to be cognizant of impacts the variation in terminal voltage may have on other potential limiting factors during staged verification, like auxiliary bus voltage etc. My concern with how we presented this is twofold – one concerning the exact recommendations we'll be making regarding how to conduct calculations to make verification results more useful, and the second is concerning publishing something that disparages the way a large number (perhaps most, I can't be sure) of GO's establish their generator Facility Ratings in under FAC-008.

- See responses to above comments regarding C50.14/13 IEEE standard and MOD-025 verification testing points.
- Regarding FAC-008, the generator machine capability rating may very well be the value specified by OEM under nominal voltage conditions with a tolerance band (e.g., +/- 0.05 pu). However, this is a separate issue than what is discussed in MOD-025 standard and the activities performed to meet the MOD-025 requirements.



Carl's Comments in Document

- Addressed terminology, particularly using "staged verification testing" terms from standard.
- Modifications made to White Paper to further clarify *composite* capability curve, including effects of terminal voltage on OEL/UEL limits on machine reactive power output. This is the primary focus

of the MOD-025 staged verification testing and reporting, and is the main concern regarding use of staged verification test data in planning models without careful and consistent calculations (if at all possible).

Rich Kowalski

The PVMVTF whitepaper does a reasonably good job of highlighting concerns with the application of the existing version of MOD-025. The whitepaper describes how MOD-025 is structured in a manner that will not reliably yield reactive power limits that accurately represent the actual capabilities of the reactive resources, as there are many reasons why field test results are not directly usable. However, I am not providing detailed comments on the whitepaper; rather, my comments are more general in nature. I also recommend against a SAR at this point in time, primarily because I think that much more prep work is necessary.

The industry has recognized the challenges of identifying accurate and representative resource reactive power limits for use in power system modeling. To address this situation, for example, industry worked with NATF to develop a modeling reference document, "Modeling Reference Document, Reporting and Verification of Generating Unit Reactive Power Capability for Synchronous Machines". [http://www.natf.net/docs/natf/documents/resources/planning-and-modeling/natf-reference-document-reporting-and-verification-of-generating-unit-reactive-power-capability-for-synchronous-machines.pdf]. I believe that it was thought that this document would be a tool that would be useful towards meeting the MOD-025 requirements.

PPMVTF's concern about MOD-025 suggests a persisting lack of clarity around the use of that standard, perhaps in conjunction with the NATF modeling reference document, to establish reactive power limits appropriate for power system modeling. The concern raised by the task force does suggest that some form of clarification is warranted, perhaps in the standard itself, in some form of supplemental application/implement documentation, or in some improved bridge between the two.

I recommend the following:

- The PPMVTF should greatly enhance the detail in their whitepaper, integrating the key components of the NATF modeling reference document, to provide a more comprehensive description of the problems associated with using test data to determine reactive limits.
- The revised whitepaper should also include clearly articulate and detail proposed solutions to the identified problems: how to use the test data, in conjunction with spec sheet/other test data, etc. PPMVTF should have the right expertise to accomplish this. If not, they should approach SAMS to augment the group or otherwise get the expertise on board.
- Once the enhanced whitepaper is complete, determine if the whitepaper, in itself, provides the clarification needed and perhaps MOD-025 can stand as it is; or
- Consider whether the whitepaper indicates that a Reliability Guideline is a sufficient complement to the existing MOD-025; or

- Consider whether the whitepaper supports that MOD-025 is in need of an overhaul, in which case, I would very strongly recommend that the PPVMTF be sure that they have developed the specific technical recommendations and enhancements that need to be baked into MOD-025 (see second bullet). In this case, as part of a SAR, the Standard Drafting Team should be delivered a good compendium of technical material to use to craft/refine standard language with, and should not be put in the position of having to develop the technical solutions themselves.

natf-reference-doc
ument-reporting-an

- PPMVTF believes that the White Paper, as written, reasonably and clearly presents concerns with the current implementation of MOD-025. This includes the shortcomings of staged verification testing, inaccurate use of testing data in planning models, and inconsistent or lack of use of calculation methods to determine appropriate values for planning models under varying seasonal conditions. The PPMVTF believes that the standard requires a significant revision (with a dissenting opinion that it should be eliminated in its entirety), and that alternatives such as Compliance Implementation Guidance or another NERC Reliability Guideline will not address the reliability issues presented regarding MOD-025 implementation. While these documents, as well as the NATF reference document, show recommendations for meeting the requirements defined in the standard and provide additional steps regarding calculation methods, these are voluntary and do not address the underlying issues with the standard as previously described. The PPMVTF does not believe that proposing solutions to these issues is within its purview; rather, PPMVTF has clearly laid out the issues with the MOD-025 standard for a Standard Drafting Team to determine the most effective and efficient path forward. The White Paper, NERC Reliability Guideline Appendix D on MOD-025, and NATF reference document provide useful references in these endeavors.
- Multiple GOs have expressed concerns that the MOD-025-2 standard requires significant time and cost for testing on a 5-year basis. They are particularly concerned that the time- and resource-intensive testing produces information and data that is inherently of little use (in almost all cases) by the TPs and PCs. Further, if the TP and PC use the data without careful consideration, this could be leading to inaccurate assumptions in planning studies.

Inverter-Based Resources Performance Task Force Review of NERC Reliability Standards SARs

Action

Approve Standard Authorization Requests.

Background

The IRPTF was formed in 2017 following several grid disturbances involving inverter-based resources (IBRs). In 2018, the NERC Planning and Operating Committees approved an IRPTF-developed whitepaper on identified gaps in PRC-024-2 based on IRPTF's findings following investigations of the grid disturbances. Subsequently, a Standards Authorization Request (SAR) to modify PRC-024-2 based on the whitepaper was endorsed by the PC and OC and approved by the NERC Standards Committee. This led to the formation of a Standards Drafting Team (SDT) to modify PRC-024-2.

In 2019, the IRPTF undertook an effort to perform a comprehensive review of all other NERC Reliability Standards to determine if there were any potential gaps or improvements needed related to inverter-based resources. To accomplish this activity, IRPTF volunteers reviewed all of the current and future enforceable reliability standards, identified potential gaps or improvements, and presented findings to the entire IRPTF. The IRPTF reviewed these findings and finalized a set of recommendations. These findings and recommendations were documented in the *IRPTF Review of NERC Reliability Standards Whitepaper*[1], which was approved by the OC and PC in March 2020.

The whitepaper documents issues with FAC-001-3, FAC-002-2, MOD-026-1, MOD-027-1, PRC-002-2, and VAR-002-4.1 and recommends that these standards be revised to address these issues. Consequently, the IRPTF drafted four SARs to resolve these issues.

Proposed motion language, if applicable:
"I move to approve the Inverter-Based Resources Performance Task Force (IRPTF) SARs."

Summary

Leave Blank for meeting participant notes

[1] https://www.nerc.com/comm/PC/InverterBased%20Resource%20Performance%20Task%20Force%20IRPT/Review_of_NERC_Reliability_Standards_White_Paper.pdf

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IRPTF Standards Review SARs

Approve

Jeff Billo, IRPTF Vice Chair
RSTC Meeting
June 10, 2020

RELIABILITY | RESILIENCE | SECURITY




Background

2016	2017	2018	2019
• Blue Cut Fire Event	• IRPTF Formed • Canyon 2 Fire Event	• PRC-024 Gaps Whitepaper	• Comprehensive review of all other Reliability Standards

Whitepaper

- IRPTF performed a review of all NERC Reliability Standards to identify potential gaps or needed clarifications related to inverter-based resources (IBRs)
- All identified issues were documented in the *IRPTF Review of NERC Reliability Standards Whitepaper*: https://www.nerc.com/comm/PC/InverterBased%20Resource%20Performance%20Task%20Force%20IRPT/Review_of_NERC_Reliability_Standards_White_Paper.pdf
- The Planning Committee and Operating Committee approved the whitepaper at their respective March 2020 meetings

SARs

Based on the Whitepaper, IRPTF developed four Standard Authorization Requests (SARs):

1. **FAC-001-3 and FAC-002-2** should be revised to: (a) clarify which entity is responsible for determining which facility changes are materially modifying, and therefore require study, (b) clarify that a Generator Owner should notify the affected entities before making a change that is considered materially modifying, and (c) revise the term "materially modifying" so as to not cause confusion between the FAC standards and the FERC interconnection process;
2. **MOD-026-1** and **MOD-027-1** should either be revised or a new model verification standard should be developed for IBRs since these standards stipulate verification methods and practices which do not provide model verification for the majority of the parameters within an inverter-based resource. For example, the test currently used to comply with MOD-026-1 does not verify the model parameters associated with voltage control behavior during large disturbance conditions;
3. **PRC-002-2** should be revised to require disturbance monitoring equipment in areas not currently contemplated by the existing requirements, specifically in areas with potential inverter-based resource behavior monitoring benefits;
4. **VAR-002-4.1** should be revised to clarify that the reporting of a status change of a voltage controlling device per Requirement R3 is not applicable for an individual generating unit of a dispersed power producing resource, similar to the exemption for Requirement R4.

Request

- The IRPTF requests that the Reliability and Security Technical Committee approve all four SARs

Questions and Answers

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IRPTF Review of NERC Reliability Standards

NERC Inverter-Based Resource Performance Task Force (IRPTF)
White Paper - March 2020

Executive Summary

The electric industry is still experiencing unprecedented growth in the use of inverters as part of the bulk power system and growth is possibly creating new circumstances where current standards may not be sufficiently addressing those needs. As a result, the NERC Planning Committee (PC) and Operating Committee (OC) assigned the task of evaluating today's current standards and requirements to the Inverter-Based Performance Task Force (IRPTF). This white paper details the findings of the IRPTF as a result of this activity and makes recommendations on actions that should be taken to address the issues identified.

Recommendations

The IRPTF identified potential gaps and areas for improvements in the following standards, and makes the following recommendations:

1. **FAC-001-3 and FAC-002-2** should be revised to: (a) clarify which entity is responsible for determining which facility changes are materially modifying, and therefore require study, (b) clarify that a Generator Owner should notify the affected entities before making a change that is considered materially modifying, and (c) revise the term "materially modifying" so as to not cause confusion between the FAC standards and the FERC interconnection process;
2. **MOD-026-1** and **MOD-027-1** should either be revised or a new model verification standard should be developed for inverter-based resources (IBRs) since these standards stipulate verification methods and practices which do not provide model verification for the majority of the parameters within an inverter-based resource. For example, the test currently used to comply with MOD-026-1 does not verify the model parameters associated with voltage control behavior during large disturbance conditions;
3. **PRC-002-2** should be revised to require disturbance monitoring equipment in areas not currently contemplated by the existing requirements, specifically in areas with potential inverter-based resource behavior monitoring benefits;
4. Clarifications should be made to **TPL-001-4** to address terminology throughout the standard that is unclear with regards to inverter-based resources the next time the standard is revised. This terminology was not changed in the recently FERC-approved **TPL-001-5** version of the standard; and
5. **VAR-002-4.1** should be revised to clarify that the reporting of a status change of a voltage controlling device per Requirement R3 is not applicable for an individual generating unit of a dispersed power producing resource, similar to the exemption for Requirement R4.

The IRPTF did not identify issues with the existing standard language in the BAL, CIP, COM, EOP, INT, IRO, NUC, PER, or TOP NERC Reliability Standards.

The IRPTF recommends that a Standards Authorization Request (SAR)s be developed to address each of the issues identified. IRPTF recommends that this be made a priority by the NERC Standards Committee, due to the continued growth of BPS-connected inverter-based resources.

Background

The IRPTF was formed in 2017 following several grid disturbances involving IBRs. In 2018, the PC and OC approved an IRPTF-developed white paper[1] on identified gaps in PRC-024-2 based on IRPTF's findings following investigations of the grid disturbances. Subsequently, a SAR to modify PRC-024-2 based on the white paper was endorsed by the PC and OC and approved by the NERC Standards Committee. This led to the formation of a Standards Drafting Team (SDT) to modify PRC-024-2.

In 2019, the IRPTF undertook an effort to perform a comprehensive review of all NERC Reliability Standards to determine if there are any further potential gaps or improvements beyond what was identified for PRC-024-2, based on the work and findings of the IRPTF. To accomplish this activity, IRPTF volunteers reviewed all of the current and future enforceable reliability standards, identified potential gaps or improvements, and presented findings to the entire IRPTF. The IRPTF reviewed these findings and finalized a set of recommendations.

The IRPTF acknowledges that the findings in this whitepaper are limited by the knowledge of its members and other issues may be discovered as industry and technology continues to evolve and grow. Any such issues may be addressed through the NERC technical committee or Standards Committee processes. In particular, the IRPTF acknowledges that it did not have subject matter experts in regards to the CIP, COM, NUC, and PER standards. Nevertheless, the IRPTF performed a cursory review of these standards and did not identify any potential gaps or improvements related to IBRs.

A similar review was also conducted as part of NERC Project 2014-01 for dispersed power producing resources.[2] However, industry knowledge of IBR technology and experience with NERC Reliability Standards implementation has evolved since that project was completed. For example, the Project 2014-01 efforts led to revisions of PRC-024-1, but those efforts did not capture the issues IRPTF identified in the PRC-024-2 Gaps Whitepaper.

FAC Standards Issues

The IRPTF identified issues with FAC-001-3 and FAC-002-2 that should be addressed. The IRPTF did not identify any issues with any other FAC standards.

FAC-001-3 and FAC-002-2

[1] PRC-024-2 Gaps White Paper, https://www.nerc.com/pa/Stand/Project%20201804%20Modifications%20to%20PRC0242/NERC%20IRPTF%20PRC-024-2%20Gaps%20Whitepaper.pdf

[2] Project 2014-01 Whitepaper, https://www.nerc.com/pa/Stand/Prjct201401StdrdsAppDispGenRes/DGR_White_Paper_v17_clean_01_13_2016_Final_rev1.pdf

The purpose of FAC-001-3 is to ensure that Facility interconnection requirements exist for Transmission Owners and Generator Owners (GO)s when connecting new or materially modified facilities. The purpose of FAC-002-2 is to ensure studies are performed to analyze the impact of interconnecting new or materially modified facilities on the Bulk Electric System (BES). An ambiguity exists in these standards for both synchronous resources and IBRs, but it may be amplified for IBRs that are comprised of many smaller individual units connected through a network of collection feeder circuits.

Both standards imply that the term "materially modified" should be used to distinguish between facility changes that are required to be studied and those that need not be studied. However, there is not a requirement for any entity to determine what changes are to be considered materially modifying and GOs are not required to notify potentially affected entities of the changes. This has led to confusion and potential reliability issues within industry. For example, a Transmission Planner (TP) may consider an IBR control system software change to be materially modifying, but if the GO does not consider such a change to be materially modifying they will not notify the TP of the change.

Additionally, the frequency of change of components could be higher for IBRs and the magnitude of such changes could vary. For example, due to a rapid change in wind turbine generator (WTG) technology, it is a common practice to re-power an existing wind power plant with bigger blades while keeping the same electrical generator and converter systems (for both Type 3 and Type 4 WTGs). This may be considered a material modification since a new set of bigger blades (e.g., 93 m to 208 m) can produce more power at a lower wind speed. However, the nameplate rating of the plant will remain unchanged. From an interconnection requirements' perspective, it is the electrical generator and converter system that impacts the majority of the steady-state, short-circuit, and dynamic characteristics and therefore will be mostly unchanged. Therefore, the question remains if these sort of repowering projects should be studied under FAC-002-2 R1 and which entity should make that determination. Therefore, the IRPTF recommends these standards be modified to specify which entity is responsible for determining what facility changes should be considered materially modifying and requiring that Generator Owners notify the appropriate affected entities before they make such a change.

The IRPTF further notes that if the plant owner makes a change in electrical generator, power electronic converter, or any control systems (including change of OEMs for partial individual units), it should be considered as "materially modifying". On the other hand, due to the advanced nature of control systems in the power electronic converters, it is not uncommon to have firmware updates (similar to the updates on a personal computer) occasionally that may have no impact on the functionalities of the WTGs or plant-level controls in any way. Therefore, such firmware updates that do not affect the electrical performance of the plant should not be considered as "materially modifying".

Additionally, in FERC-jurisdictional areas, the term "Materially Modification" refers to a new generation project's impact on other generators in the interconnection queue. This has led to widespread confusion across the industry regarding the correct application of these terms related to the FERC Open Access Transmission Tariff (OATT) implementation and the NERC Reliability Standards requirements. The application of these terms is different between the FERC process and the NERC Reliability Standards (specifically FAC-001-3 and FAC-002-2). For example, if a GO changes out the inverters on an existing solar

PV resource, the change may have no impact on other generators in the interconnection queue, and thus would not be considered a material modification under the FERC OATT rules. But such a change could have reliability impacts on the system that should be studied in accordance with FAC-002-2. Any revision to these standards should consider changing the term to avoid this confusion. FAC-001-3 and FAC-002-2 should be modified to clarify the use of "materially modifying", particularly as it relates to compliance with the standards.

MOD Standards Issues

The IRPTF identified issues with MOD-026-1 and MOD-027-1 that should be addressed. The IRPTF did not identify any issues with any other MOD standards that are not already being addressed in other forums.

MOD-026-1 and MOD-027-1

MOD-026-1 and MOD-027-1 require, among other things, GOs to provide verified dynamic models to their TP for the purposes of power system planning studies. Both standards contain language that is specific to synchronous generators and is not applicable to IBRs. For example, sub-requirement 2.1.3 in MOD-026-1 states that each verification shall include "model structure and data including, but not limited to reactance, time constants, saturation factors, total rotational inertia" The standards should be revised to clarify the applicable requirements for synchronous generators and IBRs. For example, total rotational inertia should not be required for IBRs, while voltage ride-through control settings should only be required of IBRs and not synchronous generators.

To some degree, all dynamic model parameters affect the response of a represented resource in dynamic simulations performed by power engineers. Accurate model response is required for the engineers to adequately study system conditions. Hence, it is crucial that all parameters in a model be verified in some way. However, a significant number of parameters in the models are not verified in the typical verification tests used to comply with MOD-026-1 and MOD-027-1. For example, the test currently used to comply with MOD-026-1 does not verify the model parameters associated with voltage control behavior during large disturbance conditions.

This issue is one of the predominant reasons why ride-through operation modes such as momentary cessation were able to persist and promulgate in IBRs without the knowledge of planners and system operators until the Blue Cut Fire and Canyon 2 Fire events exposed them. The dynamic models did not accurately represent this large disturbance behavior due to the model deficiency and because certain key parameters that govern large disturbance response were incorrectly parameterized. However, many of the same plants that entered momentary cessation mode during these events were able to provide verification reports that demonstrated that the small disturbance behavior driven mainly by plant-level control settings reasonably matched modeled performance in compliance with these standards.

This reliability gap exists for both synchronous generators and IBRs. However, it is potentially more severe for IBRs since their behavior is based more on programmable control functions than for synchronous generators which have behavior that is based more on the physical characteristics of the machine. Both MOD-026-1 and MOD-027-1 should be reviewed and potentially revised to provide sufficient clarification for verification of generating resource model parameters, or a new standard should be developed to meet

the reliability objective. Additionally, the IRPTF notes that it is not feasible to stage large disturbances for verification purposes, so other methods for verification of model performance under large disturbance conditions may need to be developed.

PRC Standards Issues

The IRPTF identified issues with PRC-002-2 that should be addressed. The IRPTF did not identify any issues with any other PRC standards that are not already being addressed in other forums.

PRC-002-2

The purpose of the NERC standard PRC-002-2 is to have adequate data available to facilitate analysis of BES disturbances. Requirements R1 and R5 provide guidance on selecting BES elements where data monitoring is required, which is summarized briefly below.

1. Per Requirement R1 (which uses criteria outlined in Attachment 1), Sequence of Event Recording (SER) and Fault Recording (FR) devices are required at BES buses with high short circuit MVA values. The methodology identifies the top 20 percent of BES buses with highest short circuit MVA values and requires a subset of these buses to be monitored for SER and FR data.
2. Requirement R5, identifies BES locations based on a size criteria for generating resources and other critical elements such as HVDC, IROLs and elements of UVLS program, for which Dynamic Disturbance Recording (DDR) data is required. In regard to generation resources, it includes requirements for monitoring at sites with either gross individual nameplate rating of greater than or equal to 500 MVA or gross individual nameplate rating greater than or equal to 300 MVA where gross plant/facility aggregate nameplate rating is greater than or equal to 1000 MVA.

Requirements R1 and R5 are written with a focus on synchronous machine dominated systems. The BES elements with short circuit MVA in the top 20% are typically elements at baseload generating plants with multiple generating units or BES elements within a heavily meshed transmission network usually close to large load centers. IBRs do not contribute much fault current and are usually interconnected in remote parts of the system. As such, the short circuit MVA for the point of interconnection (POI) bus and nearby BES buses is not expected to be in the top 20%. Hence, BES buses near these resources are more likely to be omitted from requiring SER and FR data monitoring. In addition, most IBRs do not meet the nameplate rating criteria outlined in Requirement R5. With increasing penetration of IBRs, it is important that some of these resources and nearby BES elements are monitored with DDR and SER/FR devices, respectively.

Recent disturbance analyses of events involving IBRs including the Blue Cut Fire and Canyon 2 Fire have demonstrated the lack of disturbance monitoring data available from these facilities and nearby BES buses to adequately determine the causes and effects of their behavior. None of the IBRs involved in these two events met the size criteria stated in PRC-002-2 to be required to have disturbance monitoring. Additionally, none of the buses near the IBRs met the criteria in Requirement R1 for being required to have SER and FR devices since the IBRs inherently produce very little fault current. This led to difficulty in adequately assessing the events.

