

System Restoration Manual

April 2017

2. RESTORATION PROCEDURES

System restoration will take place at two levels: restoration of the NYISO Reliability Coordinator Area's backbone system in accordance with a NYISO restoration procedure and restoration of local areas in accordance with TO restoration procedures. These procedures shall be designed to restore the NYCA system in a safe, orderly, and prompt manner following a major or total blackout. Since the exact extent or nature of a disturbance cannot be predicted, the procedures are prepared as general guidelines.

2.1 NYISO System Restoration Procedure

The NYISO's procedures for system restoration are contained in the Restoration State section of the *NYISO Emergency Operations Manual* (posted as an Operations manual on the NYISO Web site at the following URL:

http://www.nyiso.com/public/markets_operations/documents/manuals_guides/index.jsp).

The NYISO Restoration Procedure has been developed by the NYISO and TOs and is contained in Attachment B of the *NYISO Emergency Operations Manual*. The contents of Attachment B constitute Critical Electric Infrastructure Information, therefore distribution is limited. The restoration procedure includes reference documents, which shall be employed by system operators during a restoration event. These include the following:

- a. A Restoration Diagram, which provides a common network configuration reference for all NYCA transmission and substations stations 230 kV and above, identifies available synchronization points on the system, and identifies the preferred energization path to establish the transmission backbone.
- b. A Restoration Procedure, which identifies the Black Start Facilities, the switching operations required to establish the transmission backbone, preferred synchronization points between the Black Start Facilities, guidance on voltage levels to be maintained, locations and magnitudes of load to be restored to maintain system voltage, and brief notes addressing procedure implementation.
- c. A Black Start Facilities List, identifying their location, capabilities, and fuel sources
- d. A Line Charging List associated with all lines 230 kV and above identified in the Restoration Diagram.
- e. A set of Restoration Guidelines, which provides detailed guidance beyond that included in the Restoration Procedure.
- f. An Inter-Area Restoration Coordination table, which provides the elements of coordination in restoring the Interconnection with the neighboring Reliability Coordinators.

2.2 Transmission Owner System Restoration Procedures

Transmission Owners within the NYISO's Reliability Coordinator Area shall maintain local system restoration plans (SRPs) for their transmission districts consistent with NYSRC,

NPCC, and NERC standards. These restoration procedures shall be coordinated with the restoration procedures of neighboring TOs. The TOs must maintain current copies of these procedures at the NYISO.

Procedures and protocols for off-site power requirements of nuclear power plants, including priority of restoration, are described in Nuclear Plant Interface Requirement (NPIR) documents maintained by the local transmission owners and the interconnected nuclear power plant.

2.3 Black Start Resource Restoration Procedures

Each Generator Operator with a Black Start Resource shall have documented procedures for starting each Black Start Resource and fulfilling its requirements in the SRP without the availability of an outside electric supply.

3. RESTORATION-RELATED FACILITIES

The NYISO and the TOs within the NYISO's Reliability Coordinator Area shall secure adequate Black Start Facilities to meet the requirements of the NYISO's System Restoration Procedure. Black Start Resources are individual units that have the capability, following a system-wide blackout, to start up and energize a bus without the availability of an outside electric supply. Black Start Facilities are multi-unit plants, containing at least one Black Start Resource, where the entire plant can be restarted without the availability of an outside electric supply. All Black Start Facilities must incorporate at least one Black Start Resource. It is not required that all units at a Black Start Facility be Black Start Resources.

3.1 Black Start Resources

3.1.1 NYISO Black Start Service Resources

The NYISO determines the need and adequacy of Black Start Facilities for the NYISO's restoration procedure through operating studies and simulation. The NYISO restoration procedure shall include identification of any Black Start Facility and the characteristics of such units, including but not limited to the following: the name of the Black Start Facility, location, megawatt and megavar capacity, and type of unit. Procedures for acquiring the necessary Black Start Resources as identified in NYISO studies are in Section 7, Black Start Capability Service, of the *NYISO Ancillary Services Manual* (posted as an Operations manual on the NYISO Web site at the following URL:

http://www.nyiso.com/public/markets_operations/documents/manuals_guides/index.jsp).

3.1.2 Transmission Owner Black Start Service Resources

Transmission Owners within the NYISO's Reliability Coordinator Area are responsible for determining the need and adequacy of Black Start Facilities to meet the requirements of their local restoration procedure. The TO restoration procedure shall include identification of any Black Start Facilities and the characteristics of such units, including but not limited to the following: the name of the Black Start Facility, location, megawatt and megavar capacity, and type of unit. The identity of TO Black Start Facilities shall be made available to the NYISO and to affected TOs. Transmission Owners are responsible for procuring any required local Black Start Resources.

