Working to Perfect the Flow of Energy

PJM Manual 38

Operations Planning

Revision: 7

Effective Date: December 20 , 2012

Prepared by

Operations Support Division

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PJM Manual 38

Operations Planning

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Approval

Approval Date: 12/20/2012
Effective Date: 12/20/2012

Simon Tam, Manager

Transmission Operations Department

Current Revision

Revision 07 (12/20/2012):

- Revised Attachment A, section A.4: added sensitivity study to monitor external facilities and contingencies along the PJM border. Added N-2 sensitivity analysis to avoid cascading outages due to relay-induced tripping.
- Revised Attachment A, section A.3.3: added note to incorporate significant DR into generation dispatch when appropriate (during summer OATF study)
- Revised Attachment B, section B.9: added the PJM action to redispatch if the contingency overload of a non-market BES facility is over its Load Dump rating.

Introduction

*We*lcome to the ***PJM Manual for Operations Planning***. In this Introduction, you will find the following information:

- What you can expect from the PJM Manuals in general (see "*About PJM Manuals*").
- What you can expect from this PJM Manual (see "*About This Manual*").
- How to use this manual (see "*Using This Manual*").

About PJM Manuals

The PJM Manuals are the instructions, rules, procedures, and guidelines established by PJM for the operation, planning, and accounting requirements of PJM RTO and the PJM Energy Market. The Manuals are grouped under the following categories:

- Transmission
- PJM Energy Market
- Generation and transmission interconnection
- Reserve
- Accounting and Billing
- PJM Administrative services

For a complete list of all PJM Manuals, go to www.pjm.com and select "Manuals" under the "Documents" pull-down menu.

About This Manual

The ***PJM Manual for Operations Planning*** focuses on how PJM and the PJM Members are expected to carry out reliability coordination duties in accordance with the PJM Reliability Plan.

The ***PJM Manual for Operations Planning*** consists of three sections. These sections are listed in the table of contents beginning on page ii.

Intended Audience

The Intended Audiences for the ***PJM Manual for Operations Planning*** are:

- *PJM technical support staff*— Prepare and disseminate the reliability analyses.
- *Transmission Owner and Generation Owner Operators* — Use the operation planning information to supplement real time operations tools.
- *PJM system operators* — Use the operation planning information and perform current day analysis to supplement real time operations tools.

References

There are several reference documents that provide background or relate to the ***PJM Manual for Operations Planning***:

- PJM Manual for ***Balancing Operations*** (m-12)
- PJM Manual for ***Transmission Operations*** (m-03)
- PJM Manual for ***System Restoration*** (m-36)
- PJM Manual for ***Definitions & Acronyms*** (m-35)

Using This Manual

Because we believe that explaining concepts is just as important as presenting the procedures, we start each section with an overview. Then, we present details and procedures. This philosophy is reflected in the way we organize the material in this manual. The following paragraphs provide an orientation to the manual's structure.

What You Will Find In This Manual

- A table of contents that lists two levels of subheadings within each of the sections
- An approval page that lists the required approvals and a brief outline of the current revision
- Sections containing the specific guidelines, requirements, or procedures including PJM actions and PJM Member actions
- Attachments that include additional supporting documents, forms, or tables.
- A section at the end detailing all previous revisions of the PJM Manual.

Section 1: Seasonal Operating Studies

Welcome to the Seasonal Operating Studies section of the **PJM Manual for Operations Planning**

- This section of the manual addresses PJM preparation of seasonal operating studies.

1.1 PJM Seasonal Operating Studies

The PJM Operations Assessment Task Force (OATF) is responsible for the preparation of seasonal operating studies (two per year—summer and winter). OATF is composed of representatives from the transmission owners (TOs) and PJM. PJM provides the leader of the OATF and is responsible for the analysis and publication of results.

This study assesses the PJM RTO Bulk Electric System as it is expected to exist during the upcoming peak season. The purpose of the study is to determine the ability of the PJM system to be operated reliably in accordance with NERC, RFC, and SERC standards. The results of the study are based on the assumed system conditions which differ from actual operating conditions due to unplanned generation and transmission outages, the effects of unseasonable weather on load, and unit availability other than what was simulated in the study. Refer to the OATF Scope in Attachment A.

Power flow cases are developed which represent probable system conditions during the upcoming peak season. Thermal and reactive limits are identified and supplemental sensitivity analyses are performed that address areas of concern. [NERC Standard TOP-002-a, R11]

PJM Actions:

PJM is responsible for the following activities:

- Providing a leader of the OATF.
- Preparing a study plan for the seasonal study and gaining approval of the plan from the OATF and the PJM System Operations Subcommittee (SOS).
- Requesting and receiving data from the TOs and incorporating the TO data into the analysis
- Running the power flow cases and sensitivities.
- Analyzing the output of the cases and sensitivities and developing analysis for review by the TOs.
- Upon review by the TOs, publish the results of the study to PJM System Operations and the TOs.
- Provide summary documentation and training to System Operators.