With the changing resource mix and increasing penetration of IBRs, PRC-002-2 does not serve its intended purpose adequately. To the extent that the standard is already requiring monitoring devices, the location requirements need to be revised. These revisions are necessary so that required data is available for the purposes of post-mortem event analysis and identifying root causes of large system disturbances.

TPL Standards Issues

The IRPTF did not identify any requirements that may need to be changed in TPL-007-3, Transmission System Performance for Geomagnetic Disturbance Events, or the upcoming revisions to the standard. The IRPTF did identify several clarifications that may be helpful in the requirements of TPL-001-4, Transmission System Planning Performance Requirements. However, these clarifications are minor in nature and do not warrant changing the standard at this time. These clarifications should be considered by a subsequent SDT if the standard is revised in the future.

TPL-001-4

TPL-001-4 requires Planning Coordinators (PCs) and TPs to assess the reliability of their portion of the BES for various conditions across several specified future years and to plan Corrective Action Plans to address identified performance deficiencies. The requirements and sub-requirements include, among other things, certain simulation assumptions to be used by the planner and performance requirements.

Sub-requirements 3.3 and 4.3 describe simulation assumptions that the planner should use when performing contingency analysis for the steady-state and stability portion of the assessment, respectively. Sub-requirements 3.3.1.1 and 4.3.1.2 each require the planner to include the impact of the "tripping of generators where simulations show generator bus voltages or high side of the [GSU] voltages are less than known or assumed generator" low voltage ride-through capability.

The term GSU transformer can be confusing to GOs of IBR facilities because they will often refer to the transformer that steps the voltage up from the individual inverter (e.g., 600 V) to the collector system voltage (e.g., 34.5 kV). In this case, there is usually another transformer (i.e., the MPT) to step the voltage up from the collector system voltage to transmission system voltage. It was likely the intent of the TPL-001-2 SDT to be referring to transmission system voltages when drafting the language that refers to known or assumed generator low voltage ride-through capability at the high-side of the GSU. Therefore, the language in these sub-requirements should be modified to provide clarity for inverter-based resources.

Sub-requirements 4.1.1 and 4.1.2 provide stability performance criteria when a generator "pulls out of synchronism" in system simulations. Although an inverter-based resource does synchronize with the grid, the phrase "pulls out of synchronism" is typically applicable only to synchronous generators, referring to when a synchronous machine has an angular separation from the rest of the grid. Therefore, these sub-requirements could be clarified by clearly stating that this performance criteria is for synchronous generators.

Sub-requirement 4.3.2 specifies that stability studies must "simulate the expected automatic operation of existing and planned devices designed to provide dynamic control of electrical system quantities when such devices impact the study area." It then contains a list of example devices that have dynamic behavior. Not

included in this list are power plant controllers and inverter controls, which often dominate the dynamic response of IBRs. While the sub-requirement does not preclude the simulation of plant-level controllers and inverter controls, it would add clarity if they were added to the list.

The suggested clarifications for sub-requirements 3.3, 4.3, 4.1.1, 4.1.2, and 4.3.2 should be considered by a future SDT when editing the standard. However, the IRPTF does not believe the clarifications by themselves warrant changing the standard at this time. It should be noted that the identified issues with TPL-001-4 also apply to the draft TPL-001-5 standard that is awaiting FERC approval as of the publication of this whitepaper.

VAR Standards Issues

The IRPTF identified issues with VAR-002-4.1 that should be addressed. The IRPTF did not identify any issues with any other VAR standards.

VAR-002-4.1

The purpose of VAR-002-4.1 is "to ensure generators provide reactive support and voltage control, within generating Facility capabilities, in order to protect equipment and maintain reliable operation of the Interconnection." Requirement R3 requires each Generator Operator (GOP) to notify its Transmission Operator (TOP) of a status change on "the AVR, power system stabilizer, or alternative voltage controlling device within 30 minutes of the change." Requirement R4 is similar in that it requires each GOP to notify its TOP of "a change in reactive capability due to factors other than a status change described in Requirement R3."

For dispersed power producing resources, it is not clear if a GOP is required to notify the TOP for the status change of voltage control on an individual generating unit. For example, if an IBR consisting of one hundred inverters has one inverter trip out of service, is the GOP required to notify the TOP per Requirement R3? NERC Project 2014-01 revised VAR-002 Requirement R4 to clarify that it is not applicable to individual generating units of dispersed power producing resources. The IRPTF did not identify any reason why Requirement R3 should be treated differently than Requirement R4 in this respect and recommends VAR-002-4.1 be modified to make this same clarification to Requirement R3.

Conclusion and Recommendation

The IRPTF performed a comprehensive review of NERC Reliability Standards to determine if there were potential gaps for improvements based on the work and findings of the IRPTF. The outcome of this analysis includes the following recommendations:

1. **FAC-001-3 and FAC-002-2** should be revised to address the issues described herein;
2. **MOD-026-1** and **MOD-027-1** should either be revised to address the issues described herein or a new model verification standard should be developed for IBRs
3. **PRC-002-2** should be revised to address the issues described herein;
4. Clarifications should be made to **TPL-001-4** to address the issues described herein the next time the standard is revised. This recommendation also applies to the draft **TPL-001-5**; and
5. **VAR-002-4.1** should be revised to address the issues described herein.

The IRPTF recommends that a SAR(s) be developed to address each of the issues identified. IRPTF recommends that this be made a priority by the NERC Standards Committee, due to the continued growth of BPS-connected inverter-based resources.

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Standard Authorization Request (SAR)

Complete and submit this form, with attachment(s) to the NERC Help Desk. Upon entering the Captcha, please type in your contact information, and attach the SAR to your ticket. Once submitted, you will receive a confirmation number which you can use to track your request.

The North American Electric Reliability Corporation (NERC) welcomes suggestions to improve the reliability of the bulk power system through improved Reliability Standards.

Requested information			
SAR Title:	FAC-001-3 Facility Interconnection Requirements; FAC-002-2, Facility Interconnection Studies		
Date Submitted:	Mm/dd/2020		
SAR Requester			
Name:	TBD		
Organization:	TBD		
Telephone:	TBD	Email:	TBD

SAR Type (Check as many as apply)

☐ New Standard	☐ Imminent Action/ Confidential Issue (SPM Section 10)
☒ Revision to Existing Standard	☐ Variance development or revision
☐ Add, Modify or Retire a Glossary Term	☐ Other (Please specify)
☐ Withdraw/retire an Existing Standard	

Justification for this proposed standard development project (Check all that apply to help NERC prioritize development)

☐ Regulatory Initiation	☒ NERC Standing Committee Identified
☐ Emerging Risk (Reliability Issues Steering Committee) Identified	☐ Enhanced Periodic Review Initiated
☐ Reliability Standard Development Plan	☒ Industry Stakeholder Identified

Industry Need (What Bulk Electric System (BES) reliability benefit does the proposed project provide?):

The NERC Inverter-based Resource Performance Task Force (IRPTF) undertook an effort to perform a comprehensive review of all NERC Reliability Standards to determine if there were any potential gaps or improvements based on the work and findings of the IRPTF. The IRPTF identified several issues as part of this effort and documented its findings and recommendations in a white paper. The "IRPTF Review of NERC Reliability Standards White Paper" was approved by the Operating Committee and the Planning Committee in March 2020. Among the findings noted in the white paper, the IRPTF identified issues with FAC-001-3 and FAC-002-2 that should be addressed.

The purpose of FAC-001-3 is to ensure that Facility interconnection requirements exist for Transmission Owners and Generator Owners when connecting new or materially modified facilities. The purpose of FAC-002-2 is to ensure studies are performed to analyze the impact of interconnecting new or materially modified facilities on the Bulk Electric System (BES). An ambiguity exists in these standards in regards to

Requested information
the term "materially modified" and which entity is responsible for making such a determination. Hence, these standards need to be modified to address this issue.
Purpose or Goal (How does this proposed project provide the reliability-related benefit described above?):
This SAR proposes to revise FAC-001-3 and FAC-002-2 to clarify requirements related to material modifications of Facilities.
Project Scope (Define the parameters of the proposed project):
The proposed scope of this project is as follows: a. Consider ways to clarify which entity is responsible for making the determination of what is considered to be a material modification to a Facility. b. Consider requiring Facility owners to notify affected entities when making a material modification to a Facility. c. Consider changing the term "materially modifying" to avoid confusion with similar terminology that is used for a different purpose in the FERC Open Access Transmission Tariff. d. Consider other manners in which to clarify existing requirements to ensure new or materially modified Facilities on the Bulk Electric System (BES) are adequately accounted for to ensure reliability.
Detailed Description (Describe the proposed deliverable(s) with sufficient detail for a drafting team to execute the project. If you propose a new or substantially revised Reliability Standard or definition, provide: (1) a technical justification[1] which includes a discussion of the reliability-related benefits of developing a new or revised Reliability Standard or definition, and (2) a technical foundation document (*e.g.,* research paper) to guide development of the Standard or definition):
Both FAC-001-3 and FAC-002-2 imply that the term "materially modified" should be used to distinguish between facility changes that are required to be studied and those that need not be studied. However, there is not a requirement for any entity to determine what changes are to be considered materially modifying and Facility owners are not required to notify potentially affected entities of these changes. This has led to confusion and potential reliability issues within industry. For example, a Transmission Planner may consider an inverter-based resource (IBR) control system software change to be materially modifying, but if the Generator Owner does not consider such a change to be materially modifying they will not notify the Transmission Planner of the change. While the existing standards do require coordination and cooperation between a Facility owner and the Transmission Planner or Planning Coordinator when a new or materially modified interconnection Facility is connected to their system, for example FAC-002-2 Requirement R5, neither standard specifies what entity is responsible for determining what is considered to be a material modification. Further, the existing language is unclear about whether these requirements only apply when a different entity is proposing to interconnect to a Facility owner's Facility or if they also apply to the Facility owner's new or modified Facility.

[1] The NERC Rules of Procedure require a technical justification for new or substantially revised Reliability Standards. Please attach pertinent information to this form before submittal to NERC.

Requested information
Additionally, in FERC-jurisdictional areas, the term "Materially Modification" refers to a new generation project's impact on other generators in the interconnection queue. This has led to widespread confusion across the industry regarding the correct application of these terms related to the FERC Open Access Transmission Tariff (OATT) implementation and the NERC Reliability Standards requirements. The application of these terms is different between the FERC process and the NERC Reliability Standards (specifically FAC-001-3 and FAC-002-2). For example, if a Generator Owner changes out the inverters on an existing solar PV resource, the change may have no impact on other generators in the interconnection queue, and thus would not be considered a Material Modification under the FERC OATT rules. But such a change could have reliability impacts on the system that should be studied in accordance with FAC-002-2. The Standards Drafting Team should consider changing the term to avoid this confusion. FAC-001-3 and FAC-002-2 should be modified to clarify the use of "materially modifying", particularly as it relates to compliance with the standards.
Cost Impact Assessment, if known (Provide a paragraph describing the potential cost impacts associated with the proposed project):
The SAR proposes to clarify and address gaps in the requirements in FAC-001-3 and FAC-002-2. The cost impact is unknown.
Please describe any unique characteristics of the BES facilities that may be impacted by this proposed standard development project (*e.g.*, Dispersed Generation Resources):
The frequency of change of components could be higher for IBRs and the magnitude of such changes could vary. For example, due to a rapid change in wind turbine generator (WTG) technology, it is a common practice to re-power an existing wind power plant with bigger blades while keeping the same electrical generator and converter systems (for both Type 3 and Type 4 WTGs). This may be considered a material modification since a new set of bigger blades (e.g., 93 m to 208 m) can produce more power at a lower wind speed. However, the nameplate rating of the plant will remain unchanged. From an interconnection requirements' perspective, it is the electrical generator and converter system that impacts the majority of the steady-state, short-circuit, and dynamic characteristics and therefore will be mostly unchanged. Therefore, the question remains if these sort of repowering projects should be studied under FAC-002-2 R1 and which entity should make that determination.
To assist the NERC Standards Committee in appointing a drafting team with the appropriate members, please indicate to which Functional Entities the proposed standard(s) should apply (*e.g.*, Transmission Operator, Reliability Coordinator, etc. See the most recent version of the NERC Functional Model for definitions):
Planning Coordinator, Transmission Planner, Generator Owner, Transmission Owner, Distribution Provider
Do you know of any consensus building activities[2] in connection with this SAR? If so, please provide any recommendations or findings resulting from the consensus building activity.
This issue was captured in the "IRPTF Review of NERC Reliability Standards White Paper" which was approved by the Operating Committee and the Planning Committee.

[2] Consensus building activities are occasionally conducted by NERC and/or project review teams. They typically are conducted to obtain industry inputs prior to proposing any standard development project to revise, or develop a standard or definition.

Requested information
Are there any related standards or SARs that should be assessed for impact as a result of this proposed project? If so, which standard(s) or project number(s)?
N/A
Are there alternatives (e.g., guidelines, white paper, alerts, etc.) that have been considered or could meet the objectives? If so, please list the alternatives.
The IRPTF did not identify any alternatives since there are ambiguities in the existing language for FAC-001-3 and FAC-002-2 that need to be clarified.

Reliability Principles	
Does this proposed standard development project support at least one of the following Reliability Principles (Reliability Interface Principles)? Please check all those that apply.	
☒	1. Interconnected bulk power systems shall be planned and operated in a coordinated manner to perform reliably under normal and abnormal conditions as defined in the NERC Standards.
☐	2. The frequency and voltage of interconnected bulk power systems shall be controlled within defined limits through the balancing of real and reactive power supply and demand.
☒	3. Information necessary for the planning and operation of interconnected bulk power systems shall be made available to those entities responsible for planning and operating the systems reliably.
☐	4. Plans for emergency operation and system restoration of interconnected bulk power systems shall be developed, coordinated, maintained and implemented.
☐	5. Facilities for communication, monitoring and control shall be provided, used and maintained for the reliability of interconnected bulk power systems.
☐	6. Personnel responsible for planning and operating interconnected bulk power systems shall be trained, qualified, and have the responsibility and authority to implement actions.
☐	7. The security of the interconnected bulk power systems shall be assessed, monitored and maintained on a wide area basis.
☐	8. Bulk power systems shall be protected from malicious physical or cyber attacks.

Market Interface Principles	
Does the proposed standard development project comply with all of the following Market Interface Principles?	Enter (yes/no)
1. A reliability standard shall not give any market participant an unfair competitive advantage.	Yes
2. A reliability standard shall neither mandate nor prohibit any specific market structure.	Yes
3. A reliability standard shall not preclude market solutions to achieving compliance with that standard.	Yes
4. A reliability standard shall not require the public disclosure of commercially sensitive information. All market participants shall have equal opportunity to access commercially non-sensitive information that is required for compliance with reliability standards.	Yes

Identified Existing or Potential Regional or Interconnection Variances	
Region(s)/ Interconnection	Explanation
None	N/A

For Use by NERC Only

SAR Status Tracking (Check off as appropriate).	
☐ Draft SAR reviewed by NERC Staff ☐ Draft SAR presented to SC for acceptance ☐ DRAFT SAR approved for posting by the SC	☐ Final SAR endorsed by the SC ☐ SAR assigned a Standards Project by NERC ☐ SAR denied or proposed as Guidance document

Version History

Version	Date	Owner	Change Tracking
1	June 3, 2013		Revised
1	August 29, 2014	Standards Information Staff	Updated template
2	January 18, 2017	Standards Information Staff	Revised
2	June 28, 2017	Standards Information Staff	Updated template
3	February 22, 2019	Standards Information Staff	Added instructions to submit via Help Desk
4	February 25, 2020	Standards Information Staff	Updated template footer

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Standard Authorization Request (SAR)

Complete and submit this form, with attachment(s) to the NERC Help Desk. Upon entering the Captcha, please type in your contact information, and attach the SAR to your ticket. Once submitted, you will receive a confirmation number which you can use to track your request.

The North American Electric Reliability Corporation (NERC) welcomes suggestions to improve the reliability of the bulk power system through improved Reliability Standards.

Requested information			
SAR Title:	MOD-026-1 Verification of Models and Data for Generator Excitation Control System or Plant Volt/Var Control Functions, MOD-027-1 Verification of Models and Data for Turbine/Governor and Load Control or Active Power/Frequency Control Functions		
Date Submitted:	Mm/dd/2020		
SAR Requester			
Name:	TBD		
Organization:	TBD		
Telephone:	TBD	Email:	TBD
SAR Type (Check as many as apply)			
☒ New Standard ☒ Revision to Existing Standard ☐ Add, Modify or Retire a Glossary Term ☐ Withdraw/retire an Existing Standard		☐ Imminent Action/ Confidential Issue (SPM Section 10) ☐ Variance development or revision ☐ Other (Please specify)	
Justification for this proposed standard development project (Check all that apply to help NERC prioritize development)			
☐ Regulatory Initiation ☐ Emerging Risk (Reliability Issues Steering Committee) Identified ☐ Reliability Standard Development Plan		☒ NERC Standing Committee Identified ☐ Enhanced Periodic Review Initiated ☒ Industry Stakeholder Identified	
Industry Need (What Bulk Electric System (BES) reliability benefit does the proposed project provide?):			
The NERC Inverter-based Resource Performance Task Force (IRPTF) undertook an effort to perform a comprehensive review of all NERC Reliability Standards to determine if there were any potential gaps or improvements based on the work and findings of the IRPTF. The IRPTF identified several issues as part of this effort and documented its findings and recommendations in a white paper. The "IRPTF Review of NERC Reliability Standards White Paper" was approved by the Operating Committee and the Planning Committee in March 2020. Among the findings noted in the white paper, the IRPTF identified issues with MOD-026-1 and MOD-027-1 that should be addressed. MOD-026-1 and MOD-027-1 require, among other things, GOs to provide verified dynamic models to their Transmission Planner (TP) for the purposes of power system planning studies. Both standards contain language that is specific to synchronous generators and is not applicable to inverter-based resources			

Requested information
(IBRs). For example, sub-requirement 2.1.3 in MOD-026-1 states that each verification shall include "model structure and data including, but not limited to reactance, time constants, saturation factors, total rotational inertia…" The standards should be revised to clarify the applicable requirements for synchronous generators and IBRs. For example, total rotational inertia should not be required for IBRs, while voltage ride-through control settings should only be required of IBRs and not synchronous generators. Additionally, to some degree, all dynamic model parameters affect the response of a represented resource in dynamic simulations performed by power engineers. Accurate model response is required for the engineers to adequately study system conditions. Hence, it is crucial that all parameters in a model be verified in some way. However, a significant number of parameters in the models are not verified in the typical verification tests used to comply with MOD-026-1 and MOD-027-1. For example, the test currently used to comply with MOD-026-1 does not verify the model parameters associated with voltage control behavior during large disturbance conditions.
Purpose or Goal (How does this proposed project provide the reliability-related benefit described above?):
This SAR proposes to revise MOD-026-1 and MOD-027-1 and/or create a new standard to clarify requirements related to IBRs and to require sufficient model verification to ensure accurate generator representation in dynamic simulations.
Project Scope (Define the parameters of the proposed project):
The proposed scope of this project is as follows: a. Update requirement language to better reflect all types of generation resources and not just synchronous resources. b. Consider ways to require sufficient model verification to ensure accurate generator representation in dynamic simulations of typical phenomena that would be studied by power system engineers, including large disturbances.
Detailed Description (Describe the proposed deliverable(s) with sufficient detail for a drafting team to execute the project. If you propose a new or substantially revised Reliability Standard or definition, provide: (1) a technical justification[1] which includes a discussion of the reliability-related benefits of developing a new or revised Reliability Standard or definition, and (2) a technical foundation document (*e.g.,* research paper) to guide development of the Standard or definition):
NERC MOD-026-1 focuses on verification of data for generator excitation control system or plant volt/var control functions and MOD-027-1 focuses on verification of data for turbine-governor and load control or active power-frequency control functions. Specifically, MOD-026-1 states in footnote 1 that the excitation control system for aggregate generating plants (i.e., wind and solar PV) includes the volt/var control system including the voltage regulator and reactive power control system controlling and coordinating plant voltage and associated reactive capable resources. This language is slightly ambiguous on whether the verification activities include the inverter-level parameter values of the dynamic models. Various

[1] The NERC Rules of Procedure require a technical justification for new or substantially revised Reliability Standards. Please attach pertinent information to this form before submittal to NERC.

