

**Summary of the
FERC-NERC-Regional Entity
Joint Review of Restoration & Recovery Plans**

In September 2014, FERC initiated a joint staff review NERC and the Regional Entities, to assess entities' plans for restoration and recovery of the bulk power system following a widespread outage or blackout. The report was issued on January 29, 2016.

Overall, the joint staff review team found that the participants have system restoration plans that, for the most part, are thorough and highly-detailed. The report includes 15 recommendations and three “beneficial practices.”

- The objective of the review:
 - to assess and verify the electric utility industry's bulk power system recovery and restoration planning, and
 - to test the efficacy of related Reliability Standards in maintaining and advancing reliability in that respect.
- The joint staff review was not a compliance or enforcement initiative.
- Information gathered from a representative sample of nine registered entities with significant bulk power grid responsibilities (the participants).
- The review team examined the restoration, response and recovery plans of each participant, along with supporting information. Documents reviewed include:
 - Reliability Coordinator-approved restoration plans,
 - Procedures for deploying blackstart resources,
 - Steady state and dynamic simulations testing the effectiveness of the plans, and
 - Cyber security incident response plans and recovery plans for critical cyber assets.
- The joint staff review team then reviewed the associated Reliability Standard requirements for clarity and efficacy to determine any reliability gaps, also taking into consideration relevant recommendations from the NERC-convened Independent Experts Review Panel (IERP).
- Participants had extensive cyber security incident response and recovery plans for critical cyber assets covering the majority of the response and recovery stages.
- Several opportunities identified for improving system restoration and cyber incident response and recovery planning and readiness through, among other things, improvements to the clarity of certain Reliability Standard requirements.
- High-level recommendations include:
 - Measures be taken, including, considering changes to the current Reliability Standards to address the issues and recommendations as set out in the body of the report.
 - Perform further studies in certain areas, including those in which CIP Reliability Standards have yet to go into effect.
 - Other registered entities responsible for system restoration, cyber security incident response, or recovery readiness consider incorporating similar practices into their plans and practices, where and as appropriate
- Finally, the joint staff review team observed numerous beneficial practices employed by individual participants.

Recommendations

System Restoration Planning

- **Clarify when system changes will trigger a requirement to update restoration plans.** The joint staff review team recommends that measures be taken (including considering changes to the Reliability Standards) to address the need for updating restoration plans for all system modifications that would change the implementation of an entity's restoration plan for an extended period of time, not just permanent or planned system modifications. In considering these measures, the kinds of events that may warrant an update to the system restoration plan should be identified, taking into account the length of time the system is affected, as well as the overall objective of ensuring that restoration plans are generally flexible enough so that system modifications can be addressed without continuous updates. [Section IV.E].
PJM agrees with the recommendation, and will monitor and provide input to the current EOP SDT.
- **Verification/testing of modified restoration plan.** The joint staff review team recommends that measures be taken (including considering changes to the Reliability Standards) to address the need for re-verification of a system restoration plan when a system change precipitates the need to determine whether the plan's restoration processes and procedures, when implemented, will operate reliably, i.e., when needed to ensure that the restoration plan, when implemented, allows for restoration of the system within acceptable operating voltage and frequency limits. In considering such measures, the types of system changes that could impact reliable implementation of the restoration plan should be taken into account (e.g., identification of a new blackstart generator location or on redefinition of a cranking path). [Section IV.G]
PJM agrees with the recommendation and will implement updates to M36.
- **Operator training: Exercises on transferring control back to the balancing authority.** The joint staff review team recommends that measures be taken (including considering changes to the Reliability Standards) to address system restoration training and drilling for transitioning from transmission operator island control to balancing authority ACE/AGC control. [Section IV.H.].
PJM meets this recommendation.

Recommended Studies and Coordination Efforts

- **Planning for loss of SCADA and loss of other data sources.** Given the possibility that Supervisory Control and Data Acquisition (SCADA) computer systems, Inter-Control Center Communications Protocol (ICCP), or Energy Management System (EMS) functionality may be compromised during a major disturbance (e.g., portions of SCADA may not be available after a significant blackout), the joint staff review team recommends that further study be conducted to (a) assess system

restoration plan steps that may be difficult in the absence of SCADA, ICCP data, and/or EMS; and (b) identify viable resources, methods or practices that would enable timely system restoration to occur absent SCADA/EMS functionality, which could then be incorporated into entities' system restoration training. The study should also examine and identify best practices that may be shared across the industry. Pending such study, individual entities should initiate or update consideration of resources, methods and practices they can use in these circumstances. [Section IV.C].

PJM agrees with the recommendation, and will provide input to any future study.

- **Gain further understanding of recent blackstart resource changes.** The joint staff review team recommends study of the availability of blackstart resources, including the identification of strategies for replacing blackstart resources going forward and factors to be considered for such replacement resources (e.g., locational diversity, dual fuel, etc.). A future study may include discussions with a representative sample of generation owners and operators to gain further understanding. [Section IV.D].

