2.3.12 Winter Peak Reliability Analysis

The winter peak reliability analysis ensures that the Transmission System is capable of delivering the system generating capacity at winter peak. The PJM 50/50 winter peak demand level was chosen as being representative of a typical winter peak condition. The system generating capability modeling assumption for this analysis is that the generation modeled reflects generation by fuel class that historically operates during the winter peak demand level.

The starting point power flow is the same power flow case set that is used for the baseline analysis, with adjustments to the model for the winter peak demand level, winter peak load profile, applicable Transmission Owner winter facility ratings (otherwise default to the 50F degree rating), interchange, and accompanying generation dispatch. PJM will review facility ratings based on temperature sets below 50F degrees to ensure that the selected temperature set makes sense when considering historical temperatures. The PJM portion of the model is adjusted, and the MMWG winter model is used for areas surrounding PJM. Interchange levels for the various PJM zones will reflect all yearly long term firm (LTF) transmission service, except MAAC which will reflect the historical average. Load level, interchange, and generation dispatch for non-PJM areas impacting PJM facilities are based on statistical averages for previous winter peak periods. Thus the same baseline network model and criteria apply. The flowgates ultimately used in the winter peak reliability analysis are determined by running all applicable contingencies maintained by PJM planning and monitoring all PJM market monitored facilities and all NERC BES facilities. The contingencies used for winter peak reliability analysis will include NERC TPL category P1, P2, P3, P4, P5, P6, and P7. NERC TPL Category P0, normal system conditions will also be studied. All BES facilities and all non-BES facilities in the PJM real-time congestion management control facility list are monitored. The same single contingency power flow solution techniques used in other baseline reliability tests also apply. Details of the winter peak reliability analysis procedure, including methods of creating the study dispatch, can be found in Attachment D.3.

C.5.4 Base Case Development

Two separate base case models are developed as may be necessary; a PJM summer peak case to study summer-peaking study areas and a PJM winter peak case to study winter-peaking study areas. ~~(The need for a winter case is assessed annually. Currently the only PJM winter peaking area has summer and winter peaks sufficiently close to enable the analysis on only a summer peak case).~~ The RTEP load flow case nearest to the study time period should be selected and modified as required (modeling the projected load, generation, and transmission system configuration for the target study period).

To calculate plausible generator outage scenarios, a file containing the installed MW capacity and the Generator Unavailability Subcommittee (GUS) five-year planning equivalent forced outage rate demand (EFORd) for every PJM capacity resource will be developed. Related data is available at http://www.nerc.com/page.php?cid=4|43|47.

Attachment D-3: PJM Reliability Planning Criteria Methods

D-3.1 Winter Peak Reliability Analysis

The winter peak reliability analysis tests the ability of an electrical area to export generation resources to the remainder of PJM during winter peak conditions. The export generation is selected by using the historical mix of generation that operates at the winter peak level. This test is applied to ensure that generation capability, including renewable generation capability that typically operates at winter peak such as wind, as well as pumped hydro are not "bottled" from a reliability perspective.

The winter peak reliability analysis, from the perspective of individual generator resources, ensures that, under winter peak system conditions, their ability to provide energy to the system has a probability of not being limited by the typical dispatch of other generation resources that operate at that demand level, including resources in neighboring systems. The Generator Deliverability Test and Common Mode Outage procedure have a similar objective at the summer peak forecast load. While deliverability under all possible system conditions is not in the purview of the RTEP, analyzing the system performance under this wide range of forecasted demand levels improves overall deliverability of generating resources. Consideration will be given to the capacity factor by fuel class during this period, as described in Table 1. This test does not guarantee that a given resource will be able to deliver energy at the winter peak condition. Rather, the purpose is to demonstrate that typical winter peak generating capabilities in any electrical area can be run simultaneously, at winter peak, and that the excess energy above demand in that electrical area can be exported to the remainder of PJM. In short, the test ensures that bottled capability conditions will not exist at winter peak, limiting the availability and usefulness of a range of resources available to system operators, including renewable resources. In actual non-emergency operating conditions, the economic dispatch serves load.

D-3.2 Winter Peak Reliability Analysis Procedure

1.0 Introduction

To maintain reliability and operational flexibility during the winter peak period, resources within a given electrical area must, in aggregate, be able to be exported to other areas of PJM. PJM utilizes a Winter Peak Reliability Analysis procedure to study the system performance during typical winter peak conditions. This document provides the procedure for Winter Peak Reliability Analysis.

2.0 Study Objectives

The goal of the PJM Winter Peak Reliability Analysis study is to determine if the aggregate of generators in a given area can be reliably transferred to the remainder of PJM during winter peak conditions. Generators requesting interconnection to PJM must pass this test in order to become a PJM capacity or energy resource.

Additionally, the PJM Winter Peak Reliability Analysis will be used to ensure thermal and voltage adequacy based on normal (applicable to system normal conditions prior to contingencies) and emergency (applicable after the occurrence of a contingency) thermal ratings specific to the Transmission Owner facilities being examined during winter peak conditions.