Requested information
testing engineers and entities have stated that they are uncertain as to whether the standard applies to the plant-level parameters or the aggregate representation of the inverter-level settings. Most commonly, verification test reports for inverter-based resources involve a small set of small disturbance tests including, but not limited to, the following: • Capacitor switching test • Plant-level voltage or reactive power reference step test • Plant-level frequency reference step test • Plant-level frequency play-in or step test These tests do not perturb the generating resource such that the parameter values that dictate the large disturbance behavior of the resource are verified in any way. While some incorrect model parameters may be identified during these tests, the tests do not verify that the parameters selected for the model accurately capture the full dynamic behavior of the resource. This gives a false impression to TPs and PCs that the full set of parameters are verified for use in planning studies. This issue is one of the predominant reasons why ride-through operation modes such as momentary cessation were able to persist and promulgate in IBRs without the knowledge of planners and system operators until the Blue Cut Fire and Canyon 2 Fire events exposed them. The dynamic models did not accurately represent this large disturbance behavior due to the model deficiency and because certain key parameters that govern large disturbance response were incorrectly parameterized. However, many of the same plants that entered momentary cessation mode during these events were able to provide verification reports that demonstrated that the small disturbance behavior driven mainly by plant-level control settings reasonably matched modeled performance in compliance with these standards.
Cost Impact Assessment, if known (Provide a paragraph describing the potential cost impacts associated with the proposed project):
The SAR proposes to clarify and address gaps in the requirements in MOD-026-1 and MOD-027-1. The cost impact is unknown.
Please describe any unique characteristics of the BES facilities that may be impacted by this proposed standard development project (*e.g.*, Dispersed Generation Resources):
The abovementioned reliability gap exists for both synchronous generators and IBRs. However, it is potentially more severe for IBRs since their behavior is based more on programmable control functions than for synchronous generators which have behavior that is based more on the physical characteristics of the machine. Additionally, the IRPTF noted that it is not feasible to stage large disturbances for verification purposes, so other methods for verification of model performance under large disturbance conditions may need to be developed.
To assist the NERC Standards Committee in appointing a drafting team with the appropriate members, please indicate to which Functional Entities the proposed standard(s) should apply (*e.g.*, Transmission Operator, Reliability Coordinator, etc. See the most recent version of the NERC Functional Model for definitions):

Requested information
Transmission Planner, Generator Owner, Planning Coordinator
Do you know of any consensus building activities[2] in connection with this SAR? If so, please provide any recommendations or findings resulting from the consensus building activity.
This issue was captured in the "IRPTF Review of NERC Reliability Standards White Paper" which was approved by the Operating Committee and the Planning Committee. Additionally, the issue was discussed in the IRPTF-produced "Improvements to Interconnection Requirements for BPS-Connected Inverter-Based Resources" reliability guideline.
Are there any related standards or SARs that should be assessed for impact as a result of this proposed project? If so, which standard(s) or project number(s)?
N/A
Are there alternatives (e.g., guidelines, white paper, alerts, etc.) that have been considered or could meet the objectives? If so, please list the alternatives.
The IRPTF did not identify any alternatives since there are gaps in the existing language for MOD-026-1 and MOD-027-1 that need to be resolved.

Reliability Principles	
Does this proposed standard development project support at least one of the following Reliability Principles (Reliability Interface Principles)? Please check all those that apply.	
☒	1. Interconnected bulk power systems shall be planned and operated in a coordinated manner to perform reliably under normal and abnormal conditions as defined in the NERC Standards.
☐	2. The frequency and voltage of interconnected bulk power systems shall be controlled within defined limits through the balancing of real and reactive power supply and demand.
☒	3. Information necessary for the planning and operation of interconnected bulk power systems shall be made available to those entities responsible for planning and operating the systems reliably.
☐	4. Plans for emergency operation and system restoration of interconnected bulk power systems shall be developed, coordinated, maintained and implemented.
☐	5. Facilities for communication, monitoring and control shall be provided, used and maintained for the reliability of interconnected bulk power systems.
☐	6. Personnel responsible for planning and operating interconnected bulk power systems shall be trained, qualified, and have the responsibility and authority to implement actions.
☐	7. The security of the interconnected bulk power systems shall be assessed, monitored and maintained on a wide area basis.
☐	8. Bulk power systems shall be protected from malicious physical or cyber attacks.

[2] Consensus building activities are occasionally conducted by NERC and/or project review teams. They typically are conducted to obtain industry inputs prior to proposing any standard development project to revise, or develop a standard or definition.

Market Interface Principles	
Does the proposed standard development project comply with all of the following Market Interface Principles?	Enter (yes/no)
1. A reliability standard shall not give any market participant an unfair competitive advantage.	Yes
2. A reliability standard shall neither mandate nor prohibit any specific market structure.	Yes
3. A reliability standard shall not preclude market solutions to achieving compliance with that standard.	Yes
4. A reliability standard shall not require the public disclosure of commercially sensitive information. All market participants shall have equal opportunity to access commercially non-sensitive information that is required for compliance with reliability standards.	Yes

Identified Existing or Potential Regional or Interconnection Variances	
Region(s)/ Interconnection	Explanation
None	N/A

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SAR Status Tracking (Check off as appropriate).	
☐ Draft SAR reviewed by NERC Staff ☐ Draft SAR presented to SC for acceptance ☐ DRAFT SAR approved for posting by the SC	☐ Final SAR endorsed by the SC ☐ SAR assigned a Standards Project by NERC ☐ SAR denied or proposed as Guidance document

Version History

Version	Date	Owner	Change Tracking
1	June 3, 2013		Revised
1	August 29, 2014	Standards Information Staff	Updated template
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2	June 28, 2017	Standards Information Staff	Updated template
3	February 22, 2019	Standards Information Staff	Added instructions to submit via Help Desk
4	February 25, 2020	Standards Information Staff	Updated template footer

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Standard Authorization Request (SAR)

Complete and submit this form, with attachment(s) to the NERC Help Desk. Upon entering the Captcha, please type in your contact information, and attach the SAR to your ticket. Once submitted, you will receive a confirmation number which you can use to track your request.

The North American Electric Reliability Corporation (NERC) welcomes suggestions to improve the reliability of the bulk power system through improved Reliability Standards.

Requested information			
SAR Title:	VAR-002-4.1 Generator Operation for Maintaining Network Voltage Schedules		
Date Submitted:	Mm/dd/2020		
SAR Requester			
Name:	TBD		
Organization:	TBD		
Telephone:	TBD	Email:	TBD

SAR Type (Check as many as apply)

- ☐ New Standard
- ☒ Revision to Existing Standard
- ☐ Add, Modify or Retire a Glossary Term
- ☐ Withdraw/retire an Existing Standard
- ☐ Imminent Action/ Confidential Issue (SPM Section 10)
- ☐ Variance development or revision
- ☐ Other (Please specify)

Justification for this proposed standard development project (Check all that apply to help NERC prioritize development)

- ☐ Regulatory Initiation
- ☐ Emerging Risk (Reliability Issues Steering Committee) Identified
- ☐ Reliability Standard Development Plan
- ☒ NERC Standing Committee Identified
- ☐ Enhanced Periodic Review Initiated
- ☒ Industry Stakeholder Identified

Industry Need (What Bulk Electric System (BES) reliability benefit does the proposed project provide?):

The NERC Inverter-based Resource Performance Task Force (IRPTF) undertook an effort to perform a comprehensive review of all NERC Reliability Standards to determine if there were any potential gaps or improvements based on the work and findings of the IRPTF. The IRPTF identified several issues as part of this effort and documented its findings and recommendations in a white paper. The "IRPTF Review of NERC Reliability Standards White Paper" was approved by the Operating Committee and the Planning Committee in March 2020. Among the findings noted in the white paper, the IRPTF identified issues with VAR-002-4.1 that should be addressed.

The purpose of VAR-002-4.1 is "to ensure generators provide reactive support and voltage control, within generating Facility capabilities, in order to protect equipment and maintain reliable operation of the Interconnection." Requirement R3 requires each Generator Operator (GOP) to notify its Transmission Operator (TOP) of a status change on "the AVR, power system stabilizer, or alternative voltage controlling device within 30 minutes of the change." Requirement R4 is similar in that it

Requested information
requires each GOP to notify its TOP of "a change in reactive capability due to factors other than a status change described in Requirement R3." For dispersed power producing resources, it is not clear if a GOP is required to notify the TOP for the status change of a voltage controlling device on an individual generating unit. For example, if an IBR consisting of one hundred inverters has one inverter trip out of service, is the GOP required to notify the TOP per Requirement R3? NERC Project 2014-01 revised VAR-002 Requirement R4 to clarify that it is not applicable to individual generating units of dispersed power producing resources. The IRPTF did not identify any reason why Requirement R3 should be treated differently than Requirement R4 in this respect and recommended VAR-002-4.1 be modified to make this same clarification to Requirement R3.
Purpose or Goal (How does this proposed project provide the reliability-related benefit described above?):
This SAR proposes to revise VAR-002-4.1 to address ambiguities within the existing standard. The goal is to add clarity and address the ambiguity in the existing requirements.
Project Scope (Define the parameters of the proposed project):
The proposed scope of this project is to clarify VAR-002-4.1 Requirement R3 in regards to whether the GOP of a dispersed power resource must notify its associated TOP of a status change of a voltage controlling device on an individual generating unit, for example if a single inverter goes offline in a solar PV resource.
Detailed Description (Describe the proposed deliverable(s) with sufficient detail for a drafting team to execute the project. If you propose a new or substantially revised Reliability Standard or definition, provide: (1) a technical justification[1] which includes a discussion of the reliability-related benefits of developing a new or revised Reliability Standard or definition, and (2) a technical foundation document (*e.g.,* research paper) to guide development of the Standard or definition):
The Standards Drafting Team should clarify VAR-002-4.1 Requirement R3 in regards to whether the GOP of a dispersed power resource must notify its associated TOP of a status change of a voltage controlling device on an individual generating unit.
Cost Impact Assessment, if known (Provide a paragraph describing the potential cost impacts associated with the proposed project):
The SAR proposes to clarify VAR-002-4.1 Requirement R3. The cost impact is unknown, but it is expected to be minimal since it should only impact communication procedures.
Please describe any unique characteristics of the BES facilities that may be impacted by this proposed standard development project (*e.g.*, Dispersed Generation Resources):
Dispersed power producing resources are made up of multiple individual generating units. It may be impractical, place an undue burden upon the associated GOPs and TOPs, and have no material reliability benefit to have GOPs notify TOPs in regards to the status change of a voltage controlling device on a single individual generating unit.
To assist the NERC Standards Committee in appointing a drafting team with the appropriate members, please indicate to which Functional Entities the proposed standard(s) should apply (*e.g.*, Transmission

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Requested information
Operator, Reliability Coordinator, etc. See the most recent version of the NERC Functional Model for definitions):
Generator Operators and Generator Owners
Do you know of any consensus building activities[2] in connection with this SAR? If so, please provide any recommendations or findings resulting from the consensus building activity.
This issue was captured in the "IRPTF Review of NERC Reliability Standards White Paper" which was approved by the Operating Committee and the Planning Committee.
Are there any related standards or SARs that should be assessed for impact as a result of this proposed project? If so, which standard(s) or project number(s)?
N/A
Are there alternatives (e.g., guidelines, white paper, alerts, etc.) that have been considered or could meet the objectives? If so, please list the alternatives.
The IRPTF did not identify any alternatives since the language in VAR-002-4.1 needs clarification.

Reliability Principles	
Does this proposed standard development project support at least one of the following Reliability Principles (Reliability Interface Principles)? Please check all those that apply.	
☒	1. Interconnected bulk power systems shall be planned and operated in a coordinated manner to perform reliably under normal and abnormal conditions as defined in the NERC Standards.
☒	2. The frequency and voltage of interconnected bulk power systems shall be controlled within defined limits through the balancing of real and reactive power supply and demand.
☐	3. Information necessary for the planning and operation of interconnected bulk power systems shall be made available to those entities responsible for planning and operating the systems reliably.
☐	4. Plans for emergency operation and system restoration of interconnected bulk power systems shall be developed, coordinated, maintained and implemented.
☐	5. Facilities for communication, monitoring and control shall be provided, used and maintained for the reliability of interconnected bulk power systems.
☐	6. Personnel responsible for planning and operating interconnected bulk power systems shall be trained, qualified, and have the responsibility and authority to implement actions.
☐	7. The security of the interconnected bulk power systems shall be assessed, monitored and maintained on a wide area basis.
☐	8. Bulk power systems shall be protected from malicious physical or cyber attacks.

[2] Consensus building activities are occasionally conducted by NERC and/or project review teams. They typically are conducted to obtain industry inputs prior to proposing any standard development project to revise, or develop a standard or definition.

Market Interface Principles	
Does the proposed standard development project comply with all of the following Market Interface Principles?	Enter (yes/no)
1. A reliability standard shall not give any market participant an unfair competitive advantage.	Yes
2. A reliability standard shall neither mandate nor prohibit any specific market structure.	Yes
3. A reliability standard shall not preclude market solutions to achieving compliance with that standard.	Yes
4. A reliability standard shall not require the public disclosure of commercially sensitive information. All market participants shall have equal opportunity to access commercially non-sensitive information that is required for compliance with reliability standards.	Yes

Identified Existing or Potential Regional or Interconnection Variances	
Region(s)/ Interconnection	Explanation
None	N/A

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SAR Status Tracking (Check off as appropriate).	
☐ Draft SAR reviewed by NERC Staff ☐ Draft SAR presented to SC for acceptance ☐ DRAFT SAR approved for posting by the SC	☐ Final SAR endorsed by the SC ☐ SAR assigned a Standards Project by NERC ☐ SAR denied or proposed as Guidance document

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Standard Authorization Request (SAR)

Complete and submit this form, with attachment(s) to the NERC Help Desk. Upon entering the Captcha, please type in your contact information, and attach the SAR to your ticket. Once submitted, you will receive a confirmation number which you can use to track your request.

The North American Electric Reliability Corporation (NERC) welcomes suggestions to improve the reliability of the bulk power system through improved Reliability Standards.

Requested information			
SAR Title:	PRC-002-2 Disturbance Monitoring and Reporting Requirements		
Date Submitted:	Mm/dd/2020		
SAR Requester			
Name:	TBD		
Organization:	TBD		
Telephone:	TBD	Email:	TBD

SAR Type (Check as many as apply)	
☐ New Standard	☐ Imminent Action/ Confidential Issue (SPM Section 10)
☒ Revision to Existing Standard	☐ Variance development or revision
☐ Add, Modify or Retire a Glossary Term	☐ Other (Please specify)
☐ Withdraw/retire an Existing Standard	

Justification for this proposed standard development project (Check all that apply to help NERC prioritize development)	
☐ Regulatory Initiation	☒ NERC Standing Committee Identified
☐ Emerging Risk (Reliability Issues Steering Committee) Identified	☐ Enhanced Periodic Review Initiated
☐ Reliability Standard Development Plan	☒ Industry Stakeholder Identified

Industry Need (What Bulk Electric System (BES) reliability benefit does the proposed project provide?):

The NERC Inverter-based Resource Performance Task Force (IRPTF) undertook an effort to perform a comprehensive review of all NERC Reliability Standards to determine if there were any potential gaps or improvements based on the work and findings of the IRPTF. The IRPTF identified several issues as part of this effort and documented its findings and recommendations in a white paper. The "IRPTF Review of NERC Reliability Standards White Paper" was approved by the Operating Committee and the Planning Committee in March 2020. Among the findings noted in the white paper, the IRPTF identified issues with PRC-002-2 that should be addressed.

The purpose of PRC-002-2 is to have adequate data available to facilitate analysis of BES disturbances. Requirements R1 and R5 specify where sequence of events recording (SER) and fault recording (FR) data, and where dynamic Disturbance recording (DDR) data, respectively, are required in the Bulk Electric System (BES).

Requested information
Requirements R1 and R5 are written with a focus on synchronous machine dominated systems with periodic review of monitoring equipment needs for the system. The BES elements with short circuit MVA in the top 20% are typically elements at baseload generating plants with multiple generating units or BES elements within a heavily meshed transmission network usually close to large load centers. Inverter-based resources (IBRs) do not contribute much fault current and are usually interconnected in remote parts of the system. As such, the short circuit MVA for the point of interconnection (POI) bus and nearby BES buses is not expected to be in the top 20%. Hence, BES buses near these resources are more likely to be omitted from requiring SER and FR data monitoring. In addition, most IBRs do not meet the nameplate rating criteria outlined in Requirement R5. With increasing penetration of IBRs, it is important that some of these resources and nearby BES elements are monitored with DDR and SER/FR devices. Recent disturbance analyses of events involving IBRs including the Blue Cut Fire and Canyon 2 Fire have demonstrated the lack of disturbance monitoring data available from these facilities and nearby BES buses to adequately determine the causes and effects of their behavior. None of the IBRs involved in these two events met the size criteria stated in PRC-002-2 to be required to have disturbance monitoring. Additionally, none of the buses near the IBRs met the criteria in Requirement R1 for being required to have SER and FR devices since the IBRs inherently produce very little fault current. This led to difficulty in adequately assessing the events. With the changing resource mix and increasing penetration of IBRs, PRC-002-2 does not serve its intended purpose adequately. To the extent that the standard is already requiring monitoring devices and periodic assessments, the location requirements and associated periodic assessments need to be revised. These revisions are necessary so that required data is available for the purposes of post-mortem event analysis and identifying root causes of large system disturbances.
Purpose or Goal (How does this proposed project provide the reliability-related benefit described above?):
This SAR proposes to revise PRC-002-2 to address gaps within the existing standard. The goal is to modify the requirements to ensure adequate data is available and periodically assessed to facilitate the analysis of BES disturbances, including in areas of the Bulk Power System (BPS) that may not be covered by the existing requirements.
Project Scope (Define the parameters of the proposed project):
The proposed scope of this project is as follows: a. Consider ways to ensure that the identification and periodic assessment of BES and/or BPS buses for which SER and FR data is required provides adequate monitoring of BES Disturbances. This may include updates to supplemental information such as the previously provided “Median Method Excel Workbook”. b. Consider ways to ensure that the identification and periodic assessment of BES and/or BPS Elements for which DDR data is required provides adequate monitoring of BES disturbances. c. Consider other manners in which to add to, modify or clarify the existing requirements to ensure adequate monitoring of BES disturbances.

Requested information
Detailed Description (Describe the proposed deliverable(s) with sufficient detail for a drafting team to execute the project. If you propose a new or substantially revised Reliability Standard or definition, provide: (1) a technical justification[1] which includes a discussion of the reliability-related benefits of developing a new or revised Reliability Standard or definition, and (2) a technical foundation document (*e.g.,* research paper) to guide development of the Standard or definition):
Per Requirement R1 (which uses criteria outlined in Attachment 1), Sequence of Event Recording (SER) and Fault Recording (FR) devices are required at BES buses with high short circuit MVA values. The methodology identifies the top 20 percent of BES buses with highest short circuit MVA values and requires a subset of these buses to be monitored for SER and FR data. However, BES elements with short circuit MVA in the top 20% are typically elements at baseload generating plants with multiple generating units or BES elements within a heavily meshed transmission network usually close to large load centers. IBRs do not contribute much fault current and are usually interconnected in remote parts of the system. As such, the short circuit MVA for the point of interconnection (POI) bus and nearby BES buses is not expected to be in the top 20%. Hence, BES buses near these resources are more likely to be omitted from requiring SER and FR data monitoring, though it is possible that monitoring in these areas is needed for disturbance analysis, as was the case in the Blue Cut Fire and Canyon 2 Fire events. Requirement R5, identifies BES locations based on a size criteria for generating resources and other critical elements such as HVDC, IROLs and elements of UVLS program, for which Dynamic Disturbance Recording (DDR) data is required. In regard to generation resources, it includes requirements for monitoring at sites with either gross individual nameplate rating of greater than or equal to 500 MVA or gross individual nameplate rating greater than or equal to 300 MVA where gross plant/facility aggregate nameplate rating is greater than or equal to 1000 MVA. However, most IBRs do not meet the nameplate rating criteria outlined in Requirement R5. With increasing penetration of IBRs, it is important that some of these resources and nearby BES elements are monitored with DDR devices to ensure adequate coverage for disturbance analysis while balancing cost impacts.
Cost Impact Assessment, if known (Provide a paragraph describing the potential cost impacts associated with the proposed project):
The SAR proposes to modify PRC-002-2 requirements. The cost impact is unknown, however, the cost of disturbance monitoring hardware is approximately $50,000 to $100,000 per installation if the existing onsite equipment is not already set up for monitoring and storage.
Please describe any unique characteristics of the BES facilities that may be impacted by this proposed standard development project (*e.g.*, Dispersed Generation Resources):

[1] The NERC Rules of Procedure require a technical justification for new or substantially revised Reliability Standards. Please attach pertinent information to this form before submittal to NERC.

Requested information
IBRs contribute very little short circuit MVA and are typically smaller in aggregate nameplate rating when compared to legacy synchronous resources. The criteria for selecting disturbance monitoring locations should take this into account.
To assist the NERC Standards Committee in appointing a drafting team with the appropriate members, please indicate to which Functional Entities the proposed standard(s) should apply (*e.g.*, Transmission Operator, Reliability Coordinator, etc. See the most recent version of the NERC Functional Model for definitions):
Planning Coordinator, Reliability Coordinator, Generator Owner, Transmission Owner
Do you know of any consensus building activities[2] in connection with this SAR? If so, please provide any recommendations or findings resulting from the consensus building activity.
This issue was captured in the "IRPTF Review of NERC Reliability Standards White Paper" which was approved by the Operating Committee and the Planning Committee. Additionally, the IRPTF produced "BPS-Connected Inverter-Based Resource Performance"(see Chapter 6) and "Improvements to Interconnection Requirements for BPS-Connected Inverter-Based Resources" reliability guidelines touch on monitoring considerations for IBRs.
Are there any related standards or SARs that should be assessed for impact as a result of this proposed project? If so, which standard(s) or project number(s)?
N/A
Are there alternatives (e.g., guidelines, white paper, alerts, etc.) that have been considered or could meet the objectives? If so, please list the alternatives.
The IRPTF did not identify any alternatives since there is a gap in PRC-002-2.

Reliability Principles	
Does this proposed standard development project support at least one of the following Reliability Principles (Reliability Interface Principles)? Please check all those that apply.	
☐	1. Interconnected bulk power systems shall be planned and operated in a coordinated manner to perform reliably under normal and abnormal conditions as defined in the NERC Standards.
☐	2. The frequency and voltage of interconnected bulk power systems shall be controlled within defined limits through the balancing of real and reactive power supply and demand.
☒	3. Information necessary for the planning and operation of interconnected bulk power systems shall be made available to those entities responsible for planning and operating the systems reliably.
☐	4. Plans for emergency operation and system restoration of interconnected bulk power systems shall be developed, coordinated, maintained and implemented.
☐	5. Facilities for communication, monitoring and control shall be provided, used and maintained for the reliability of interconnected bulk power systems.
☐	6. Personnel responsible for planning and operating interconnected bulk power systems shall be trained, qualified, and have the responsibility and authority to implement actions.