PJM would support this study.

- **Gain further understanding of the use of direct current (DC) facilities for restoration.** The joint staff review team recommends that a study be conducted to determine the benefits of including existing or future voltage source converter DC lines in system restoration plans. [Section IV.D].

PJM would support this study.

- **Blackstart resource testing under anticipated blackstart conditions.** The joint staff review team recommends a study be performed to identify options for expanding restoration plan testing beyond the currently-required blackstart resource testing, to ensure the blackstart resource can energize equipment needed to restore the system as intended in the restoration plan. Any expanded testing requirements should take into consideration whether such testing is practical while maintaining system reliability, and whether such expanded testing requirements could affect the identification of blackstart resources in the future. [Section IV.F].

PJM exceeds NERC Standards related to Blackstart unit testing. PJM requires annual testing and has a cold weather testing program. Where possible, Blackstart unit testing mimics the conditions expected during restoration. However, PJM has a concern over making Blackstart testing too cumbersome would cause some units to no longer want to provide Blackstart service.

- **Obtaining insight from entities that have experienced a widespread outage.** The team recommends that applicable entities that have not recently experienced a blackout or other

events which impacted, or could have the potential to impact, the viability of their restoration plans reach out to those who have experienced such events, in an effort to continuously improve their restoration plans. Entities could benefit from the sharing of experiences across different regions of the country to gain insight into events that may not have ever occurred locally, including:

- Severe flooding and storm impacts on facilities and equipment depended on for system restoration;
 - Effects of extreme temperatures, including severe cold weather impacts on facilities and equipment depended on for system restoration; and
 - Preparedness training for the above impacts. [Section IV.I].
- PJM is active in providing reports to industry regarding any challenging operations. PJM agrees with this recommendation.

Cyber Incident Response and Recovery Plans

- **Response and recovery plan ownership:**
 - Cyber security incident response plans and recovery plans for critical cyber assets specifically designate accountability at the cyber asset level (e.g., EMS servers, remote terminal unit (RTU) concentrators, network routers, etc.). The team recommends that measures be taken (include considering changes to the Reliability Standards) to address this.
 - **PJM agrees with and meets this recommendation.**
- **Require details on types of cyber security events that should trigger a response and reporting:**
 - Address the need for cyber security incident response plans to include details around the types of events that should trigger a response, and what types should be reported (include considering changes to the Reliability Standards).
 - **PJM agrees with and meets this recommendation.**
- **Use of technical expertise and advanced tools:**
 - Cyber event monitoring and response would be greatly improved by expanding the use of cyber security technical expertise and advanced technical tools, and recommends that measures be to address the use of these tools to improve cyber event monitoring and response taken. In addition, clarify that these advanced tools and resources should be employed in a manner that does not negate the benefits by making the cyber security event monitoring process more cumbersome or unnecessarily burdensome (include considering changes to the Reliability Standards).
 - **PJM agrees with and meets this recommendation.**
- **Recovery plan inventory assumptions risk:**
 - Eliminate, to the extent possible, “inventory assumptions” in cyber asset recovery plans that could significantly affect prompt recovery of critical cyber assets. For example, entities may assume that hardware from external sources or other third party vendor support needed for recovery of critical cyber assets will be available, without necessarily having measures to ensure availability. Likewise, entities may not consider interdependent or common-mode failure scenarios, which can create the need to recover multiple critical cyber assets concurrently from the same vendors (include considering changes to the Reliability Standards).
 - **PJM agrees with and meets this recommendation.**

Recommended Studies and Practices

- **Independent review of cyber security response and recovery plans.**
 - Recovery plans for critical cyber assets and cyber security incident response plans be reviewed by an independent authority or third party for the purpose of supporting thoroughness and technical reliability, using a trusted or qualified third party to ensure a proper security review.
 - **PJM does not currently utilize an independent party to review its response and recovery plans. PJM is reviewing this recommendation.**

- **Exercises of response and recovery plans using paper drills:**
 - participation in full operational exercises and other more complex simulations provides greater insight into the viability of a given cyber response and recovery plan, and believes that participation in such exercises by the industry is valuable for developing robust recovery and response plans. The joint staff review team recommends that applicable entities participate in exercise scenarios and simulations structured to gain insight into the viability of cyber response and recovery plans (i.e., beyond paper drills and tabletop exercises), including testing for interdependencies and other vulnerabilities.
 - PJM agrees with and meets this recommendation.

- **Gain further understanding of response and recovery plan updating following testing or actual cyber events:**
 - Conduct a study to better understand the associated plan improvements made by entities where testing or an actual cyber event reveals the need or opportunity for improvements to a response and recovery plan. In addition, the study should examine and identify best practices with regard to the types of plan improvements made from entities' analyses of actual cyber events and/or testing.
 - Recommendation is pointed towards FERC/NERC conducting another industry study.