

PRR 114 Attachment
NYISO Description and Justification for Black Start Steam Unit Testing Changes
September 2012

Introduction

The New York Restoration Plan comprises two separate, coordinated plans. The NYISO maintains a statewide plan, which provides for the restoration of electric service to New York by means of the 345 kV transmission backbone of New York that is energized by hydro units in western and northern New York (“NYISO Restoration Plan”). This plan satisfies the NERC and NPCC black start and system restoration requirements for the New York Control Area. In addition, Con Edison maintains a supplemental local plan for the accelerated restoration of its service territory by means of gas and steam turbine units located there (“Con Edison Restoration Plan”). This supplemental plan is not reported to NERC and NPCC, and the units that participate in this plan are not subject to the NERC and NPCC black start and system restoration requirements.

The NYISO is proposing revisions to the steam turbine unit testing procedures in Rate Schedule 5 of the NYISO Market Services Tariff. In addition to testing, training of personnel and maintaining equipment are important to the success of a black start plan. The NYISO is not proposing any changes to existing training and equipment maintenance requirements.

Current NYISO Procedures for Black Start Testing Steam Turbine Units

Currently, a steam turbine unit must be in hot condition, i.e., online and firm to the system (released to the NYISO for operation), before starting the test. Once the unit has been isolated from the transmission system, it is required to start up using energy and voltage control from a black start gas turbine unit to energize its internal light and power bus. The steam turbine unit must synchronize to the transmission system in no more than six hours, and it must be firm to the system and operating at minimum load in no more than eight hours. This comprehensive test is performed annually.

Proposed Black Start Testing for Steam Turbine Units

The NYISO is proposing that a similar comprehensive test be performed by the steam turbine units every three years. The comprehensive test requires synchronization to the transmission system and requires that the unit is firm and operating at minimum load in no more than eight hours. The six hour milestone for synchronization to the transmission system has been eliminated, because it is not a useful measure for demonstrating black start capability.

The comprehensive test can be performed if the steam turbine unit is hot from current operation or when it becomes hot on the way up from a cold start. If the unit is in a cold condition, it can start its internal light and power bus from the transmission system to come to a hot condition, then isolate from the transmission system to start the test.

Steam turbine units are required to perform a test each year. If a steam turbine unit has completed a successful comprehensive test within the last two years, it will be eligible to perform an intervening year test. This intervening years test requires:

- the steam turbine unit to be isolated from the transmission system
- a cranking path to be established between the steam turbine unit and an isolated black start gas turbine unit
- energizing the steam turbine unit's internal light and power bus with the gas turbine unit
- adding auxiliary loads (e.g., boiler feed pump, fans) that would be required to introduce fire into the boiler
- demonstrating ten minutes of steady operation of the loaded internal light and power bus

The intervening years test does not require fire in the boiler or synchronization to the transmission system. It must be completed within four hours.

Basis and Justification for the Proposed Black Start Testing for Steam Turbine Units

The objective of the proposed changes to the steam turbine unit black start test procedure is to reduce the start-up cycles of critical equipment and thereby improve the likelihood that the steam turbine units will be available in the long term. The existing steam turbine units in the Con Edison Restoration Plan range in age from more than 40 years to almost 55 years. Given the age of the units, unnecessary start-up cycles are a concern. The steam turbine unit black start test procedure, as currently prescribed in NYISO procedures, requires an additional cycle on the entire unit each time a test is performed. Revising the test procedure will reduce the start-up cycles on steam turbine units' boilers, equipment that is already subject to significant thermal cycles as a result of normal operation, and will reduce the risk of equipment failure, thereby improving equipment reliability.

The NYISO researched the regulatory definition of black start units and the testing requirements for black start units, in the context of both NERC and the NPCC ISO/RTO areas. Key findings include:

NPCC and NERC do not require black start testing for units like the steam turbine units in the Con Edison Restoration Plan:

- NERC and NPCC black start criteria do not apply to steam turbine units participating in the Con Edison Restoration Plan because this plan, and the units in it, are supplemental to the NYISO Restoration Plan and are not reported by the NYISO (as the Reliability Coordinator and the Transmission Operator) to NERC and NPCC.
- Industry-wide, black start units generally comprise hydro-electric and gas turbine units. The NERC and NPCC definitions and test requirements for black start units, including those in NPCC Directory 8, do not align with the operating characteristics of the steam

turbine units in the Con Edison Restoration Plan, as those units cannot connect to an unenergized transmission system.