[2] Consensus building activities are occasionally conducted by NERC and/or project review teams. They typically are conducted to obtain industry inputs prior to proposing any standard development project to revise, or develop a standard or definition.

Reliability Principles	
☐	7. The security of the interconnected bulk power systems shall be assessed, monitored and maintained on a wide area basis.
☐	8. Bulk power systems shall be protected from malicious physical or cyber attacks.

Market Interface Principles	
Does the proposed standard development project comply with all of the following Market Interface Principles?	Enter (yes/no)
1. A reliability standard shall not give any market participant an unfair competitive advantage.	Yes
2. A reliability standard shall neither mandate nor prohibit any specific market structure.	Yes
3. A reliability standard shall not preclude market solutions to achieving compliance with that standard.	Yes
4. A reliability standard shall not require the public disclosure of commercially sensitive information. All market participants shall have equal opportunity to access commercially non-sensitive information that is required for compliance with reliability standards.	Yes

Identified Existing or Potential Regional or Interconnection Variances	
Region(s)/ Interconnection	Explanation
None	N/A

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☐ Draft SAR reviewed by NERC Staff ☐ Draft SAR presented to SC for acceptance ☐ DRAFT SAR approved for posting by the SC	☐ Final SAR endorsed by the SC ☐ SAR assigned a Standards Project by NERC ☐ SAR denied or proposed as Guidance document

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Resources Subcommittee - Scope

Purpose

The Resources Subcommittee (RS) assists the NERC Reliability and Security Technical Committee (RSTC) ~~Operating Committee (OC)~~ in enhancing Bulk Electric System (BES) reliability by implementing the goals and objectives of the ~~OC~~ RSTC Strategic Plan with respect to issues in the areas of balancing resources and demand, interconnection frequency, and control performance.

Functions

The RS accomplishes this by:

- Reviewing and assisting in the development of generation and load "balancing" standards, which may include developing any necessary reference documents.
- Reviewing and assisting in the development of interconnection balancing standards to assure problems resulting from balancing do not adversely affect reliability.
- Providing industry leadership and guidance on matters relating to balancing resources and demand issues as well as resulting issues related to interconnection frequency .
- Addressing the reliability aspects of inadvertent interchange creation, accounting, and payback.
- Reviewing balancing authorities' control performance (e.g., CPS and DCS) on a periodic basis.
- Addressing technical issues on automatic generation control (AGC), time error correction, operating reserve, and frequency response.
- Providing oversight and guidance on aspects of interchange scheduling as it applies to impacts on balancing and inadvertent interchange.
- Providing oversight and guidance to its working groups and task forces.

Deliverables

- Assistance in the determination and issuance of the yearly Frequency Bias Settings and Frequency Response Obligations
- Reporting of subcommittee activity for the regularly scheduled RSTC~~OC~~ meetings
- Review and endorsement of the Frequency Response Annual Analysis Report (Determination of the annual Interconnection Frequency Response Obligation)
- Support for the development of the frequency response and balancing related sections of the NERC State of Reliability reports
- Response to other directives and requests of the NERC RSTC~~OC~~.

Reporting

The RS reports to the NERC RSTC~~OC~~ and shall maintain communications with other groups as necessary on balancing resources and demand issues and interconnection frequency related issues.

Officers

The NERC RSTC~~OC~~ Chair appoints the RS officers (Chair and Vice Chair) for a specific term (generally two years). The subcommittee officers may be reappointed for additional terms. The RS officers are considered members of the subcommittee and may vote. The RS Chair ~~is considered a non-voting member of the RSTCOC and, at a minimum,~~ is expected to attend the regular standing committee meetings to report on assignments, provide a summary report of the group's activities as requested, and advise the RSTC~~OC~~ on important issues. The Vice Chair position is considered important for succession planning with the anticipation that the Vice Chair will be appointed as RS Chair for the next term. The RS may recommend officer candidates for the RSTC~~OC~~ Chair's consideration.

Membership

The RS shall have sufficient expertise and diversity to be able to speak knowledgably for the industry and provide meaningful and useful guidance to assist the industry in the carrying out of its reliability responsibilities. NERC segment membership balance resides with the parent committee (RSTC~~OC~~), allowing the subcommittee to focus on the expertise required to carry out its functions.

General Requirements

RS membership requirements are focused on *expertise* related to system control and control performance.

Expertise

The RS must have sufficient expertise within its ranks to fully understand and provide guidance on the Resource and Demand Balancing (BAL) and other applicable standards.

Commitment and Participation

RS members must be *committed* to their service on the subcommittee. Members must prepare for and actively *participate* in all subcommittee meetings in person or on conference calls. As needed, members must also write and review draft reports, serve on standard authorization request and standard drafting teams if selected, and bring issues to their Regional Entities, trade organizations, and utilities for further discussion and insight.

Replacing Members

The subcommittee may request a replacement for a member that fails to attend in person three consecutive regularly scheduled meetings without sending a proxy.

Voting Members

1. **Regional representatives.** Each Region should provide at least one member. The Regions are expected to select their representatives based on their expertise in the RS's subject matter.

2. **Interconnections and countries.** If the set of Regional representatives does not provide for at least one representative from each interconnection and two representatives from the U.S. and Canada, the subcommittee chair, working with the NERC staff, will ask for additional members from the Regional reliability councils or trade organizations as necessary to fulfill these requirements.
3. **Company representatives.** No single company may have multiple members representing a single Region.

Non-voting members — Guests and Observers

RS meetings are open to others who wish to attend as a guest of the subcommittee. The chair will provide guests and observers the opportunity to contribute to the subcommittee's discussions, provided the subcommittee's voting members have sufficient time to:

- Complete the debate of their motions, and
- Complete the meeting agenda.

Meeting Procedures

General

The RS follows the meeting procedures explained in the following documents:

- NERC Antitrust Compliance Guidelines,
- Participant Conduct Policy Applicable to NERC Operating Committee and its Subgroups, and
- *Robert's Rules of Order, Newly Revised*.

Scheduled Meetings

The RS routinely holds in-person standing meetings quarterly, usually in the last full week of January, April, July, and October. Meetings of the RS's working groups are held in conjunction with these meetings. Advance notices of these meetings are posted on the NERC website. Other open or confidential (see below) meetings of the RS and/or one or more of its working groups may be scheduled, either call in or in person, as the need arises.

Quorum

A quorum for conducting business is 50 percent of the RS members eligible to vote (either in person or calling in). If a quorum is not present then the subcommittee may not take any actions requiring a vote of the subcommittee. However, the chair may, with the consent of the members present, allow discussion of agenda items.

Majorities

The subcommittee uses a simple majority of the voting members present for all motions.

Minority Opinions and Personal Comments

The minutes of every RS meeting will include exhibits for minority opinions and personal comments, when provided. The chair shall communicate both the majority and any minority views when presenting subcommittee discussion results with the OC.

Confidential Sessions

The chair of the RS 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. To stay in the confidential session a signed "NERC Confidentiality Agreement for NERC Resources Subcommittee Members" is required.

Subgroups

The RS may form task forces and working groups as necessary, without RSTC~~OC~~ approval. The subcommittee must review the progress of its subgroups at least annually and decide to either continue or disband these groups as needed. Membership in the subgroups may consist of non-RS members to allow for expertise in desired areas.

Task forces are usually ad-hoc and are not expected to exist after completing their assignments; conversely, working groups may be ongoing.

Task force and working group chairs (or delegates) are expected to attend the regular subcommittee meetings to report on assignments and subgroup activity.

Current working groups are:

- Frequency Working Group
- Inadvertent Interchange Working Group
- Reserves Working Group

NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Security Guideline: BCSI Cloud Encryption (9) and Compliance Implementation Guidance: Cloud Solutions and Encrypting BCSI (10)

Marc Child, CIPC Chair
RSTC Meeting
June 10, 2020

RELIABILITY | RESILIENCE | SECURITY




Primer for Cloud Solutions and Encrypting BES Cyber System Information

- **Security Guideline**
  - Education on cloud services and encryption
  - Foundational for understanding compliance complexities
  - Primer for scenario- specific compliance implementation guidance document
  - Approved by Compliance Input Working Group
  - Endorsed by CIPC Executive Cmte

RSTC Action: Accept for posting as a Security Guideline

Security Guideline for Electricity Sector: Primer for Cloud Solutions and Encrypting BCSI

Introduction

This document is intended to provide supplemental information for *Compliance Implementation Guidance: Cloud Solutions and Encrypting BCSI*, guidance for using encryption as a means to protect and restrict access to BCSI in a cloud environment. This primer presents the basic concepts and addresses principles of information encryption during storage, transit, and use.

This document is not intended to establish new requirements under NERC's Reliability Standards, to modify the requirements in any existing Reliability Standards, nor provide an interpretation under Section 7 of the Standard Processes Manual. Additionally, there may be other ways to fulfill the obligations of the Requirements that are not expressed within this document.

The technical information that follows is intended to increase understanding of how encryption can provide additional protection for BES Cyber System Information, when used in conjunction with access controls and other CIP requirements.

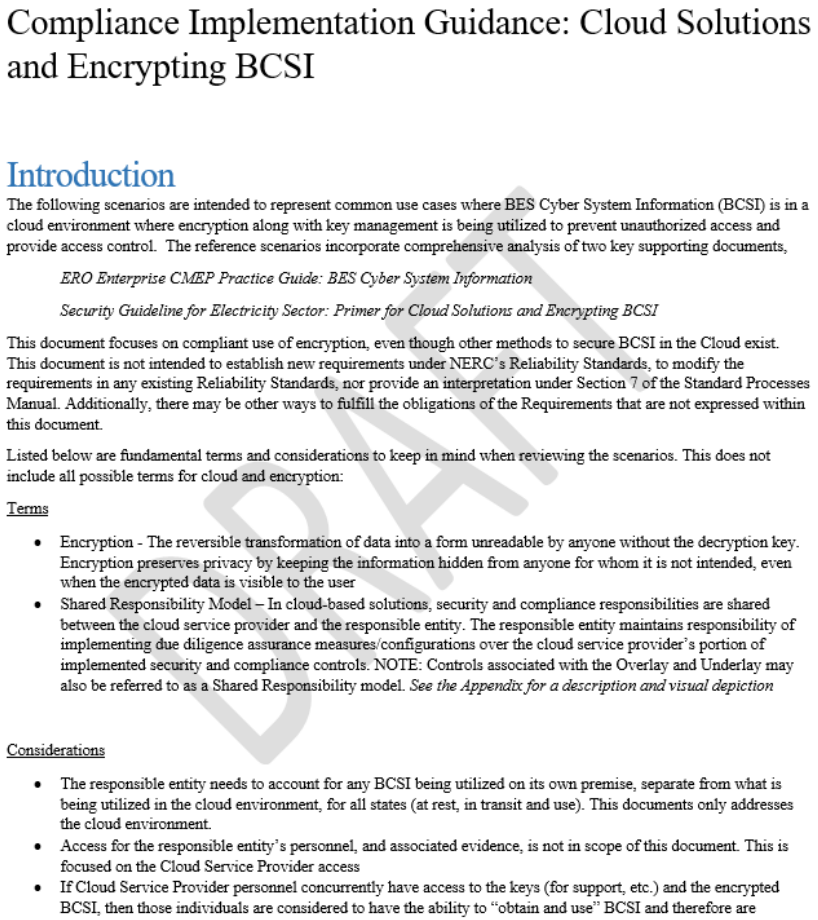
Concepts

Cloud Service Provider Services and Examples

Cloud Solutions and Encrypting BES Cyber System Information

- **Compliance Implementation Guidance**
  - CIP-004 and CIP-011 guidance
  - Expands on concepts presented in the primer, provides specific guidance on compliance evidence and controls
  - Leverages information gathered through partnerships with cloud providers
  - Exhaustive list of additional vendor-specific reference material
  - Approved by Compliance Input Working Group
  - Endorsed by CIPC Executive Cmte

RSTC Action: Approve for submission to ERO as candidate for compliance implementation guidance



Compliance Implementation Guidance: Cloud Solutions and Encrypting BCSI

Introduction

The following scenarios are intended to represent common use cases where BES Cyber System Information (BCSI) is in a cloud environment where encryption along with key management is being utilized to prevent unauthorized access and provide access control. The reference scenarios incorporate comprehensive analysis of two key supporting documents,

ERO Enterprise CMEP Practice Guide: BES Cyber System Information

Security Guideline for Electricity Sector: Primer for Cloud Solutions and Encrypting BCSI

This document focuses on compliant use of encryption, even though other methods to secure BCSI in the Cloud exist. This document is not intended to establish new requirements under NERC's Reliability Standards, to modify the requirements in any existing Reliability Standards, nor provide an interpretation under Section 7 of the Standard Processes Manual. Additionally, there may be other ways to fulfill the obligations of the Requirements that are not expressed within this document.

Listed below are fundamental terms and considerations to keep in mind when reviewing the scenarios. This does not include all possible terms for cloud and encryption:

Terms

- Encryption - The reversible transformation of data into a form unreadable by anyone without the decryption key. Encryption preserves privacy by keeping the information hidden from anyone for whom it is not intended, even when the encrypted data is visible to the user
- Shared Responsibility Model – In cloud-based solutions, security and compliance responsibilities are shared between the cloud service provider and the responsible entity. The responsible entity maintains responsibility of implementing due diligence assurance measures/configurations over the cloud service provider's portion of implemented security and compliance controls. NOTE: Controls associated with the Overlay and Underlay may also be referred to as a Shared Responsibility model. *See the Appendix for a description and visual depiction*

Considerations

- The responsible entity needs to account for any BCSI being utilized on its own premise, separate from what is being utilized in the cloud environment, for all states (at rest, in transit and use). This documents only addresses the cloud environment.
- Access for the responsible entity's personnel, and associated evidence, is not in scope of this document. This is focused on the Cloud Service Provider access
- If Cloud Service Provider personnel concurrently have access to the keys (for support, etc.) and the encrypted BCSI, then those individuals are considered to have the ability to "obtain and use" BCSI and therefore are

Questions and Answers

Security Guideline for Electricity Sector: Primer for Cloud Solutions and Encrypting BCSI

Introduction

This document is intended to provide supplemental information for *Compliance Implementation Guidance: Cloud Solutions and Encrypting BCSI,* guidance for using encryption as a means to protect and restrict access to BCSI in a cloud environment. This primer presents the basic concepts and addresses principles of information encryption during storage, transit, and use.

This document is not intended to establish new requirements under NERC's Reliability Standards, to modify the requirements in any existing Reliability Standards, nor provide an interpretation under Section 7 of the Standard Processes Manual. Additionally, there may be other ways to fulfill the obligations of the Requirements that are not expressed within this document.

The technical information that follows is intended to increase understanding of how encryption can provide additional protection for BES Cyber System Information, when used in conjunction with access controls and other CIP requirements.

Concepts

Cloud Service Provider Services and Examples

In Software as a Service (SaaS), a third-party vendor hosts applications and makes them available to customers over the Internet. Common examples include office productivity software, trouble ticket software, and online meeting tools.

Platform as a Service (PaaS) - A cloud computing model in which a third-party provider delivers hardware and software tools, usually those needed for application development. An example of this type of service would be a vendor-managed platform that hosts 3rd party applications during their development.

Infrastructure as a Service (IaaS) refers to the delivery of computer infrastructure on an outsourced basis to support the customer's operations. When a Cloud Service Provider provides remote hardware, storage, network components or data center space, the product is considered to be IaaS. A common example would be cloud-managed storage system used for backing up business records, off-premises.

Encryption

Encryption is the transformation of information into a form unreadable by anyone without the decryption key. Encryption preserves privacy by obfuscating the information from anyone for whom it is not intended. For example, one may encrypt a folder by passing it through an encryption program. Only those with access to the key will be able to reverse the process and read the original contents. Before encrypted information can be used again, the information must be decrypted to its original, readable state. This is accomplished by using a key and the appropriate encryption algorithm to reverse the process.

The strength of a given encryption process is determined by the complexity of the mathematical algorithm behind it. Like many technologies, encryption is constantly changing. To maintain a sufficient degree of information security, utilities should periodically review and keep pace with cyber industry encryption best practices. One such source for cyber industry encryption best-practice information includes (but is not limited to) the Federal Information Processing Standards (FIPS) 140-2.

Encryption Key Management

Two basic encryption key management models are aids for understanding the security of encrypted information. In the first model, when a Registered Entity has control of the encryption keys, access to BCSI by the cloud service provider is entirely controlled by the Registered Entity. In the second model, the encryption process and/or key management may be mutually managed between the Registered Entity and the cloud service provider.

In the first model, which we'll refer to as entity-managed encryption, the Registered Entity manages the encryption keys in a Hardware Security Module (HSM), on their own premises, via a 3rd party separate from the cloud service provider, or in a service within the cloud solution. An HSM is a special network computer/cluster performing cryptographic operations such as key management and encryption. An HSM cluster resides on the Registered Entity's network (on prem, with a 3rd party, or in the cloud) and is designed to scale and offer high speed encryption of your information. Entity-managed encryption is one way that a cloud service provider would not have access to the keys and therefore could not decrypt or read the information.

From a compliance perspective, entity-managed encryption has a major advantage in simplicity and security. The Registered Entity has complete control of the encryption keys and encrypted information. The cloud service provider cannot decrypt or read the information. Consequently, demonstrating access controls around BCSI protected with entity-managed encryption is not as complex as those required for a mutually-managed encryption management approach.

However, entity-managed encryption has some disadvantages. The cloud service provider may not be capable of providing support to a Registered Entity if encryption keys are lost. The cloud service provider does not have access to decrypt information for the purposes of

supporting storage or applications. Key material being transferred from the Responsible Entity or 3rd Party to the cloud could be at risk of corruption while in transit. Additionally, there is significant additional overhead burden on the Registered Entity to maintain the keys, or contract with a third party to do so.

In the second model, which we'll refer to as mutually-managed encryption, the Registered Entity may choose an implementation design in which the Cloud Service Provider has some or all control of the encryption process. This may be referred to as mutually-managed encryption, because the Cloud Service Provider and the Registered Entity would share access and management of the encryption keys and processes. The Cloud Service Provider may have access to some or all of the Registered Entity's information because the Cloud Service Provider has access to the keys.

Mutually-managed encryption generally offers more flexibility and support operationally. When a Cloud Service Provider manages part, or all, of the encryption, there is less overhead for the Registered Entity. Cloud Service Providers can manage security, support applications and infrastructure. Other services a Cloud Service Provider can offer under this model are resetting passwords, decrypting files, managing applications and other general support tasks, because the Cloud Service Provider manages all or part of the encryption process.

The disadvantage to the mutually-managed approach is that the key management may not be entirely controlled by the Responsible Entity, and therefore could enable the cloud service provider to decrypt files (including BCSI) and view them in the original, unencrypted form. This inherently can increase the risk of unauthorized disclosure or access. A Registered Entity would need to incorporate controls around mutually-managed key management and cloud service provider access into their CIP access management program.

Three States of Information

CIP-011 discusses handling and protections for BCSI data in storage, transit, and use. Data at rest is data which is not being actively processed or used, and exists in storage. As the name implies, data in transit is being moved from one system to another. Data in use refers to data that is being used or modified by an end-user.

Email serves as a good example of information at rest, and in transit. For example, BCSI data attached to or embodied in an email sent outside of a corporate network (or even within a corporate network that relies upon a cloud-based email service) is simultaneously in transit (from one user to another) and in storage (in email servers, and in backups for those servers).

Another SaaS example would be a document open for editing or review using an online office productivity application. The document is simultaneously in transit from the Cloud Service Provider to the end-users desktop, in storage and backup in the cloud, and in use by the authorized end-user during editing.

Backup data stored off-premises in the cloud can serve as an example for IaaS. When a Registered Entity encrypts backup data and transmits it to the Cloud Service Provider, the BCSI is encrypted in use (during backup operations) and in transit, as it is sent to the Cloud Service Provider. The BCSI will be encrypted at rest, as the Cloud Service Provider saves the information to disk.

Encrypted Information in transit

Encryption of information in transit does not receive a lot of attention in local networks, because the information never leaves the private company network. However, encryption of information is of primary concern in a cloud environment, because the information will traverse network elements that are not controlled by the Regulated Entity as the information travels between the end user and Cloud Service Provider.

Email services and online office productivity applications are good examples. Email and files destined for the cloud move over the public Internet as they move from the Registered Entity to the Cloud Service Provider. Unencrypted information moving over the public internet poses a higher risk of unauthorized exposure or access. On its journey to a Cloud Service Provider, the information must pass through intermediate service provider networks, none of whom will be party to the Registered Entity's agreement with the Cloud Service Provider. These intermediate service providers have little or no obligation to a Registered Entity or the Cloud Service Provider to protect the transit of the information.

BCSI information travelling across the public Internet must be encrypted in transit to ensure it is not usable by unauthorized individuals. The majority of Cloud Service Providers, email services, and online office applications use encryption to protect information in transit. Transport Layer Security is most commonly used to secure communications between customers and services like e-mail, online shopping, online banking, and other communications over the Internet. Anytime the prefix, "https://" is in front of a web address, Transport Layer Security encryption is being used. Even though Transport Layer Security encryption is commonly used to secure information in transit, encryption should be verified and not assumed.

