



**DRAFT
OPERATIONS MEMO REV: 0**

Date: 08/3/09

To: Dispatching Department / Reliability Engineers

ISSUED BY: Operations Planning

Subject: Operational guidelines for the implementation and use of the Transient Stability Analysis (TSA) Tool

Background

The Transient Stability Analysis (TSA) Tool was developed to determine the stability of predetermined areas within the PJM RTO using real-time information contained within the PJM EMS State Estimator model. The tool also includes a study mode which can be utilized to study historical or user built/adjusted cases using the same PJM EMS State Estimator model.

It is important to note that limits determined by the TSA tool are based on real-time situations and topology. As a result, suggested TSA limits may be more or less restrictive than the stability limits used and documented by PJM within PJM Manual 3 Section 5 or other procedures. This is because, before TSA was developed, most PJM stability limits were the product of off-line studies, primarily PSS/E, in which “worst-case” base cases may not have matched the real-time model of a given day.

Stability Areas

There are currently fifteen (15) stability areas recognized and monitored by TSA.

1. Salem-Hope Creek/Artificial Island
2. Byron (Byron Units 1 and 2)
3. Homer City (Homer City 1, 2, and 3)
4. Clover Plant (Clover Units 1 and 2)
5. Bath County (Bath County Units 1 through 6)
6. Conemaugh Plant (Conemaugh Units 1 and 2)
7. Rockport Plant (Rockport Units 1 and 2)
8. Northeast PA [NEPA] (Montour Units 1 and 2, other)
9. Conesville 345kV Plant (Conesville Units 4, 5, and 6)
10. Smith Mountain (Smith Mountain Units 1 through 5)
11. Gavin-Mountaineer (Gavin Units 1 and 2 and the Mountaineer Unit)
12. Powerton (Powerton Units 5 and 6)
13. Lee County (Lee County Units 1 through 8)
14. Muddy Run (Muddy Run Units 1 through 8)



15. New Church (New Church Units 1 through 7)

TSA Utilization – Normal Operating Conditions (No planned outages that impact stability)

Day Ahead:

The published stability operating procedures and limitations will be used in PJM DA analysis. If the PJM DA analysis indicates an operational restriction, a TSA analysis will be performed and the impacted Transmission Owner and Generation Owner will be notified of the new limits and the condition requiring the use of the new limits.

Note: PJM will analyze limits multiple days in advance and continue to reanalyze, revise and communicate limits as system forecasts change.

Real Time:

TSA will continuously monitor the fifteen (15) stability regions previously defined. If the TSA analysis indicates instability, PJM will direct the Transmission Owner and/or Generation Owner to take the necessary steps to alleviate the stability violation. The steps to take will be dictated by the specifics of the area and are included in the existing stability operating procedures

TSA Utilization – Planned Transmission/Generation Outage Scenario

Day Ahead:

For a planned outage of a transmission or generation facility that impacts the previously defined fifteen (15) stability areas, PJM will utilize the TSA tool to determine the “worst case” stability restrictions that will result from the planned outage. The stability restrictions will be communicated to the affected generation and transmission owners on a day ahead basis (or sooner as required). The TSA derived stability limitations will be included in the PJM DA Market.

Note: PJM will analyze limits multiple days in advance and continue to reanalyze, revise and communicate limits as system forecasts change.

Real Time:

PJM Dispatch will monitor the TSA tool in real time operations to ensure that the stability of the affected areas is maintained. Additional system adjustments may be required during real time to maintain stability as system conditions change. For areas with flexible generation, the real time TSA limits may be less severe than the DA calculated values and will be used to minimize the impact to generation in the area.

TSA Utilization – Unplanned Transmission/Generation Outage Scenario

Day Ahead:

N/A.

Real Time:



Due to the fact that a “worst case” DA study was not performed, PJM Dispatch will immediately direct the Transmission Owner and Generation owner to adjust the system based upon the published stability operating procedures. Once the system is secure, PJM Dispatch will continue to monitor the TSA tool in real time operations to ensure that the stability of the affected areas is maintained. Additional system adjustments may be required during real time to maintain stability as system conditions changes.

Depending upon the time of the equipment trip, it may be possible to include the unplanned outage in the analysis for the next operating day. The process listed under the “TSA Utilization – Planned Transmission/Generation Outage Scenario” would then be followed.

Communication between PJM, Generation Owners, Generating Plants, and Transmission Owners

All communication regarding TSA (both future and real-time operations) should be communicated by PJM to the generation and transmission operators. Generating Plants will receive their directives through their generation owner or via their normally utilized channels. If there is any confusion about communication, Generating Plants may contact PJM directly, however all affected parties should be apprised of the discussion.

Protocols to Establish and Control to TSA determined Limits

Day-Ahead

1. Determine the most limiting timeframe for the next operating day. Historical TSA study cases and planned outages information will show which time of day is most limiting for a given stability area.
2. Using the study mode of the TSA tool, build a case matching the forecast information for the operating day in question.
3. Utilize and document helpful and available non-cost measures (see below) to increase the stability limit in the case.
4. Once the case is complete with all adjustments made, run the case to determine the limit that will be used on the operating day for the studied stability area.
5. In the study case, note the output of any relevant units within the stability area.
6. Contact relevant Generation owners and inform them of the limits developed for the operating day. Determine how and when the necessary units will adjust in a safe and stable manner to meet the limits. This is generally achieved via manual dispatch or the PJM Unit Dispatch System if an interface has been established.



7. Once finalized with the Generation Owner, inform all affected transmission owners, PJM dispatch, and PJM markets of the plan
8. The TSA operating limits defined for the operating day should be followed unless TSA predicts or approaches a violation in real-time.

Note: PJM will analyze limits multiple days in advance and continue to reanalyze, revise and communicate limits as system forecast change.

Real-Time

1. Monitor TSA limits in real-time for any approaching violations.
2. If the limits in any stability area are violated, redispatch generation as necessary to bring the stability area below its limits. This is generally achieved via manual dispatch or the PJM Unit Dispatch System if an interface has been established.
3. If any units in a given stability area are looking to come online, a TSA study should be run using the most recent case. Turn the unit on in study mode at the desired/target output and re-run the study to ensure stability will be maintained. In the case that the TSA limits have remained relatively stable and there is enough room for the unit to ramp up to a predetermined point/economic minimum, allow the units to come online.

Corrective Actions

PJM and/or Transmission Owners shall study and implement all non-cost and off cost measures to improve stability limitations in the applicable day-ahead monitored areas and utilize generation adjustments to control stability concerns for all areas in real-time. These measures include but are not limited to the following:

Non-Cost Measures (Day-Ahead Only)

1. Raising the VAR output of other units monitored and/or other units in the area.
2. Switching of SVCs and/or bulk and distribution capacitors in the area.
3. Utilizing the Load Tap Changers (LTC) in the area.
4. Examining other system configuration options such as closing normal-open breakers, voltage schedule adjustments and coordination of area generator reactive output where effective and available.

Off Cost Measures (Day-Ahead and Real-Time)

When studying the Day-Ahead Monitored Areas, all of the available non-cost steps shall be completed prior to redispatch. Due to the severity of stability issues, when limits are approached and/or violated in real-time operation, redispatch will be used immediately.



Note: Since the TSA tool is exclusive to PJM, generation plants and transmission owners are required to follow PJM's direction at all times. At no time should a more or less restrictive case/limitation be deferred to from any source outside of PJM unless it is determined that the TSA tool is inoperable.

cc: (All affected generation owners/generating stations), (All affected transmission owners)

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