- NERC, after thorough review and comment by industry representatives, has found no reliability concerns with testing black start units every third year.¹
- There is no technical justification or reliability need for an annual, comprehensive test of steam turbine units to demonstrate black start capability based on NERC and NPCC's test requirements.

The intervening years test demonstrates the capability of the components necessary for black start of the units. It tests the ability of the unit to use an isolated gas turbine unit to start and support all the auxiliary loads required to introduce fire into the boiler of the steam turbine unit. When considered in conjunction with normal starts, the intervening years test reasonably shows that the start-up sequence (which includes battery, diesel generator and gas turbine unit starts; energizing and adding to the internal light and power bus the loads necessary to start the boiler; and actually starting the steam turbine unit and synchronizing to the transmission system) is successfully completed.

The parts of the start-up sequence that are not demonstrated by the intervening years test are proven during the comprehensive test, and much of the start-up sequence is demonstrated during each normal start. The steam turbine units in the Con Edison Restoration Plan start very reliably. During 2010 and 2011, they started normally and successfully 289 times in 293 attempts, a success ratio of 98.6 percent. There have been no instances of steam turbine unit trips during black start testing.

Control systems on the black start gas turbine units used to energize the internal light and power buses are designed to provide reliable, stable power for the loads needed to start the steam turbine units. The in-rush currents when pumps, fans and motors are initially started are critical loading conditions. For the approximately four hour duration of the intervening years test, the gas turbine units will be required to demonstrate their ability to pick up and hold those loads. Representative data for steam turbine units in the Con Edison Restoration Plan indicate that auxiliary loads for the intervening years test range from about 33 percent to 46 percent of the demonstrated capacity of gas turbine units used to energize the internal light and power bus, and steady state auxiliary loads for the comprehensive test range from about 60 percent to 66 percent of the demonstrated capacity of gas turbine units used to energize the internal light and power bus. Transient loads up to about 92 percent of the demonstrated capacity were seen. Gas turbine unit trips during past black start testing occurred early in the start-up sequence and would be detected in intervening years tests. Other issues identified in past tests have been addressed.

NPCC and NERC do not require black start testing for units like the steam turbine units in the Con Edison Restoration Plan. However, the steam turbine units assist in picking up load during system restoration and are an important part of the Con Edison Restoration Plan. The NYISO

¹ See comments on EOP-005-02 at http://www.nerc.com/filez/standards/System_Restoration_Blackstart.html

supports more stringent testing requirements for these units in the New York City area than at the regional or national level. The NYISO's proposed testing procedure continues to require testing of the steam turbine units each year, with a comprehensive test every three years and an intervening years test in the two years between comprehensive tests. These proposed tests are more stringent than NPCC and NERC testing requirements.

Finally, the NYISO's proposed testing procedure will not permit a steam turbine unit to perform an intervening years test if it has not successfully completed a comprehensive test within the last two years.

Recommended NYSRC Rule Changes

Based on its evaluation, the NYISO has not found any adverse reliability impacts from the revised steam turbine unit testing procedures as proposed. The NYISO has determined that these procedures will provide assurance that the units needed for safe, orderly and prompt system restoration will be available to perform when called upon.

The NYISO believes that the attached, proposed rule changes will appropriately clarify the test requirements for the units participating in the New York Restoration Plan, including the steam turbine units participating in the Con Edison Restoration Plan. Specifically, the NYISO suggests that NYSRC Measurement G-M3 be amended to describe the test requirements that each type of unit - hydro, gas turbine unit, or steam turbine - participating in the New York Restoration Plan must successfully complete. This includes the requirement that a steam turbine unit complete a comprehensive test every three years and intervening years tests in the intervening two years.