Encrypted Information at Rest (Storage)

Encryption protects information, including BCSI information, at rest whether in the cloud or other environment. Information will be at rest in SaaS, IaaS, on-premise environments, and when on portable devices (e.g. laptops, thumb drives). When information at rest is stored in an encrypted state, it will be extremely difficult or impossible to access without the encryption keys. If encrypted information is stolen, or inadvertently released, decrypting it to its original state will be extremely difficult.

Encrypted Information in Use

BCSI in the cloud environment may not have a “use” state; it is up to each Registered Entity to define “use” and whether that state exists in their specific implementation. Where a “use” state may exist in a cloud environment, encryption of BCSI while being used may not be practical or even an option. Instead, access controls (such as username and password or two-factor authentication) may be used as a security measure to prevent any BCSI in a “use” state from being accessed by unauthorized personnel.

Cloud Geography

For reliability and resiliency reasons, data in the cloud may be distributed and stored over a wide geographical area. It is not uncommon for cloud data to traverse regional locations or international borders, although agreements limiting storage to certain geographical regions or nations are commonplace. Geographical location in the cloud can be complicated because data may be redistributed or moved to a new location as a cost-saving or reliability measure. In effect, the controlling location of cloud data can change, if the agreements between Cloud Service Provider and Registered Entity do not prohibit it.

A disadvantage to this geographically distributed storage model is that if a breach were to occur, while the data is in a foreign country, the Registered Entity may not have the same legal recourse to enforce the terms of the agreement as they would have in the US.

However, utilizing a distributed model for data storage, where the customer’s data is split up across multiple locations, can be an effective security control, especially if encryption is also applied. This would prevent a physical attacker from obtaining access to all of the data, and if also encrypted, prevent their ability to read and use the data. A common example of this methodology is Blockchain. Additionally, as a physical security feature, cloud storage does not

require physical labeling of Registered Entity data on a specific server location in a data center, which prevents data center personnel from recognizing data owners.

The shared nature of cloud storage means that the Cloud Service Provider may be responsible for managing some or all of the system. Consequently, the Cloud Service Provider may have access to BCSI stored within the system and in transit during communication with the Registered Entity. If the information is not encrypted during transit and while at rest, security management of a cloud service can require more complex access controls, contract language and non-disclosure agreements.

For specific cloud service and key management examples, see *Compliance Implementation Guidance: Cloud Solutions and Encrypting BCSI*

Compliance Implementation Guidance: Cloud Solutions and Encrypting BCSI

Introduction

The following scenarios are intended to represent common use cases where BES Cyber System Information (BCSI) is in a cloud environment where encryption along with key management is being utilized to prevent unauthorized access and provide access control. The reference scenarios incorporate comprehensive analysis of two key supporting documents,

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Listed below are fundamental terms and considerations to keep in mind when reviewing the scenarios. This does not include all possible terms for cloud and encryption:

Terms

- Encryption - The reversible transformation of data into a form unreadable by anyone without the decryption key. Encryption preserves privacy by keeping the information hidden from anyone for whom it is not intended, even when the encrypted data is visible to the user
- Shared Responsibility Model – In cloud-based solutions, security and compliance responsibilities are shared between the cloud service provider and the responsible entity. The responsible entity maintains responsibility of implementing due diligence assurance measures/configurations over the cloud service provider's portion of implemented security and compliance controls. NOTE: Controls associated with the Overlay and Underlay may also be referred to as a Shared Responsibility model. *See the Appendix for a description and visual depiction*

Considerations

- The responsible entity needs to account for any BCSI being utilized on its own premise, separate from what is being utilized in the cloud environment, for all states (at rest, in transit and use). This documents only addresses the cloud environment.
- Access for the responsible entity's personnel, and associated evidence, is not in scope of this document. This is focused on the Cloud Service Provider access
- If Cloud Service Provider personnel concurrently have access to the keys (for support, etc.) and the encrypted BCSI, then those individuals are considered to have the ability to "obtain and use" BCSI and therefore are considered having electronic access to BCSI. However, unauthorized individuals who obtain encrypted BCSI, but have no ability to use it within a meaningful timeframe, are not considered to have access. [1]
- If Cloud Service Provider personnel have physical access to the location where the Responsible Entity's encrypted BCSI is stored, they are deemed to have physical access per CIP-004-6 R4.1.3 only if those same personnel also have the encryption key(s). Personnel with physical access, but no access to encrypted keys, are deemed to not have physical access to BCSI. [1]
- The terms 'Storage' and 'At Rest' are synonymous
- Terms listed in the scenarios may not correspond as exact matches with all cloud solutions
- Responsible Entity has identified the applicable data states (transit, storage, use) for their cloud implementation
- Responsible Entity has provisions in place ensuring current encryption best practices are maintained (e.g. Federal Information Protection Standards (FIPS) 140-2)
- Most of the requirements referenced below do not apply to Medium Impact BES Cyber Systems without ERC

Cloud-Specific Scenarios

Below are some typical scenarios using specific vendors for implementations of cloud technology. Options exist in structuring arrangements between the Responsible Entity and the Cloud Service Provider. These scenarios present possible options for providing CIP requirements assurance evidence measures within a cloud environment. Note: The specific products, security solutions and associated nomenclature may change over time. Additionally, mention of specific vendors and their services is not considered an endorsement of any kind. These scenarios are simply intended to illustrate security concepts and the compliance impacts associated with each.

1. Microsoft 365

The following scenarios are intended to reflect what evidence may be used to demonstrate compliance, depending on how the Registered Entity chose to implement the solution.

a. Cloud Service Provider manages keys and stores keys

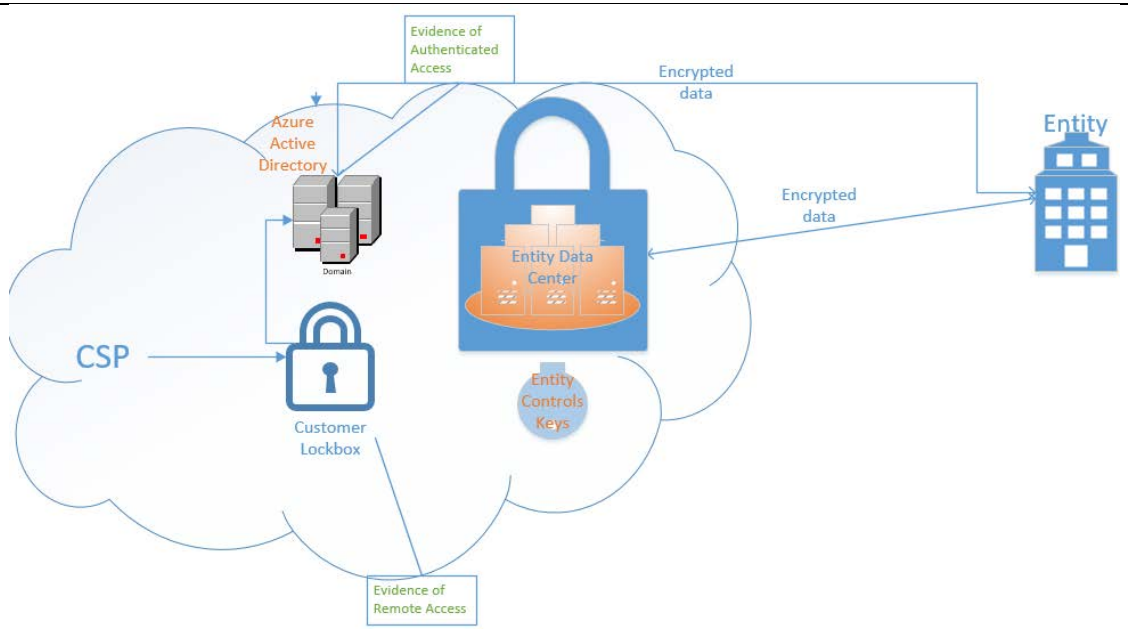
Compliance Impact	Evidence Examples	Applicable Requirements
Cloud Service Provider has access to BCSI	All of the following would be required: • Documentation of the security controls implemented within Cloud Service Provider's environment that satisfy the applicable requirements,	CIP-004-6 R4.1.3 R4.4

[1] See the 4/26/2019 ERO Enterprise CMEP Practice Guide: BES Cyber System Information

	• Independent audit validating the implementation of the documented security controls and effectiveness of those controls, • Contractual language binding the cloud service provider to maintain the applicable security controls and notify the responsible entity of material changes or failings of those security controls within defined time frames. • Documented authorization process (CIP-004-6 R4.1.3), • List of Cloud Service Provider individuals with access (CIP-004-6 R4.1.3), • Logging and monitoring of BCSI storage location user activity, if possible/available (to confirm accuracy of the list of Cloud Service Provider individuals) (CIP-004-6 R4.1.3 and R4.4) • 15-month access review for Cloud Service Provider personnel (CIP-004-6 R4.4), • Revocation within 24 hours of notification for terminations (CIP-004-6 R5.3), and • Evidence of the application of encryption (CIP-011-2 R1.2)	R5.3 CIP-011-2 R1.2

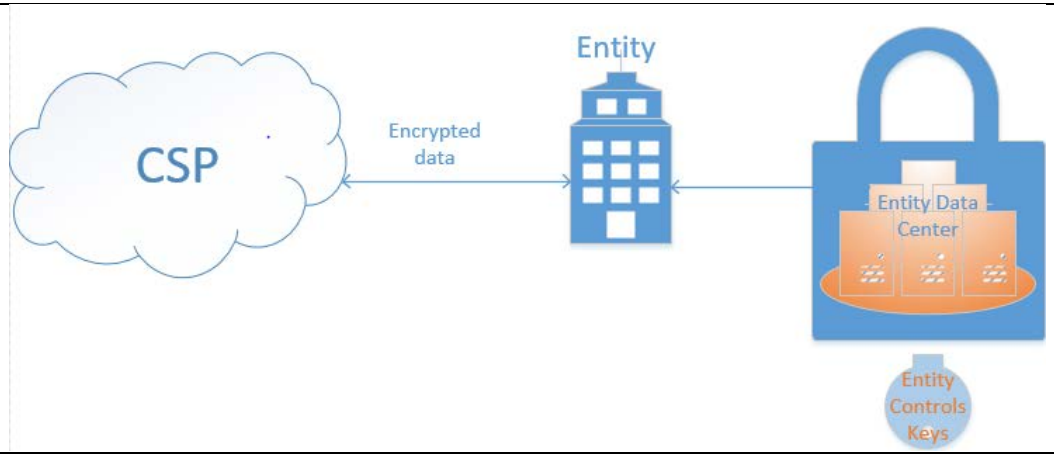
b. Responsible Entity provides root keys (Customer Key) and manages and stores those keys in Azure vault (Cloud Service Provider) and Cloud Service Provider access is managed by Customer Lockbox

Compliance Impact	Evidence Examples	Applicable Requirements
Cloud Service Provider has access to key store (and therefore could have electronic access to BCSI)	All of the following would be required: • Documentation of the security controls implemented within Cloud Service Provider's environment or solution that satisfy the applicable requirements, • Independent audit validating the implementation of the documented security controls and effectiveness of those controls, • Contractual language binding the cloud service provider to maintain the applicable security controls and notify the responsible entity of material changes or failings of those security controls within defined time frames. • List of authorized personnel from Azure Active Directory (CIP-004-6 R4.1.3 and 4.4), • Evidence of implementation of Customer Lockbox to manage support access requests and authorization (CIP-004-6 R4.1.3), • Logs showing each Customer Lockbox access / usage (including start and end date/time for each use) and associated authorization (CIP-004-6 R4.4 and 5.3), • Evidence of the application of encryption at rest and in transit (CIP-011-2 R1.2),	CIP-004-6 R4.1.3 R4.4 R5.3 CIP-011-2 R1.2



c. Bring Your Own Key (BYOK) and the responsible entity stores them onsite or outside of the cloud environment (Responsible entity privately creates/manages keys and does not use Azure to store keys)

Compliance Impact	Evidence Examples	Applicable Requirements
Cloud Service Provider personnel do not have access to BCSI	Responsible Entity must demonstrate that BCSI is encrypted and not accessible by Cloud Service Provider personnel (CIP-011-2 R1.2). This may include any of the following: • Evidence that keys are being managed on premise or by a 3rd party, such as report or screenshot from the key management tool. • Agreement or purchase order with Cloud Service Provider showing what services have been implemented, including detail of how the services have been implemented • Evidence to show encryption of information determined by the Responsible Entity such as a firewall policy or configuration output report	CIP-011-2 R1.2

2. ServiceNow Ticketing System

The following scenarios are intended to reflect what evidence may be used to demonstrate compliance, depending on how the Registered Entity chose to implement the solution.

a. Cloud Service Provider manages keys and stores keys

Compliance Impact	Evidence Examples	Applicable Requirements
Cloud Service Provider has access to BCSI	All of the following would be required: • Documentation of the security controls implemented within Cloud Service Provider's environment or solution that satisfy the applicable requirements, • Independent audit validating the implementation of the documented security controls and effectiveness of those controls, • Contractual language binding the cloud service provider to maintain the applicable security controls and notify the responsible entity of material changes or failings of those security controls within defined time frames. • Documented authorization process (CIP-004-6 R4.1.3), • List of Cloud Service Provider individuals with access (CIP-004-6 R4.1.3), • Logging and monitoring of BCSI storage location user activity, if possible/available (to confirm accuracy of the list of Cloud Service Provider individuals) (CIP-004-6 R4.1.3 and R4.4) • 15-month access review for Cloud Service Provider personnel (CIP-004-6 R4.4), • Revocation within 24 hours of notification for terminations (CIP-004-6 R5.3), and • Evidence of the application of encryption at rest and in transit (CIP-011-2 R1.2)	CIP-004-6 R4.1.3 R4.4 R5.3 CIP-011-2 R1.2

b. Responsible Entity manages key and stores in vault provided by the Cloud Service Provider; the Cloud Service Provider does not inherently have access to key store nor the Responsible Entity's data

Compliance Impact	Evidence Examples	Applicable Requirements
Cloud Service Provider could be provisioned access to key store and/or data (both would be necessary to access BCSI)	All of the following would be required: • Documentation of the security controls implemented within Cloud Service Provider's environment that satisfy the applicable requirements, • Independent audit validating the implementation of the documented security controls and effectiveness of those controls, • Contractual language binding the cloud service provider to maintain the applicable security controls and notify the responsible entity of material changes or failings of those security controls within defined time frames. • Documented authorization process (CIP-004-6 R4.1.3), • List of Cloud Service Provider individuals with access to BCSI, if any (CIP-004-6 R4.1.3), • Logging and monitoring of BCSI storage location user activity, if possible/available (to confirm accuracy of the list of Cloud Service Provider individuals) (CIP-004-6 R4.1.3 and R4.4) • 15-month access review for Cloud Service Provider personnel (CIP-004-6 R4.4), • Revocation within 24 hours of notification, for terminations (CIP-004-6 R5.3), and • Evidence of the application of encryption at rest and in transit (CIP-011-2 R1.2)	CIP-004-6 R4.1.3 R4.4 R5.3 CIP-011-2 R1.2

c. BYOK and Client Storage (the responsible entity stores the keys on premise or with a 3rd party outside of the cloud environment)

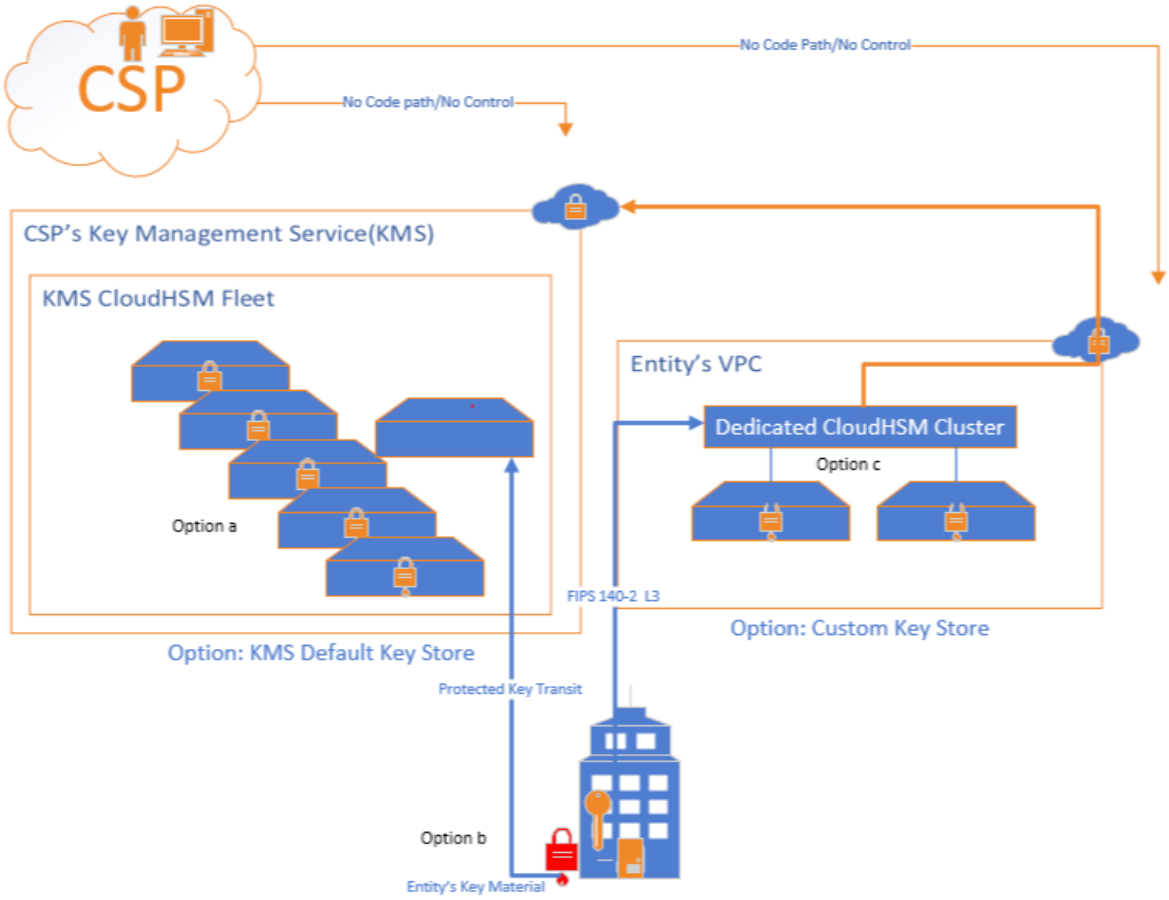
Compliance Impact	Evidence Examples	Applicable Requirements
Cloud Service Provider personnel do not have access to BCSI	Responsible Entity must demonstrate that BCSI is encrypted and not accessible by Cloud Service Provider personnel (CIP-011-2 R1.2). This may include any of the following: • Evidence that keys are being managed on premise or by a 3rd party, such as report or screenshot from the key management tool. • Agreement or purchase order with Cloud Service Provider showing what services have been implemented, including detail of how the services have been implemented • Evidence to show encryption of information determined by the Responsible Entity such as a firewall policy or configuration output report	CIP-011-2 R1.2

3. **Amazon Web Services** - AWS Key Management System (KMS) is integrated with AWS services to encrypt data at rest and in transit. Customer master keys (CMK) are owned and managed by the Customer (Responsible Entity) within their account. Most AWS services that are

integrated with KMS support customer-managed CMKs which allows the customer to manage the keys themselves. Other services may only support AWS-managed CMKs — these CMKs are still unique to the customer's AWS account and provide the same audit visibility to log files. Data protection controls are also provided by other services depending on the functional operations of the actual implementation. The scenarios listed here illustrate three arrangement options for a Responsible Entity to manage keys in AWS KMS and store data that the Responsible Entity determines to contain BCSI in cloud storage service:

a. Responsible Entity manages key and stores in AWS KMS (Cloud Service Provider) - Multi-tenant Hardware Security Module (HSM)
b. Responsible Entity brings own keys and manages key in AWS KMS -- Multi-tenant HSM
c. Responsible Entity manages key and stores in AWS KMS (Cloud Service Provider), Dedicated HSM

In all three scenarios, AWS personnel do not have an ability to access the keys.



Compliance Impact	Evidence Examples	Applicable Requirements

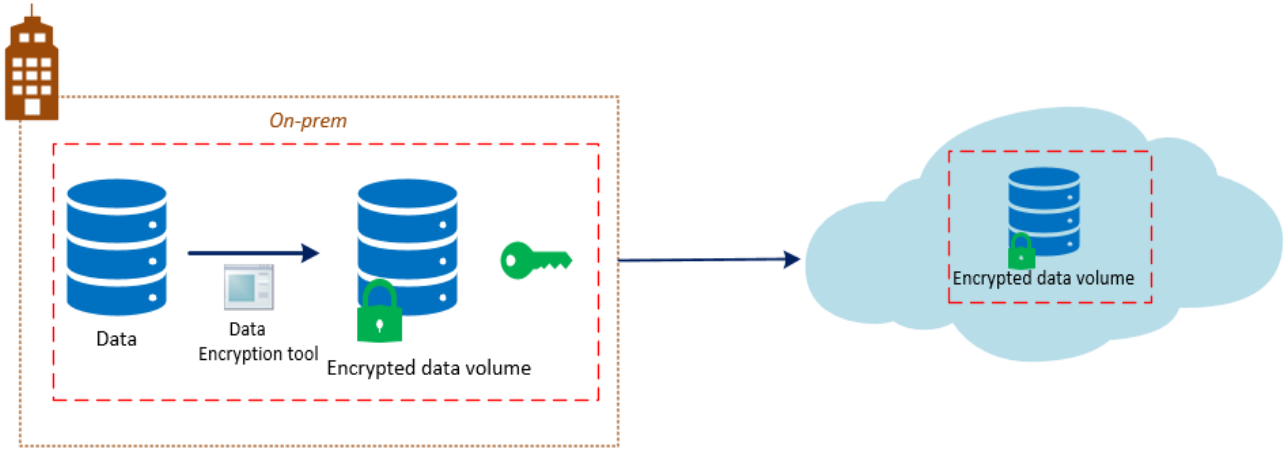
Cloud Service Provider does not have access to key material or BCSI and no 'code path' access exists As part of Shared Responsibility, the Responsible Entity manages access to the BCSI	Responsible Entity must demonstrate that BCSI is encrypted and not accessible by Cloud Service Provider personnel (CIP-011-2 R1.2). This may include any of the following: • Evidence that keys are being managed on premise or by a 3rd party, such as report or screenshot from the key management tool. • Agreement or purchase order with Cloud Service Provider showing what services have been implemented, including detail of how the services have been implemented • Evidence to show encryption of information determined by the Responsible Entity such as a firewall policy or configuration output report	CIP-011-2 R1.2

4. CommVault Storage/Backup in the cloud

The following scenarios are intended to reflect what evidence may be used to demonstrate compliance, depending on how the Registered Entity chose to implement the solution.