3.0 General Procedures and Assumptions for Winter Peak Reliability Analysis

Step 1: Develop Base case

The RTEP base case is developed for a reference year 5 years in the future. All RTEP identified system upgrades and Supplemental RTEP Projects are included in the system model. PJM load is modeled at a non-diversified forecasted 50/50 winter peak load level per the latest applicable PJM load forecast and 50F degree ratings. PJM will review facility ratings based on temperature sets below 50F degrees to ensure that the selected temperature set makes sense when considering historical temperatures. Target PJM RTO area interchange that reflects all yearly long term firm (LTF) transmission service will be maintained. Generation and Merchant Transmission projects that have proceeded at least through the execution of the Facility Study Agreement stage of the interconnection process are considered in the model along with any associated network upgrades. The starting point dispatch is developed as explained in the next step.

Step 2: Establish initial RTEP dispatch for unit under study

Existing PJM Resources: Place all in-service nuclear resources on-line at a generation value equal to their installed capacity. Wind units are derated in the initial dispatch to 33% of their nameplate capability. Coal units are initially derated consistent with Table 1. Queued Units in the PJM queue that have an ISA will be placed on-line consistent with Table 1. The target generation value for each Transmission Owner (TO) zone in the model is dispatched at a magnitude to meet the projected load + losses + PJM RTO interchange. In addition, for the PJM MAAC zone, the average historical interchange for the winter peak period, as calculated by PJM is calculated and applied to that zone. If necessary, generation resources in each TO zone are then uniformly de-rated until the target generation value is met.

The following applies to all queued resources in PJM and neighboring systems. Model all non-ISA queued generation offline. All ISA queued generation is modeled online. If selected by the test procedure, PJM

queued resources will have the potential to be dispatched to 100%.

For queued interconnection studies, all queued resources in the study queue ahead of the unit under study are set at 0 MW but available to be turned on per the Generator Deliverability procedure and Common Mode Outage test procedure. The resource request under study is also set at 0 MW but available to be turned on. Resource requests queued after the unit under study are not modeled. The loading on each transmission line that results from this dispatch and the application of a contingency is the base loading of the facility. (See Addendum 2 for treatment of Common Mode Outage Procedures).

Table 1 – Winter Peak Base Case Initial Target Dispatch

Network Model	Current year + 5 base case
Load Model	50/50 Winter Peak with the bus by bus load profile set by the local Transmission Owner
Capacity Factor for Base Generation Dispatch for PJM Resources (Online in Base Case)	Solar – 5% Wind – 33%

	Hydro – 38% Nuclear – 98% Coal < 500 MW – 51% Coal >= 500 MW – 73% Natural Gas – 25% All other fuel types will be modeled at their historical baseline output as determined by PJM.
Interchange Values	Yearly long term firm (LTF) transmission service (except MAAC which will use historical averages)
Contingencies	NERC Category P0, P1, P2, P3, P4, P5, P6, and P7
Monitored Facilities	All PJM market monitored facilities

Step 3: Determine potential overloads

The method to determine potential overloads is similar to the methods used for the generator deliverability test. Also, the Common Mode Outage procedure is applied to include the effects NERC Category P2, P4, P5, and P7 events such as bus faults, faulted breakers, and double circuit towerline outages.

Step 4: Determine 80/20 DC loading

This portion of the test is similar to the generator deliverability procedure except the ramping limits listed in Table 2 are enforced.

Table 2 – Winter Peak Study Generation Ramping Limits

Fuel Type	Ramping Limits (% of Pmax)
Solar	10%
Wind	80%
All other resources	100%

Step 5: Determine Facility Loading Adder

This portion of the test is similar to the generator deliverability procedure except ramping limits listed in Table 2 are enforced.

Step 6: Determine Final Flowgate Loading

This portion of the test is similar to the generator deliverability procedure except ramping limits in Table 2 are enforced.

4.0 General Procedures and Assumptions for Load Deliverability (NERC P1) Test

The PJM system will be analyzed using the same procedure as applied in section 2.3.9 Load Deliverability Analysis, however the winter case as described previously in this section will be used as the study case.

5.0 General Procedures and Assumptions for Normal System (NERC P0) and N-1 (NERC P1) Events

The PJM system will be analyzed using the same procedure as applied in section 2.3.6 Baseline Thermal Analysis and section 2.3.7 Baseline Voltage Analysis and monitored for thermal and voltage limits, however the winter case as described previously in this section will be used as the study case.

6..0 General Procedures and Assumptions for "N-1-1" (NERC P3 and P6) Events

The PJM system will be analyzed using the same procedure as applied in section 2.3.8 NERC Category C3 "N-1-1" Analysis, however the winter case as described previously in this section will be used as the study case.

7.0 Consideration of Gas Pipeline Contingencies

In accordance with NERC standard TPL-001-4, PJM is required to evaluate extreme system events. NERC provides the example of the "Loss of a large gas pipeline into a region or multiple regions that have significant gas-fired generation" as an example of an extreme event category for consideration by NERC Transmission Planners and Planning Coordinators.

In order to evaluate the potential impact of gas-fired generation as a transmission contingency, PJM will maintain and assess gas pipeline contingencies. The gas pipeline contingency set will include gas pipeline contingencies due to the failure of a gas pipeline or a compressor station. The gas pipeline contingency definitions will be reviewed periodically to validate their accuracy. In addition to the gas pipeline contingencies, gas temperature threshold contingencies will be evaluated. At a pre-determined temperature threshold, PJM analysis will assume that non-firm customers (i.e. non-heating demand and 100% of natural gas generation customers in that zone) will be interrupted.

Per the TPL standard, if the analysis concludes there is Cascading caused by the occurrence of extreme events, an evaluation of possible actions designed to reduce the likelihood or mitigate the consequences and adverse impacts of the event(s) shall be conducted.