3.1.3 Black Start Testing Procedures

Black Start Testing procedure requirements shall be designed by the Transmission Operator to ensure Black Start Facilities are able to perform their intended function in the SRP. The number of units to be included in the Black Start Resource test procedures shall be determined by the SRP requirements to control voltage and frequency.

Each Generator Operator with a Black Start Resource shall prepare Black Start Resource specific testing procedures, perform Black Start Resource tests, and maintain records of such testing, in accordance with the testing requirements set by the Transmission Owner to

procedure within 90 calendar days after identifying any unplanned permanent System modifications, or prior to implementing a planned BES modification that would change the implementation of its restoration procedure.

5.1.4 NYISO Procedure Distribution

The NYISO shall distribute its most recent restoration procedure to the TOs within 30 calendar days of creation or revision. The NYISO shall provide the entities identified in its approved restoration procedure with a description of any changes to their roles and specific tasks prior to the implementation date of the procedure.

5.2 Transmission Owner Procedure Review, Verification, Update, and Distribution

5.2.1 Transmission Owner Procedure Review

The TOs shall review their local restoration procedures annually and prior to implementing any planned system modification that could affect the coordination of the NYISO and TO restoration procedures. These reviews shall evaluate the impact of procedure changes, system expansion, or system reconfiguration.

5.2.2 Transmission Owner Procedure Verification

Each TO shall verify through analysis of actual events, steady state and dynamic simulations, or testing that its restoration procedure accomplishes its intended function. This shall be completed every five years at a minimum. Such analysis, simulations, or testing shall verify:

- The capability of Black Start Facilities or ties from neighboring systems to meet the Real and Reactive Power requirements of the Cranking Paths and the dynamic capability to supply initial Loads,
- The location and magnitude of Loads required to control voltages and frequency within acceptable operating limits, and
- The capability of generating resources required to control voltages and frequency within acceptable operating limits.

Following an event where the system restoration procedure was invoked, TOs shall analyze and report on the performance of their restoration procedures.

5.2.3 Transmission Owner Procedure Update

The TOs shall update their restoration procedures within 90 calendar days after identifying any unplanned permanent System modifications. The TOs shall update their restoration procedures prior to implementing a planned BES modification that would change the implementation of their restoration procedures. In the event of any proposed changes to TO facilities or procedures that could affect the coordination of the NYISO and TO restoration procedures, the TOs shall provide notification at least two months prior to implementation.

5.2.4 Transmission Owner Procedure Distribution

Each TO shall distribute its most recent restoration procedure to the NYISO within 30 calendar days of creation or revision. The TO shall provide the entities identified in its approved restoration procedure with a description of any changes to their roles and specific tasks prior to the implementation date of the procedure.

6. RESTORATION TRAINING

6.1 NYISO Restoration Training

The NYISO shall provide for training NYISO and Market Participant operating personnel for the effective implementation of the NYCA SRP in the following area:

- Annual coordinated restoration training for NYISO and TO system operators, including:
 - Energization paths and initial switching requirements exiting the Black Start Facilities
 - Identification of acceptable voltage and frequency limits during restoration,
 - Operating Processes to reestablish connections between restored systems,
 - Simulation exercises that include modeling of each transmission owner's SRP, and
 - Annual simulations of full or partial system shutdowns and restoration, including the issuance of critique as input to the annual review of the restoration procedure.

Black Start Providers and other generator owners shall be invited to participate in training sessions and exercises as appropriate.

The NYISO shall maintain training program records showing that operating personnel have been trained in the implementation of the NYCA SRP and participated in restoration exercises.

6.2 Transmission Owner Restoration Training

Each TO shall provide for training of operating personnel for the effective implementation of the NYCA SRP in the following areas:

- Annual restoration training for its operating personnel on the local system restoration procedure
- A minimum of two hours of System restoration training every two calendar years to its field switching personnel identified as performing unique tasks associated with the TO's restoration procedure that are outside of their normal tasks.

Each TO shall participate in NYISO restoration drills, exercises, or simulations as requested by the NYISO.

The TOs shall maintain training program records showing that operating personnel have been trained in the implementation of the local system restoration procedure. These records shall be made available to the NYISO upon request.

6.3 Generator Operator Restoration Training

Each Generator Operator shall participate in NYISO restoration drills, exercises, or simulations as requested by the NYISO.