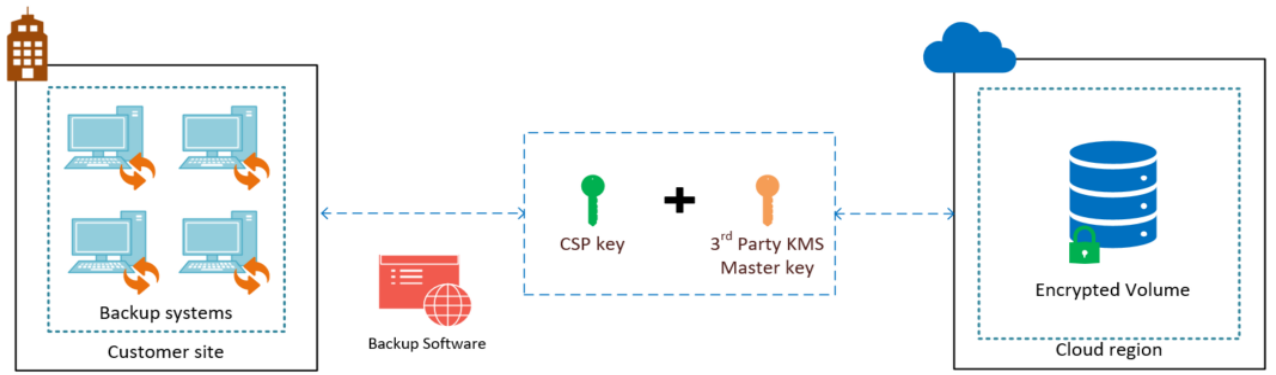
a. Encrypted BCSI repository storage (backup) and BYOK – Registered Entity encrypts BCSI repositories on-prem using their own keys and stores these repositories in the cloud.

Compliance Impact	Evidence Examples	Applicable Requirements
Cloud Service Provider does not have access to BCSI	Responsible Entity must demonstrate that BCSI is encrypted and not accessible by Cloud Service Provider personnel (CIP-011-2 R1.2). This may include any of the following: • Evidence that keys are being managed on premise or by a 3rd party, such as report or screenshot from the key management tool. • Agreement or purchase order with Cloud Service Provider showing what services have been implemented, including detail of how the services have been implemented • Evidence to show encryption of information determined by the Responsible Entity such as a firewall policy or configuration output report	CIP-011-2 R1.2



b. Registered Entity encrypts BCSI on-prem – Using a master key provided by third party KMS in combination with the key provided by Cloud Service Provider to encrypt the BCSI. Once encrypted, BCSI is stored in the Cloud Service Provider environment. Therefore, only the Responsible Entity personnel have access to BCSI.

Compliance Impact	Evidence Examples	Applicable Requirements
Neither the Cloud Service Provider nor the third party KMS have access to BCSI	Responsible Entity must demonstrate that BCSI is encrypted and not accessible by Cloud Service Provider personnel (CIP-011-2 R1.2). This may include any of the following: • Evidence that keys are being managed on premise or by a 3rd party, such as report or screenshot from the key management tool. • Agreement or purchase order with Cloud Service Provider showing what services have been implemented, including detail of how the services have been implemented • Evidence to show encryption of information determined by the Responsible Entity such as a firewall policy or configuration output report • Evidence to show BCSI repository is stored only in encrypted form in the cloud and keys Cannot be used by Cloud Service Provider where the repository is stored	CIP-011-2 R1.2



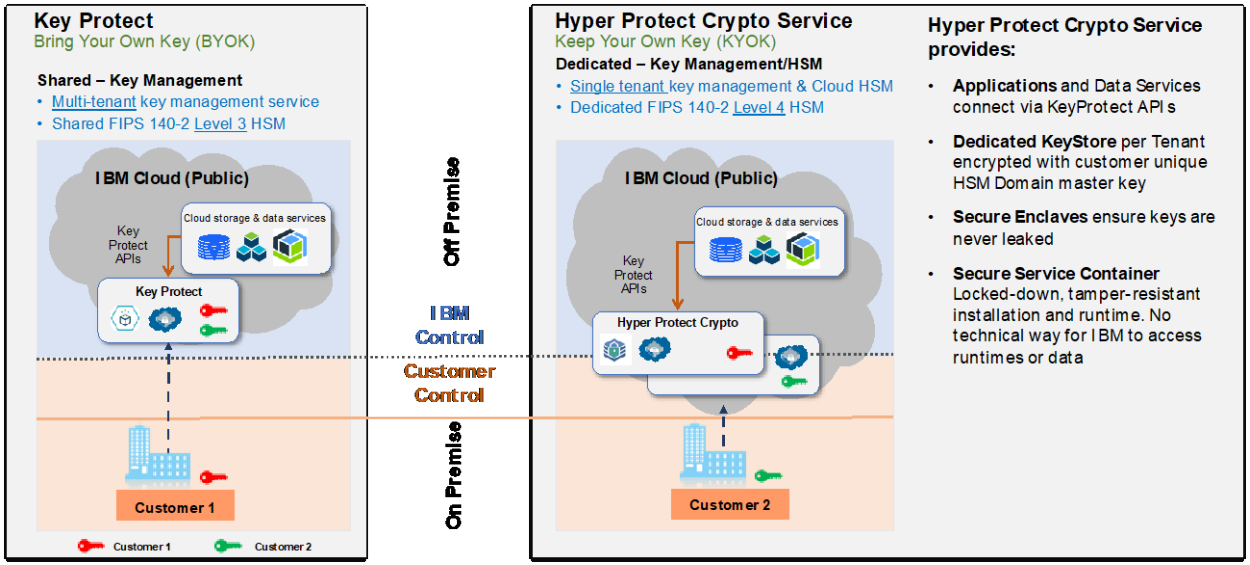
5. IBM Cloud

IBM Cloud has 2 options for Key Management Systems:

- IBM Cloud Key Protect – Multi-tenant key management system that enables Bring Your Own Key (BYOK) on a FIPS 140-2 level 3, multi-tenant hardware security module (HSM) device
- Hyper Protect Crypto Services (HPCS) – Single-tenant FIPS 140-2 level 4 HSM key management system that enables registered entities to Keep Your Own Key (KYOK)

Both Key Protect and HPCS are integrated with a number of IBM Cloud Services to enable encryption for data at rest and in transit with BYOK/KYOK.

KYOK further allows for complete isolation and control of stored data. In a KYOK scenario the customer takes ownership of the HSM through a Key Ceremony and becomes the custodian of the HSM that is dedicated to the HPCS instance the customer provisions. Once a customer takes ownership, the CSP has no access to the HSM and therefore no access to the data. Only the registered entity can access/decrypt.



The following scenarios are intended to reflect what evidence may be used to demonstrate compliance, depending on how the Registered Entity chose to implement the solution.

a. Key Protect/Bring Your Own Key (BYOK) – Registered Entity creates and manages keys outside of the cloud environment; keys are stored in the Cloud Service Provider's multi-tenant HSM where some CSP personnel have access.

Compliance Impact	Evidence Examples	Applicable Requirements
Cloud Service Provider could have access to BCSI (Electronic Only)	All of the following would be required: • Documentation of the security controls implemented within Cloud Service Provider's environment that satisfy the applicable requirements, • Independent audit validating the implementation of the documented security controls and effectiveness of those controls, • Contractual language binding the cloud service provider to maintain the applicable security controls and notify the responsible entity of material changes or failings of those security controls within defined time frames. • Evidence that keys are being managed on premise or by a 3rd party, such as report or screenshot from the key management tool • Documented authorization process (CIP-004-6 R4.1.3), • List of Cloud Service Provider individuals with access (CIP-004-6 R4.1.3), • Logging and monitoring of BCSI storage location user activity, if possible/available (to confirm accuracy of the list of Cloud Service Provider individuals) (CIP-004-6 R4.1.3 and R4.4) • 15-month access review for Cloud Service Provider personnel (CIP-004-6 R4.4), • Revocation within 24 hours of notification for terminations (CIP-004-6 R5.3),	CIP-004-6 R4.1.3 R4.4 R5.3 CIP-011-2 R1.2

	• Evidence of the application of encryption (CIP-011-2 R1.2),	

b. HPCS/Keep Your Own Key (KYOK) - Registered Entity creates and manages keys outside of the cloud environment; keys are stored in the Cloud Service Provider's single tenant HSM; the Cloud Service Provider does not have access to the HSM, once the key ceremony has occurred.

Compliance Impact	Evidence Examples	Applicable Requirements
Cloud Service Provider has no access to BCSI (KYOK Scenario)	Responsible Entity must demonstrate that BCSI is encrypted and not accessible by Cloud Service Provider personnel. • Key Ceremony registry (to demonstrate Master Key creation and sharding) • Logging and alerting of unauthorized access to the HSM • Evidence that keys, including KYOK master, are being managed on premise or by a 3rd party, such as report or screenshot from the key management tool. • Agreement or purchase order with Cloud Service Provider showing what services have been implemented, including detail of how the services have been implemented • Evidence to show BCSI repository is stored only in encrypted form in the cloud • Evidence to show that data repository is encrypted	CIP-011-2 R1.2

References

Microsoft:

https://docs.microsoft.com/en-us/microsoft-365/compliance/service-encryption-with-customer-key-faq

https://docs.microsoft.com/en-us/microsoft-365/compliance/encryption

https://docs.microsoft.com/en-us/azure/security/fundamentals/physical-security

https://docs.microsoft.com/en-us/microsoft-365/compliance/customer-lockbox-requests

https://docs.microsoft.com/en-us/microsoft-365/compliance/office-365-service-encryption?view=o365-worldwide

Amazon Web Service

https://aws.amazon.com/compliance/services-in-scope/

https://marketplace.fedramp.gov/#/products?sort=productName

https://aws.amazon.com/blogs/security/are-kms-custom-key-stores-right-for-you/

https://d1.awsstatic.com/whitepapers/aws-support-compliance-nerc-cip-standards.pdf?did=wp_card&trk=wp_card

IBM:

https://www.ibm.com/cloud

https://www.ibm.com/cloud/hyper-protect-crypto

https://www.ibm.com/cloud/hyper-protect-dbaas

https://www.ibm.com/cloud/hyper-protect-virtual-servers

https://www.ibm.com/cloud/compliance

https://www.ibm.com/security/cryptocards/hsms

FIPS/NIST Encryption Standards:

https://nvlpubs.nist.gov/nistpubs/FIPS/NIST.FIPS.140-2.pdf

NERC CIPC/RSTC Security Guidelines:

Risks related to Cloud Service Providers: https://www.nerc.com/comm/CIPC_Security_Guidelines_DL/Security_Guideline-Cloud_Computing.pdf

Security Guideline for Electricity Sector: Primer for Cloud Solutions and Encrypting BCSI

Appendix

The following is a list of recommended controls that the Registered Entity should ensure are implemented for their cloud scenario. (More detail about these controls and their associated certifications can be found here)

- Implements cryptographic mechanisms to protect the confidentiality and integrity of information stored during transport and at rest,

- Prevent unauthorized disclosure of information and detect changes to information,

- Protects the authenticity of communication sessions,

- Employs the principle of least privilege, allowing only authorized accesses for users which are necessary to accomplish assigned tasks,

- Monitors information system accounts for atypical use and reports atypical usage of information system accounts,

- Authorizes access to the information system,

- Employs automated mechanisms to support the management of information system accounts,

- Terminates user and shared/group account credentials when members leave the group,

- Reviews accounts annually,

- Monitors information system accounts for atypical use and reports atypical usage of information system accounts

Underlay and Overlay Model

- Underlay (security of the cloud) – Infrastructure (and associated controls) implemented by the Cloud Service Provider that runs all services offered by the Cloud Service Provider. This infrastructure could be composed of the hardware, software, networking, and facilities that run Cloud services offered. The security and controls associated with this infrastructure is likely verified through certifications or other internal/external activities such as penetration testing. (see picture below)
- Overlay (security in the cloud) – The portion of the cloud service/product that sits on top of the underlay and has been developed for the customer's use. In some cloud environments, the Cloud Service Provider may have the ability to access data in portions of the Overlay. Whereas in other cloud environments the Cloud Service Provider has no ability to access data in the Overlay.(see picture below)

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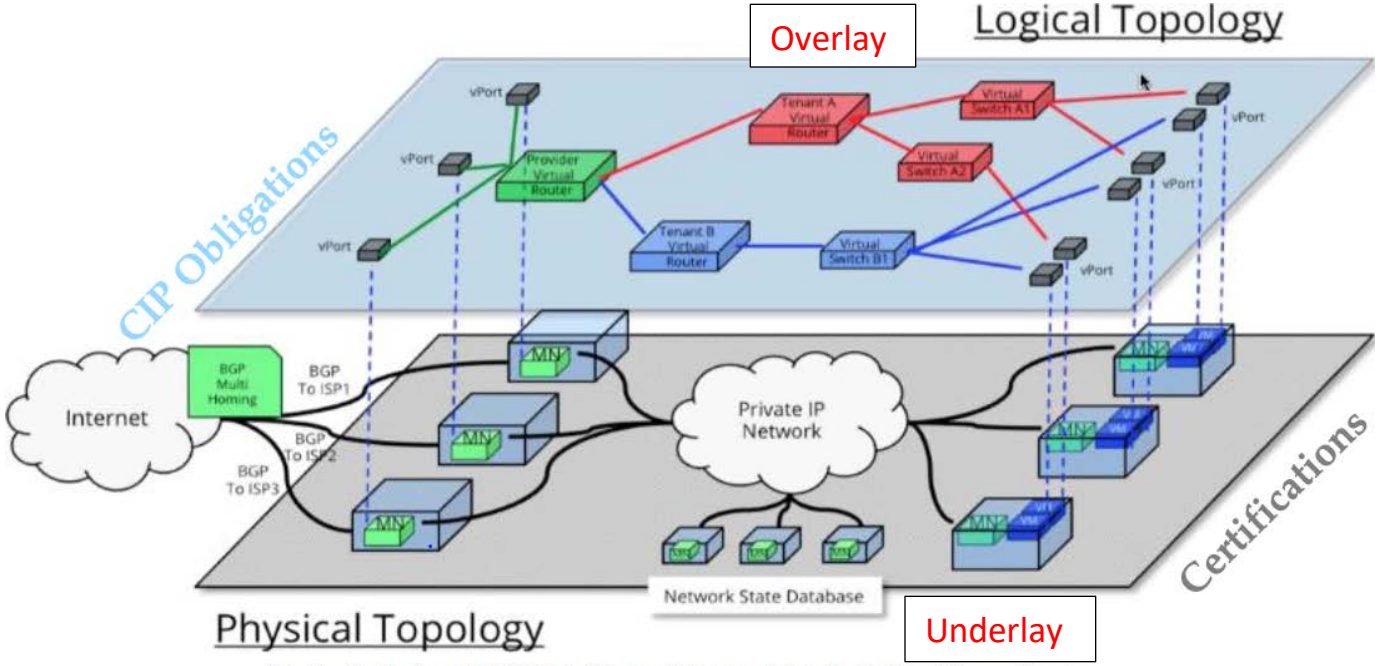


http://bradhedlund.com/2012/10/06/mind-blowing-l2-l4-network-virtualization-by-midokura-midonet/

NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Agenda Item 11
RSTC Meeting
June 10, 2020

Electromagnetic Pulse Task Force Update

Chair Aaron Shaw, AEP; Vice-Chair: Rey Ramos, Southern Company

Reliability and Technical Security Committee Meeting
June 10-11, 2020

RELIABILITY | RESILIENCE | SECURITY




Background

- Electromagnetic Pulse (EMP) events may pose a risk to the reliability of the bulk power system (BPS)
- In March of 2019, NERC's Board of Trustees (Board) established an EMP Task Force (EMPTF) to identify potential methods for promoting resilience to the EMP threat
- In November 2019, the EMPTF report to the Board included recommendations for NERC to address that would help mitigate the risk to the BPS from an EMP event

EMPTF Recommendations for NERC

- Policy recommendations
  - Establishing BPS performance expectations for a pre-defined EMP event
  - Providing industry and public education on EMPs
  - Coordination with other Critical Infrastructure sectors on EMP matters
- Research recommendations
  - Monitoring current research and report on national initiatives
  - Identification of gaps in research that need to be closed to enable movement toward EMP performance requirements and/or guidelines
  - Develop industry specifications for equipment

EMPTF Recommendations for NERC

- Vulnerability Assessment Recommendations
  - Regular collaboration and coordination with Federal Government to procure and effectively disseminate information needed by industry
  - Development of EMP vulnerability assessment methods and guidelines
  - Development of guidelines to identify and prioritize hardening of critical assets
- Mitigation Recommendations
  - Develop Guidance on EMP Mitigation
- Response and Recovery Recommendations
  - Establish national EMP notification system
  - Coordinated response planning
  - Enhance operating procedures
  - Incorporate EMP events into industry exercises and training
  - Strategies for supporting recovery

Next Steps

"The EMP Task Force should be maintained in order to monitor, inform, and facilitate any further actions stemming from the recommendations listed in this report. Due to the magnitude of this threat and the numerous items detailed in this report, membership on the EMP Task Force should be expanded, and the NERC technical committees should commence most, if not all, of the initiatives for research, vulnerability assessment, mitigation guidelines, and the items listed for response and recovery. In addition, NERC will continue to work with the DOE and EPRI to clearly understand EMPs, their effective mitigations, and the proper ways to engage industry."

Next Steps

- Scope document: to focus the EMPTF's efforts on recommendations from the Board report
  - EMP Task Force priorities
    - Establish performance expectations
    - Provide guidance on asset hardening
    - Provide guidance to industry for supporting systems and equipment for recovery
- **Membership:** confirm current members will continue to participate and seek additional volunteers
- **Logistics:** schedule meetings and develop work plan documentation
- **NERC Coordinator:** Tom Hofstetter

Questions and Answers

NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Agenda Item 12
RSTC Meeting
June 10, 2020

Reliability and Security Technical Committee Transition Plan

RELIABILITY | RESILIENCE | SECURITY




Goals of RSTC Transition

- Set up the RSTC to deliver on the goals outlined in its charter
- Maintain continuity in all ongoing, high-value work across the subgroups
- Capture best practices and synergies through the integration of processes across the “legacy” committees
- Clearly document roles and responsibilities and processes for RSTC to improve clarity going forward and speed transition
- Developing a model to support subgroups that is more collaborative and bottoms-up while maintaining alignment to overall NERC strategy

Elements of RSTC Transition

- **Strategy:** Align the strategic objectives and focus areas of RSTC to NERC's overall strategic plan
- **Governance:** Clearly establish the oversight responsibilities of the RSTC
- **Organization:** Rationalize subgroup structure to align with RSTC objectives
- **Processes:** Align processes across subgroups to ensure consistency at the RSTC level
- **Objectives/Metrics:** Define consistent metrics / KPIs for RSTC and its subgroups to ensure successful achievement of strategy

Strategy: Aligning RSTC with RISC and NERC long-term strategy

		RISC Report Risk Priorities			
		Grid Transformation	**Security Risks**	**Extreme Natural Events**	**Critical Infrastructure Interdependencies**
ERO Value Drivers	Drive activities which support Risk Priorities	• Monitor RSTC and sub-group activity to ensure it addresses across all four Risk Priorities effectively			
	Foundational Reliability Activities	• Continue situational awareness, events analysis and personnel certification; complete recurring assessments and manage standing databases (including items from NERC Rules of Procedure)			
	Organizing and deploying top talent	• Ensure that the expertise of RSTC members, sub-group members, and NERC Staff is being deployed on highest-value work based on expected risk mitigation benefits			
	Developing and delivering innovative and risk-based programs and tools	• Use a risk-based view to determine how sub-group activities can be focused on solving the highest-risk issues facing the utility industry through innovative solutions based on cross-functional expertise			
	Collaborating effectively with industry and other stakeholders	• Promote effective information-sharing and problem-solving between industry stakeholders, ERO, and other industry groups to identify risk-mitigation methods and efficiency improvements			
	Maintaining independence and objectivity	• Act as an independent oversight function for sub-groups – ensuring that the highest quality deliverables are being created without bias toward any specific technology, sector, or entity			

Governance: Aligning on Definitions and Execution based on RSTC Charter

NERC Board of Trustees

Reliability and Security Technical Committee (RSTC)

Subcommittees

- Permanent with delegated RSTC functions

Working Groups

- Continuing (1-2 years) functions, but reviewed annually
- Can be promoted to subcommittee

Task Forces

- Assigned a specific work task
- Typically < 1 year duration

Actions

- Approve
- Accept
- Remand
- Endorse

Deliverables

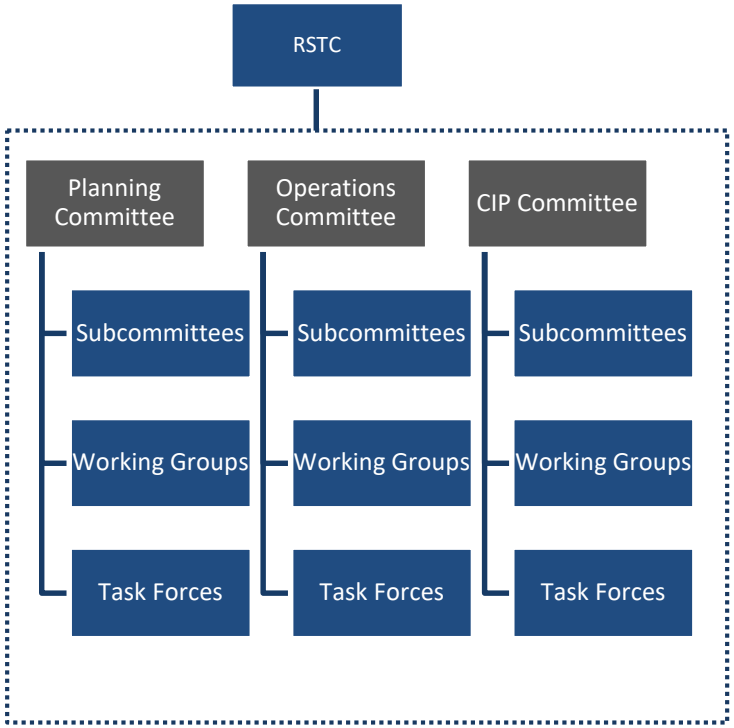
- Reliability Guidelines
- Section 1600 Requests
- Policy Outreach
- White Papers
- Reference Docs / Technical Reports
- Implementation Guidance
- Other as defined by ERO

Organization: Transitioning to Integrated Structure

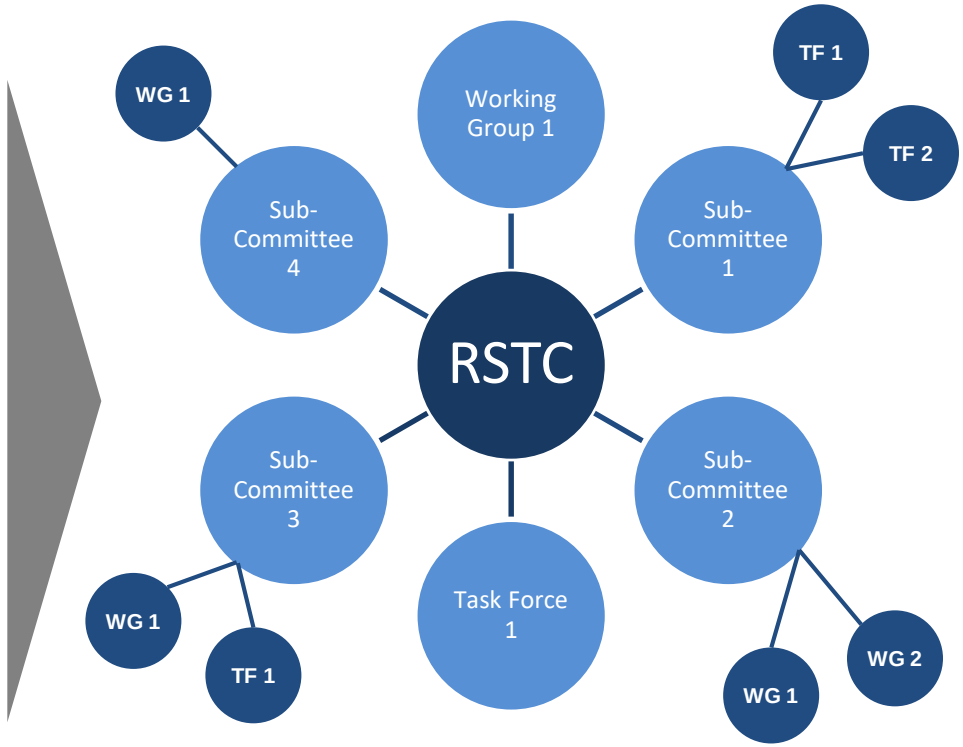
RSTC Organizational Alignment

- Confirm "classification" (SC, WG, TF)
- Confirm scope is still applicable based on RSTC objectives
- Review membership and identify areas for cross-functional collaboration
- Define reporting cadence for subgroup to RSTC (i.e., annual, ad hoc, etc.)
- Determine level of RSTC engagement (i.e., sponsor assignment) that is appropriate

Today



Future-State



Processes: Aligning Existing Processes and Defining RSTC Work Management Approach

Existing Processes ✓

- Member/Officer Selection
- Executive Committee
- Voting procedures
- Meeting Minutes
- Reliability Guidelines
- Mandatory Data Requests
- Policy Outreach
- White Papers
- Reference Documents and Technical Reports
- Implementation Guidance

Processes to be Refined

- Workplan development and review (Content / format)
- Subgroup-level work management
- Deliverable scoping
- Deliverable development and report-out
- Subgroup creation and review
- Coordination with RISC

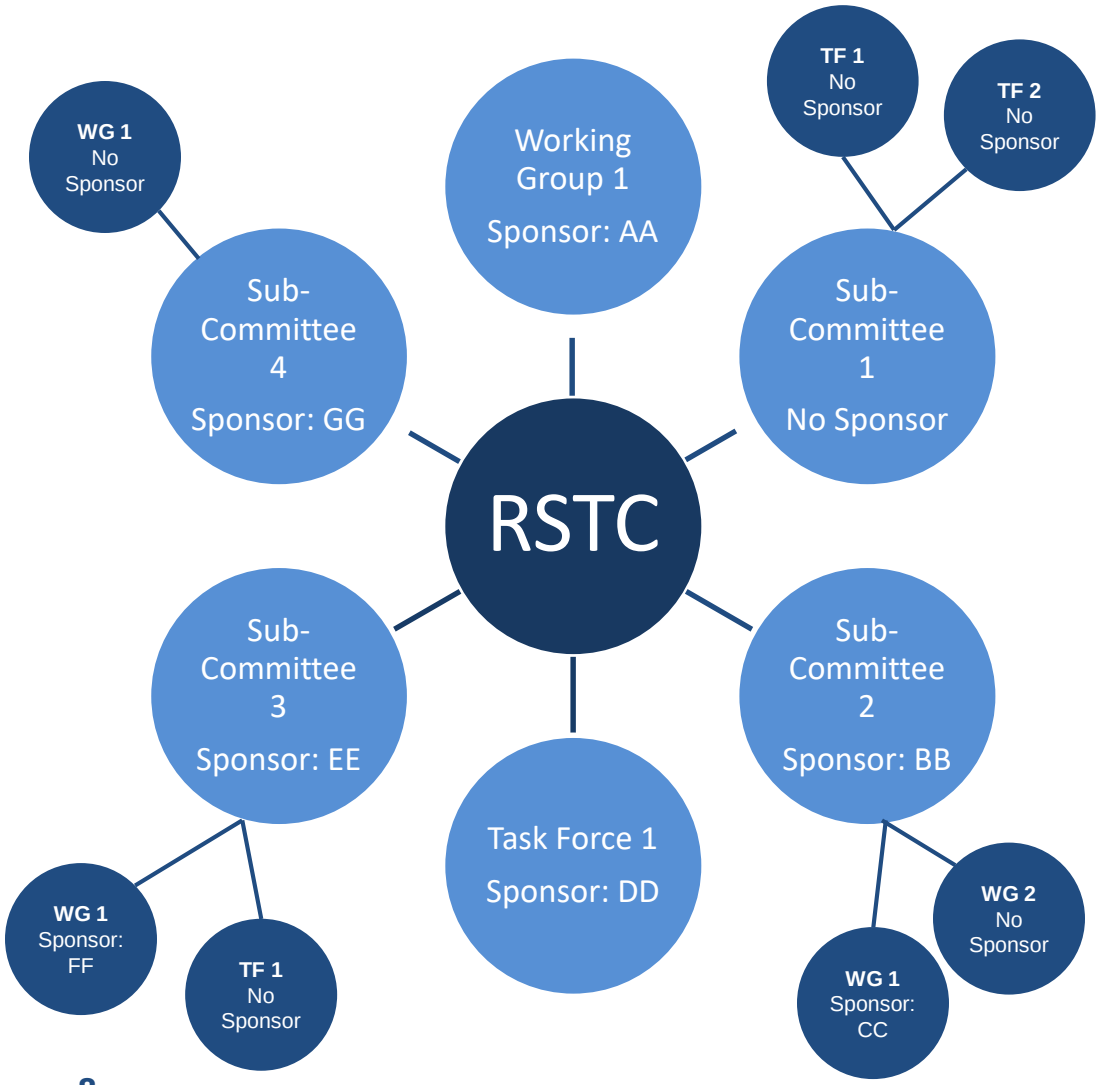
New Processes for Creation

- RSTC Agenda-setting
- Regular status reporting cadence and content (subgroups and industry forums)
- Roles & Responsibilities for RSTC Members, Subgroup leadership, and NERC Coordinators

Defined in RSTC Charter

Transition Team Discussion
Some Drafts in Appendix

Processes: Outlining Subgroup Sponsorship Approach



- Following organizational review, RSTC Sponsor(s) assigned to subgroups where sponsorship is deemed necessary
- Sponsor assignments made with regards to diversity of expertise and sector / technology representation
- Sponsors assignments will be refreshed annually by EC following review of subgroups
- **Sponsors Responsibilities:**
  - Attend at least 2 subgroup meetings per year
  - Schedule quarterly calls with subgroup leadership and NERC Coordinator to review status reports and prepare for RSTC meetings
  - Notify EC if any topics arise which should be on RSTC agenda
  - Advocate and support discussion for Subgroup-Related Topics that arise during RSTC meetings

Who is a Sponsor?

A Sponsor provides leadership through others to achieve extraordinary results. The Sponsor:

- Delegates accountability to a team leader(s)
- Supports the team leader(s) in gaining and sustaining appropriate skills and talent as members
- Assures a team leader(s) are accountable for delivering the expected results
- Empowers the team(s) to have reach and impact across organizational boundaries

What a Sponsor is NOT

Sponsors are *NOT*:

- A Chair of the working groups, dictating or telling working groups what to do
- Working group members
- Attempting to push their own personal agendas
- Representing the specific organization from which we come (NERC, Regions)

Processes: Defining Roles & Responsibilities

Draft Roles & Responsibilities Table

	Subgroup Chair	NERC Coordinator	Subgroup Members	RSTC Sponsor (if applicable)	RSTC EC	RSTC Members
Subgroup Workplans	Responsible	Support	Support	Provides Direction		Approve
RSTC Summary Workplan Items	Responsible			Provides Direction		Approve
Quarterly Status Reports	Support	Responsible	Review	Review	Review	Review
Deliverable Scoping	Propose	Support	Support			Approve
Deliverable Drafting	Oversee	Support	Responsible	Review		Review
Deliverable Approval	Present for Approval					Approve / Accept / Remand / Endorse
Manage Subgroup Workplan Execution	Responsible	Support				
RSTC Agenda Creation				Consulted	Responsible	
Annual Review of Subgroups	Consulted				Responsible	Approve
Creation of New Subgroups					Responsible	Approve
Development of RSTC Scorecard					Responsible	Approve

Objectives / Metrics: Define Consistent Metrics for RSTC and Subgroups

ERO Reliability Indicators

- Fewer, Less Severe Events
- Compliance Violations
- Misoperations Rate
- Cold-Weather- / Gas Supply-Forced Outages
- AC Transmission Forced Outages
- Unauthorized Physical / Electronic Access
- DCS events greater than MSSC
- Interconnection Frequency Response

RSTC Overall Objective:

Leverage effective industry collaboration to identify risk-based, cost-effective ways to improve / mitigate potential declines in reliability measures

Draft 2020-2022 Metrics

RSTC

- Effective Collaboration:
  - Regular (quarterly) report-outs from industry forums and subgroups on topics relevant to key reliability indicators
  - Identification of 2-3 opportunities per year for cross-functional (security, planning, ops) collaboration on a reliability issue
- Risk-Based Decision Making:
  - Review subgroup activities and reduce any activity not focused on high-priority risk items
  - Document and provide highest-priority risk items based on industry feedback to NERC BoT

Sub-Groups

- Effective collaboration:
  - Ensure representative sector, technology, and function input into all activities
  - Timely completion of deliverables and analyses
- Risk-Based Decision Making
  - Include discussion of cost/benefit for any risk-mitigating measures proposed to RSTC

Transition Approach: Expansion of Executive Committee for Transition Planning

RSTC Transition Structure

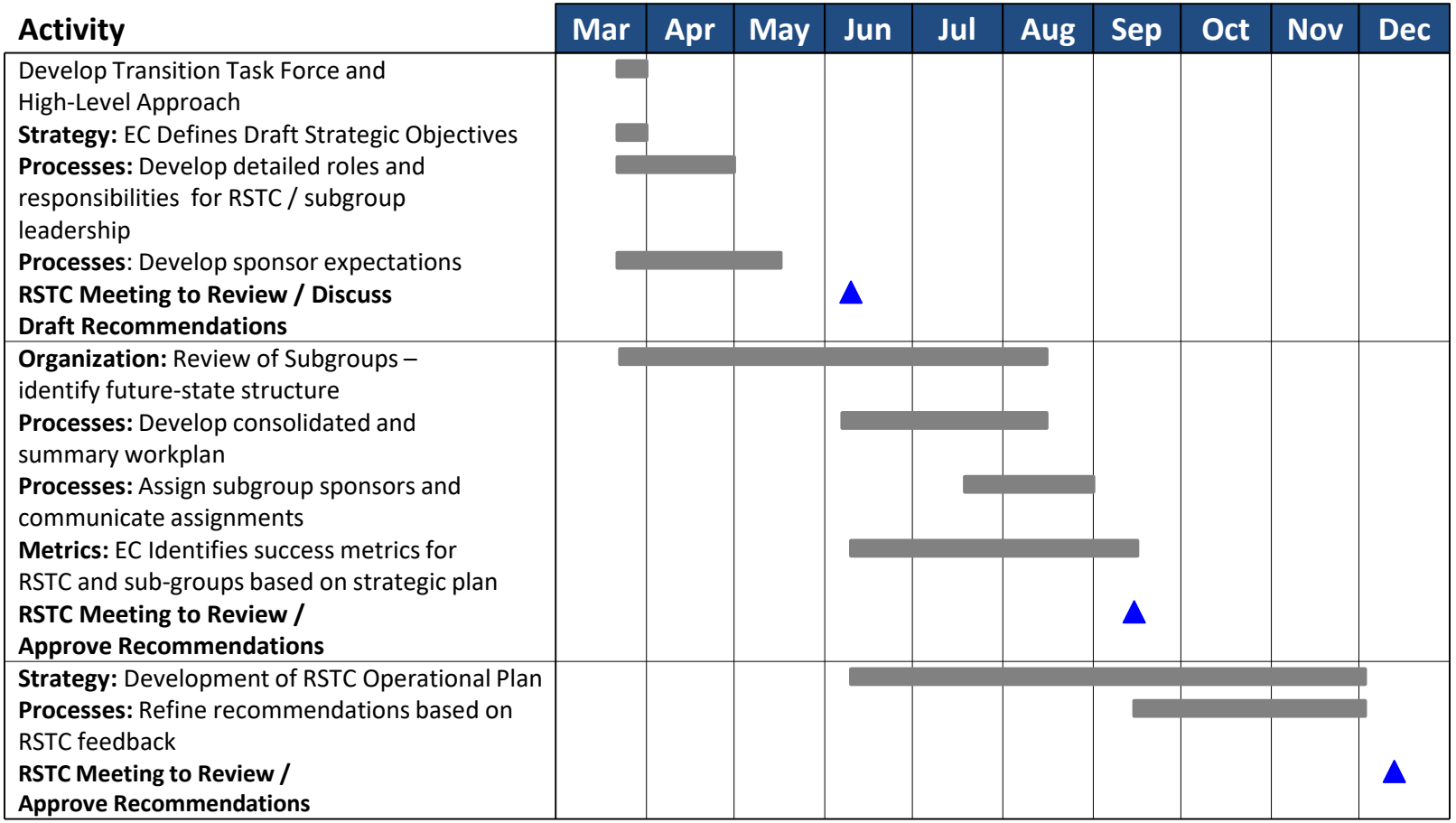
- Executive Committee expanded for Transition Planning to incorporate broader perspectives from RSTC
- Team is responsible for preparing transition recommendations for presentation to the RSTC

RSTC Executive Committee
Chair: Greg Ford
Co-Chair: Dave Zwergel
Robert Reinmuller
Marc Child
Christine Hasha
Rich Hydzik

RSTC Transition Team Members
Kayla Messamore
Ben Engelby
Greg Stone
David Jacobson

NERC Leadership & Support
Mark Lauby
Stephen Crutchfield
Tina Buzzard
Mark Olson
Tom Hofstetter

Transition Approach: High-Level Timeline for RSTC Transition



Questions and Answers

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Appendix:
Draft Deliverables

RELIABILITY | RESILIENCE | SECURITY




Strategy: Operational Plan

DRAFT

High-Level Table of Contents for Operational Plan

- Discussion of ERO priorities, mission, vision, values, etc.
- RSTC's role in achieving ERO priorities as well as any other guiding principles
- Strategic Priorities of RSTC (key activities next three years)
- Ongoing / Annual RSTC Activities
- Placeholder for Scorecard / Metrics

Organization: Subgroup Review

DRAFT

Template for Organization Review

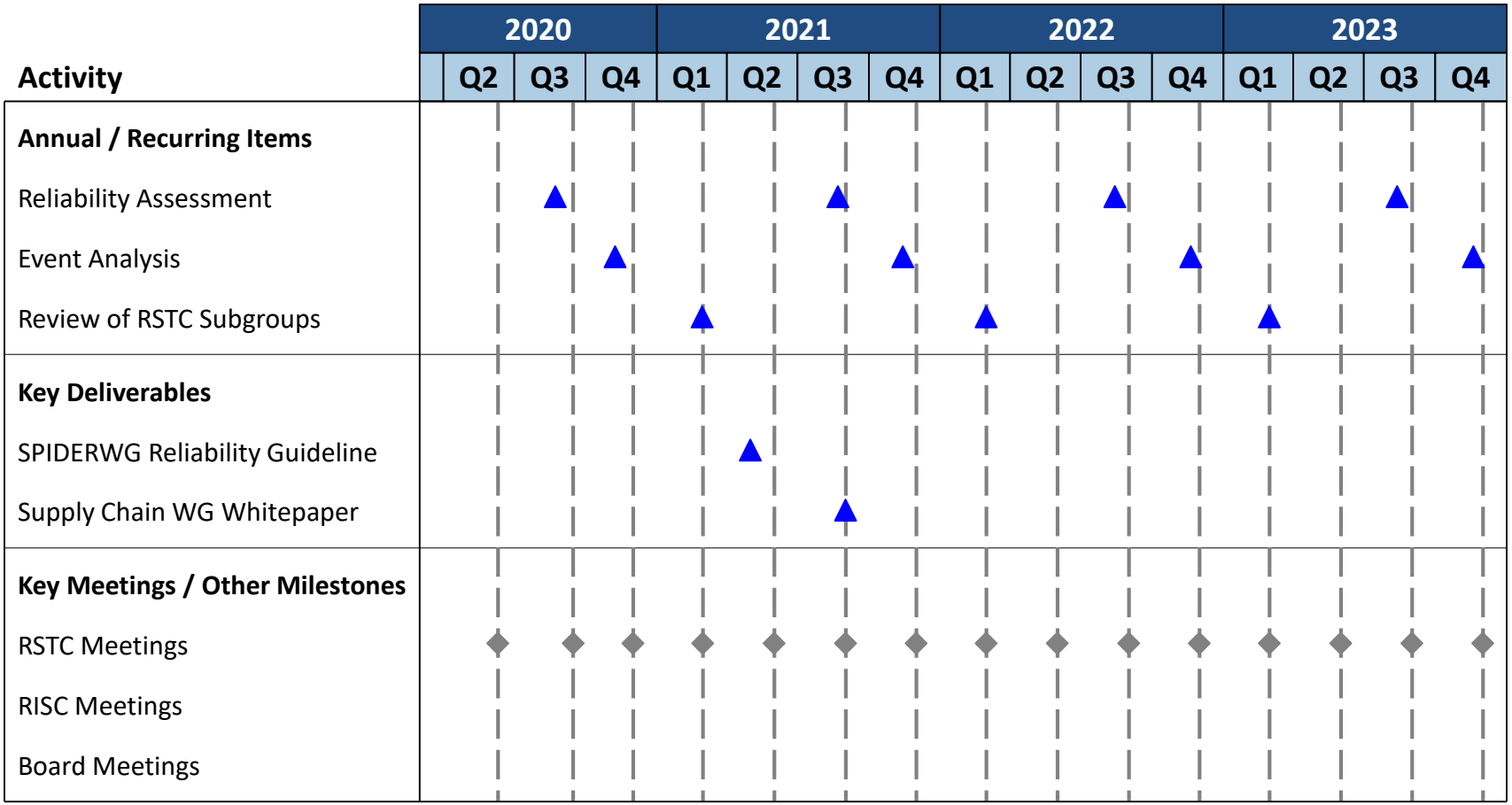
"Legacy" Committee	Subgroup	Review of Charter / Workplan	Keep / Consolidate / Disband	New Classification (SC, WG, TF)	Expected "Sunset Date"	Recommended Membership / Scope Changes	Proposed Reporting Cadence / Level of Engagement
PC	Load Modeling Task Force						
PC	SPIDERWG						
PC	Reliability Assessment Sub-Committee						
OC	EMS Working Group						
OC	IRPTF						
CIPC	Supply Chain Working Group						
Etc.							

This will be pre-populated with the review which has already been conducted by NERC staff and reviewed / validated by Transition Task Force

Processes: Workplan Creation

DRAFT

Template for RSTC Summary Workplan– ILLUSTRATIVE



Tied to detailed subgroup workplans

DRAFT

Template for RSTC Status Reports – ILLUSTRATIVE

Provided / created for all subgroups, forums, and other NERC committees on a quarterly basis

[Group Name]

[Chair & Vice Chair] | [Date]

Purpose: Based on group charter

Recent Activity

- TBD
- TBD

Items for RSTC Approval/Discussion:

- Item, Link, Desired Approval Date

Upcoming Activity

- TBD
- TBD

Workplan Status *(6 month look-ahead)*

Milestone	Status	Comments
Milestone 1	🟢	
Milestone 2	🟡	

🟢 On Track
🟡 Schedule at risk
🔴 Milestone delayed

Bolded items are included on the RSTC Summary Workplan

Include comments for all "yellow" and "red" items

Processes: Responsibilities of Working Group Chair

DRAFT

The Working Group Chair:

- Provides leadership, and encourages each group member to be a leader
- Ensures group is creative and innovative, maintain functionality and focus on goals
- Facilitates conversations so each group member has the opportunity to contribute
- Achieves desired results for each meeting, with recommendations and path forward
- Ensures Charter guidelines are met, with expected and timely results
- Assures decisions reflect the group's point of view rather than opinions of Chair
- Is accountable for and endorses the outcomes of the group
- Maintains powerful and timely communications with other working group Chairs, Sponsors, and others who benefit from the work of their group
- Seeks input from group for proper preparation of agenda and meeting materials

Objectives / Metrics: Scorecard

DRAFT

RSTC Scorecard – ILLUSTRATIVE

Objective	Metric	Target	Status
Regular report-outs from subgroups and forums			
Promote cross-functional collaborations			
Ensure representative collaboration across subgroups			
Timely completion of deliverables			
Focus on highest-value activity			
Prove report-outs to Board based on RSTC input			
Include discussion of cost-benefit for proposed risk mitigation measures			

On Track Target at risk Target will not be met

NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Agenda Item 13
RSTC Meeting
June 10, 2020

Technical Committees Update

David Zwergel, RSTC Vice Chair
RSTC Meeting
June 10, 2020

RELIABILITY | RESILIENCE | SECURITY




Critical Infrastructure Protection Committee

- Actions since March 3-4, 2020 Meeting
  - Reviewed and submitted comments about the draft State of Reliability Report
  - Endorsed proposed implementation guidance, “Cloud Solutions and Encrypting BES Cyber System Information”
  - Endorsed proposed security guideline, “Primer for Cloud Solutions and Encrypting BES Cyber System Information”

Operating Committee

- Actions since March 3-4, 2020 Meeting
  - Approved the *Technical Report: BPS-Connected Inverter-Based Resource Modeling and Studies* submitted by the IRPTF
  - Approved the *Compliance Implementation Guidance: Data Exchange Infrastructure and Testing Requirements.* This was submitted to the ERO for endorsement

Planning Committee

- PC Actions since March 3-4, 2020 Meeting
  - Endorsed the 2020 Summer Reliability Assessment

- PCEC Actions since March 3-4, 2020 Meeting
  - Approved March 2020 PC Meeting Minutes
  - Approved the *Technical Report: BPS-Connected Inverter-Based Resource Modeling and Studies* submitted by the IRPTF
  - Reviewed and approved the PC Work Plan with updates from subcommittees, task forces, and working groups

Planning Committee

- PCEC considered two white papers but did not have unanimous agreement for approval (required by PC Charter)
  - White Paper *Review of TPL-001 Standard for Incorporation of DER* (SPIDERWG)
  - White Paper *Implementation of NERC Standard MOD-025-2* (SAMS/PPMVTF)
  - Group leaders were provided feedback for consideration as they develop these for future RSTC action

- On May 15, Planning Committee subcommittees, working groups, and task forces provided work plan updates documenting completions and prioritized work for balance of 2020 and early 2021. This information has been provided to RSTC Leadership

Questions and Answers

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Atlanta, GA 30326
404-446-9646 office | 609-651-9455 cell
stephen.crutchfield@nerc.net

North American Transmission FORUM

Community *Confidentiality* *Candor* *Commitment*

To: NERC Reliability and Security Technical Committee (RSTC)

From: Roman Carter (Director, Peer Reviews, Assistance, Training, and Knowledge Management)

Date: May 26, 2020

Subject: NATF Report to the NERC RSTC—June 2020

Attachments: NATF External Newsletter—April 2020

The NATF interfaces with the industry as well as regulatory agencies on key reliability and resiliency topics to promote collaboration, alignment, and continuous improvement, while reducing duplication of effort. Some examples are highlighted below and in the attached April NATF external newsletter, which is also available on our public website: www.natf.net/news/newsletters.

Response to COVID-19 Challenges

The NATF's response and approach are highlighted in the attached newsletter. As the situation evolves, we will continue to work to help mitigate challenges. A current example is our collaborative work with NERC and others on an epidemic/pandemic response plan resource.

The COVID-19 pandemic has prompted organizations to review existing or create epidemic/pandemic-response plans. To assist in these efforts, the NATF, NERC, U.S. DOE, and FERC jointly developed a resource to help utilities create, update, or formalize their plans. The "Epidemic/Pandemic Response Plan Resource" focuses on planning/preparedness, response, and recovery activities for a severe epidemic/pandemic. See more on our COVID-19 page.

Pilot Collaborations with Regions

The ERO and NATF have committed to working together under the April 2019 memorandum of understanding to advance our mutual objectives, leverage different strengths, and minimize duplication of effort. This involves a range of topics such as conducting joint workshops on various topics and NATF development of implementation guidance for selected standards. As noted in the newsletter, it also involves deeper collaboration on higher-tier risks, such as facility ratings and entity supply chain risk mitigation.

Supply Chain Cyber Security

The newsletter highlights some NATF activities in this area, and one update since the publishing of the newsletter is the posting of the "Energy Sector Supply Chain Risk Questionnaire" for industry use. This questionnaire, developed by a group of more than 20 U.S. energy companies, is designed to provide utilities with a set of supplier- and equipment-focused questions to obtain better information on a supplier's security posture. The questionnaire works in conjunction with the "NATF Criteria," and together these complementary tools can help our industry drive convergence on information that is needed from suppliers.

The questionnaire denotes where questions directly align or will provide key supporting information regarding a supplier's adherence to each of the NATF Criteria, and the information obtained through other questions will

provide additional insight. Further, in light of the May 1 Executive Order, both the questionnaire and the NATF Criteria gather information regarding a supplier's sourcing, activities, and staffing in other countries.

Please see our Supply Chain Cyber Security Industry Coordination site for more information.

Transmission Resilience Maturity Model (TRMM)

The NATF has been working with the Electric Power Research Institute, the Department of Energy, and Pacific Northwest National Lab to develop a transmission resilience maturity model as a tool that a transmission organization can use to objectively evaluate and benchmark its currently established transmission resilience policies, programs, and investments, in order to target and prioritize enhancements where needed. A draft of the model has been created and was piloted by NATF member companies in early 2020.

Improvements to the model based upon lessons learned from the pilots are being incorporated into a TRMM version 1.0, along with a suite of supporting documentation, planned for public release in third quarter of this year.

The NATF envisions incorporating the TRMM as an additional service offering for its members including metrics, resiliency-centric assessment modules, and targeted assistance on lagging domains.

North American Transmission FORUM

Community *Confidentiality* *Candor* *Commitment*

North American Transmission Forum External Newsletter

April 2020

Coronavirus Planning and Response

At the NATF, our top priority is the health and safety of our staff and members. To help inform our decisions during this coronavirus pandemic, we have been working closely with our members and tracking updates from the Centers for Disease Control and Prevention (CDC) and state and local authorities. In response, the NATF has taken specific actions to limit potential exposure for staff and members and has initiated specific coordination and information-sharing mechanisms to assist member planning and response.

Member Support

NATF member companies are evaluating and implementing their pandemic plans and taking actions to limit potential exposure for their employees. The NATF is facilitating information-exchange mechanisms to assist the membership in this regard, such as the following:

- Weekly webinars hosted by our System Operations Practices Group
  - Sharing of information, approaches, and practices
  - Topics have included response plans, operator staffing (safety/health, shift rotation, location, etc.), family support, and coordination of field personnel
- Page on our member site
  - Discussion boards
  - Member practices
  - Resource links

External Coordination

The NATF has been in close contact with industry partners during this time to discuss potential coordination, reduce duplication of effort, and deconflict pandemic-response webinars.

Office and Travel

The NATF office is closed until further notice, and all staff are working from home. NATF travel is cancelled through at least May 1.

Meeting and Events

We have postponed our near-term events (listed below). We will work with members and our industry partners to reschedule when appropriate.

- NATF-EPRI-NERC Transmission Resiliency Summit
- Peer Review (April)
- Risk Controls Compliance and Security Workshops

Open Distribution

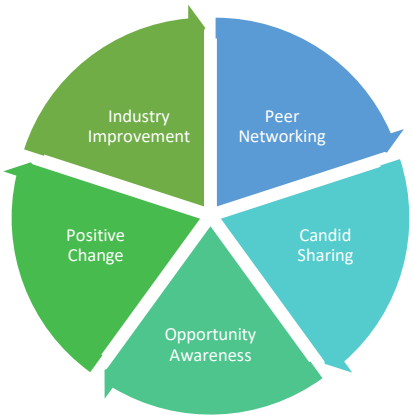
- Peer Review (May)
- System Protection Practices Group Workshop
- Metrics Face-to-Face Meeting
- NATF-NERC-EPRI Planning and Modeling Workshop

Our regularly scheduled webinars will continue as planned. The NATF membership is adept at exchanging information and sharing lessons learned during virtual meetings, and these interactions will be even more valuable as we deal with current circumstances.

The NATF will continue to support members and the industry in whatever capacity possible.

NATF's 100th Peer Review

In February, the NATF marked an organizational milestone by conducted its 100th peer review. The NATF Peer Review Program has evolved significantly since the first peer review in October 2008, and members provide consistently positive feedback on the program and the insights shared.



NATF peer reviews are diagnostic assessments of member companies with the goal of elevating programs towards excellence. NATF review teams, comprising the members' own subject-matter experts, conduct periodic, confidential evaluations of NATF member organizations (hosts). Each review consists of advance planning and preparation, two to four days of onsite interviews and observations, followed by a report to the host member's executives and staff. Noteworthy practices are brought back to NATF practice groups for prospective emulation, and specific improvement recommendations are provided to the host—often totaling 75 or more specific recommendations across four to nine technical areas. In addition, peer review team members consistently bring valuable information back to their home organizations and build new peer relationships.

At six months and one year following a review, staff meets with the host member to discuss implementation of the recommendations. Since we began this tracking in 2014, which is done to understand the "realized value" of the reviews, hosts have reported that close to 70% of the recommendations provided are fully or partially implemented or planned for future implementation.

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NATF Begins Pilot Collaborations with NERC, RF, and SERC

In April 2019, the NATF and NERC executed an updated memorandum of understanding to advance our mutual objectives, leverage respective strengths, and minimize duplication of effort. This coordination spans a range of topics, including joint workshops (e.g., the annual human performance conference, planning and modeling workshops, and the resilience summit) and NATF development of implementation guidance.

In some cases, our efforts may involve a deeper level of collaboration, including with Regional Entities (part of the "ERO Enterprise" with NERC), on higher-tier risks, as appropriate. Through discussion of this topic and agreement among the NERC and NATF and regional entity CEOs in August 2019, two initial topics (facility ratings and supply chain risk mitigation) were selected to pilot the collaboration approach with two of the Regional Entities—ReliabilityFirst (RF) and SERC. These pilot collaborations aim to highlight and reinforce the following roles for the ERO and the NATF and other industry organizations, consistent with the NERC-NATF MOU:

ERO	NATF/Industry
•identify existing and emerging risks to reliability •facilitate strategies and activities to address the identified risks	•characterize and validate the identified risks •implement appropriate strategies and activities among members to support mitigation of the identified risks

The pilot collaborations will also help to develop a repeatable approach for collaboration between the NATF and the ERO Enterprise.

Facility Ratings Collaboration

The ERO has identified, and has increased its focus on, the risk of inaccurate facility ratings and the impact on reliability of the bulk electric system. The issues identified to date generally involve discrepancies between documented equipment and/or facility ratings and current field conditions. Facility rating calculations have been inaccurate as a result of incorrectly rated or missing equipment. For example, the missing or incorrectly rated equipment includes jumpers and risers inside substations, bus bars, current transformers (including delta-connected current transformers), circuit breakers, and transmission line conductors. The ERO Enterprise has observed multiple contributing causes for the discrepancies, including insufficient processes and lack of controls.

When facility ratings are not determined correctly and applied consistently for all applicable facilities, equipment might operate beyond its capability, causing equipment damage or line sagging beyond design, resulting in unplanned outages. Additionally, system operator decisions could result in unintended consequences when based on inaccurate facility ratings.

In early 2019, the NATF initiated a project to develop practices to help ensure that facility ratings are developed using the entity's facility ratings methodology, equipment and facilities are built and maintained in the field to ensure ratings are accurate, and ratings for equipment and facilities are documented and communicated. The NATF practice document will provide a guide to members for establishing a sustainable process for developing and maintaining accurate facility ratings.

The NATF will work with its members to socialize the practice document and review member implementation of the NATF practices related to facility ratings. As part of this pilot effort, the NATF will provide periodic summary updates to SERC, RF, and NERC.

Collaboration on Entity Mitigation Practices for Supply Chain Risks

Much of the supply chain cyber security work done thus far has targeted supplier assessment and addresses risks via understanding of and changes in supplier cyber security practices and risk-mitigation activities. In some cases, an entity will be unable to gain assurance of the supplier mitigations and will implement solutions internally to further reduce the risk by detecting anomalies and implementing protective measures at the entities facilities and systems.

Regional Workshops

For the collaboration on supply chain entity risk mitigation, the NATF, RF, and SERC will work together to develop and conduct a workshop for registered entity security professionals and SMEs in each of the two regions on mitigation practices that entities can employ on their systems, equipment, and networks as an additional line of defense to augment the supply chain risk assessment and procurement practices that are focused on addressing risks at the source. The focus of the workshops will be on security and cyber risk mitigation practices, not compliance and not supplier assessment or procurement practices. The workshops will target two or three specific risks, including characterization and discussion of the risks and potential practices to mitigate the risks.

Following the workshop, NATF, RF, and SERC will publish a summary of the outcomes of the discussions for industry.

The dates and registration information will be communicated to NATF members and to registered entities in each region once arrangements are finalized.

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NATF Leads Industry Coordination and Alignment on Supply Chain Cyber Security

Supply chain cyber security risk management has been a priority for utilities over the last couple of years and is now more prevalent with the upcoming enforcement date (July) for NERC Reliability Standard CIP-013.

The NATF and its members have been working diligently on the issues facing our industry and have aligned efforts with other organizations so solutions bring maximum benefit for our members and are built on the work that has been done to date. This benefit comes largely in terms of having solutions accepted by the other industries we interact with; having a widely accepted and used approach for how the electric industry will manage cyber security issues makes the approach impactful enough to be of interest to these other industries, giving us the opportunity to work with them. This also attracts vendor organizations to develop tools that will support the approach and assist entities with implementation.

The alignment effort is being conducted through an Industry Organizations Team[1] that includes members from organizations in our industry, but also includes other industries and government organizations as well. This team worked together to align on solutions to (1) streamline common approaches to evaluating a supplier's

[1] The team of Industry Organizations includes representatives from industry trade organizations and forums, NATF member utility representatives, government agencies, key electric sector suppliers, and third-party assessors

cyber security practices, (2) provide for flexibility within the common approaches, (3) ensure the common approaches are scalable to include all suppliers and purchasing entities, and (4) assist with compliance (while the focus is on good cyber security practices, if executed properly the approaches will address requirements in the NERC supply-chain-related standards). The Industry Organizations Team stays in communication regarding open questions and issues entities are facing to help ensure that work is not duplicated, industry resources are working efficiently, and entities receive united, not conflicting, messages. A list of the participating and contributing organizations is available on the NATF public website.

New NATF Public Page

The NATF has developed a page on our public website that provides information on the work done by the contributing organizations to date, links to resources, a list of work in progress, opportunities to hear more about the efforts (e.g., webinars), announcements related to the effort, and visibility into the organizations that have been involved on the Industry Organizations Team. You can locate the web page under the new Industry Initiatives tab (select the Supply Chain Industry Coordination drop-down option) on the NATF public website.

The web page highlights these solutions:

- The "NATF Cyber Security Criteria for Suppliers" (Criteria)
- The "Supplier Cyber Security Assessment Model" (Model)
- The "Supplier Cyber Risk Assessment Questionnaire" (Questionnaire) (Coming Soon)
- The "EEI Model Procurement Contract Language Addressing Cybersecurity Supply Chain Risk" (EEI Procurement Language)

The NATF Criteria is the basis for work being done; it provides the criteria by which entities can evaluate a suppliers' cyber security practices. This Criteria was developed by NATF members, reviewed by suppliers and assessors on the NATF Proof of Concept Team, and finally reviewed by the Industry Organizations Team.

The Model, which is supported by the Industry Organizations Team, provides a streamlined, effective, and efficient industry-accepted approach for entities to evaluate supplier cyber security practices, which, if applied widely, will reduce the burden on suppliers, provide entities with more and better information, and improve cyber security. This evaluation will provide critical information for entities to consider when conducting risk assessments for potential suppliers of products and services.

The Questionnaire (coming soon!) is one of the tools an entity can use to obtain information on a suppliers' adherence to the NATF Criteria. It is a particularly helpful tool when a supplier does not have a third-party assessment conducted, the entity does not receive sufficient information in the third-party assessment report, or the third-party assessment (statement of applicability) does not cover all of the criteria.

The EEI Procurement Language provides template contract language that entities can use to address specific identified risks.

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Protection System Misoperations Analysis Annual Report

The NATF Protection System Misoperations Analysis Initiative began in 2015. The NATF collects Misoperations data, produces metrics the NATF and individual members use to assess improvement efforts, and provides detailed information that the System Protection Practices Group and members can use to address specific causes of Misoperations. The Misoperations Analysis Working Group prepares member-specific protection system performance metrics that are included in the annual NATF Reliability Performance Reports and prepares a Protection System Misoperation Annual Report to analyze Misoperation categories, causes, and sub-causes, and make recommendations to the System Protection Practices Group and members.

The annual report provides detailed cause analysis protection scheme type. This arrangement, when combined with special analysis of hardware-related and communications-related Misoperations, supports recommendations that are actionable, realistic, effective, and linked to existing NATF practices and Principles of Operating Excellence.

In addition, enough data is now available to investigate how Misoperations rates are changing over time. The 2019 report provides the NATF overall and regional dependability, security, and Misoperations rate for three-year time periods, plus assessments of the changes of Misoperation categories and involved relay technologies over the same periods.

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NATF and EPRI Team Up for Equipment Reliability

Equipment Problem Coding

Failed AC substation equipment is one of the leading causes of transmission system outages. For several years, the Equipment Performance and Maintenance (EPM) Substations Equipment and Asset Management Practices Groups have focused on understanding the causes of equipment failures and developing ways to detect negative trends **before** small problems turn into major issues that cause outages.

Equipment engineers and asset managers need to understand what equipment problems are being discovered and what failures are occurring. To make decisions about asset maintenance and replacement, this data must be easily classified by asset type, make, model, and nature of the problem.

The EPM Substations Equipment and Asset Management Practices Groups, in association with the Electric Power Research Institute (EPRI), have developed a method for coding equipment failures observed during corrective maintenance. This coding system, called equipment problem coding (EPC) meets the following objectives:

1. System provides standardized recording of both catastrophic equipment failures and functional problems, reducing the need to analyze narrative problem descriptions

2. Easily understood codes are applied “at the source” by those who are performing corrective maintenance, improving accuracy
3. Coding system can be implemented in any computerized maintenance management system
4. Standardized codes enable utilities to exchange data to better understand the types of problems experienced throughout the industry
5. System is extensible to multiple equipment types

Several NATF members are implementing the EPC system, and there are ongoing efforts to add new equipment types.

EPRI Industry Equipment Database

This year marks the fourth of an NATF collaboration with EPRI to support data collection as part of EPRI’s Industry-Wide Equipment Database (IDB) effort. NATF members submit in-service, failure data, and maintenance history for selected equipment types. This supports EPRI research that will ultimately help utilities identify high-value maintenance tasks, determine optimal maintenance frequency, make repair versus refurbish versus replace decisions, find “bad actor” equipment, and improve equipment specification and selection. NATF and member-specific failure metrics for various equipment classes are included in the annual NATF Reliability Performance Report.

The Takeaway

By implementing the EPC system and participating in the EPRI IDB program, members can take steps to identify and mitigate the causes of equipment problems before these problems evolve into catastrophic failures that cause outages.

Redacted Operating Experience Reports

Since our last newsletter, we have posted five reports to our public site for members and other utilities to use internally and share with their contractors to help improve safety, reliability, and resiliency.

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For more information about the NATF, please visit www.natf.net.