PJM TO Member Actions:

PJM TO Members are responsible for performing the following activities:

- Providing a representative to the OATF.

- Providing data, as requested by PJM, in order to create the power flow cases to accomplish the study.
- Cooperate with PJM and the other TO members to complete the study and review the results.
- Communicate the results, as necessary, within the respective TO organization.
- Provide summary documentation and training to System Operators.

1.2 Interregional Studies and Assessments

PJM participates on a number of interregional studies and assessments that are prepared under of the auspices of the Eastern Interconnection Reliability Assessment Group (ERAG). Seasonal studies are prepared two times per year-summer and winter. These studies assess the Eastern Interconnection Bulk Electric System as it is expected to exist during the upcoming peak season and the ability of the Eastern Interconnection Bulk Electric System to be operated reliably in accordance with NERC and Regional Standards.

The PJM representative is responsible for providing necessary data and information used in the analysis. Also, as the study cases are created and analyzed, the PJM representative is required to review study results and provide comments so that reports can be created and distributed.

In addition to the Seasonal studies, the ERAG also perform mid-term and long term assessments on an ad-hoc basis.

Three inter-regional study forums coordinate the analysis under the auspices of the ERAG Management Committee. These studies are performed to assess the anticipated performance of the inter-regional system and identify trends in the thermal and reactive behavior of the network. These forums are the:

- NPCC - RFC
- RFC - SERC East (VACAR, TVA)
- MRO – RFC – SERC West (TVA, Entergy, Gateway) - SPP

Additionally, PJM participates in several regional seasonal assessments to analyze the anticipated performance of the upcoming SERC and NPCC regions. These studies include:

- PJM-NYISO seasonal operating study
- The SERC seasonal assessment
- NPCC CO-12 (NPCC seasonal assessment)

Interregional studies and assessments are an important source of information about projected conditions for upcoming peak seasons. The results of such studies are distributed to PJM Operations Staff and System Operators to ensure that they have the benefit of all such analyses.

Section 2: Outage Coordination

Welcome to the *Outage Coordination* section of the ***PJM Manual for Operations Planning***. In this section, you will find the following information:

- Generator Outage Coordination
- Transmission Outage Coordination

2.1 Generator Outage Coordination

Generation Owners are required submit Outage Requests in eDart for all outages to PJM in advance of the outage start date. PJM staff is required to analyze submitted outages to ensure outages do not violate PJM reliability criteria and market rules. This notification process is not limited to MW reduction; it also includes changes to D-Curve information, Voltage Regulator Status, and other equipment outages that could result in the loss of multiple generators at a common plant. The PJM Pre-Scheduling Operations Manual (M10), Section 2, Outage Reporting, documents the PJM generator outage submittal, coordination and approval process. [NERC Standard TOP-003, R1, R2]

2.2 Transmission Outage Coordination

Transmission Owners are required to submit Outage Requests in eDart for all outages to PJM in advance of the outage start date. PJM will provide all relevant information required for system studies, such as critical facility status, Load, generation, operating reserve projection, and known Interchange Transaction via the NERC SDX secure site. The files are continuously updated on a 15-minute basis. [NERC Standard IRO-004-1] PJM staff is required to analyze submitted outages to ensure outages do not violate PJM reliability criteria and market rules. Attachment B: Transmission Reliability Analysis Procedure describes the process PJM Reliability Engineers apply to ensure transmission outages are properly analyzed and coordinated. The PJM Transmission Operations Manual (M03), Section 4, Reportable Transmission Facility Outages, documents the PJM transmission outage submittal, coordination and approval process.

Section 3: Next Day Reliability Analysis

Welcome to the *Next Day Reliability Analysis* section of the ***PJM Manual for Operations Planning***. In this section, you will find the following information:

- Process for developing the next day reliability analysis

3.1 Overview

The purpose of the next day reliability analysis is to ensure that a comprehensive operating plan can be developed which meets all of the reliability requirements and provides for a level of uncertainty in facility availability that is inevitable in real time operations.

The next day analysis brings together the latest available information regarding outages, system topology, load forecast, unit commitment, and interchange schedules, as the inputs to the analysis. The PJM EMS study model utilized in the analysis is derived from a recent Real Time State Estimator case, which reflects the real time PJM EMS model, the full list of BES facilities monitored as part of PJM's Real Time, and the full list of contingencies screened as part of PJM's Real Time analysis. This base case study model is run in the EMS study mode and is modified to reflect anticipated system conditions during the next operating day.

The results include an analysis of all BES facilities at projected peak and valley conditions for the next operating day, with a full AC analysis of all BES facilities for the full contingency list PJM screens in Real Time Operations. This includes all SOLs and IROLs for thermal, voltage, and voltage drop violations. The analysis is shared with the operators on shift, TOs, and neighboring RCs and BAs.

PJM Actions:

- Perform the next day analysis using the Transmission Reliability Analysis procedure. (Attachment B).
- Coordinate action plans with affected Transmission Owners and external systems. Schedule out-of-merit generation as required.
- Distribute results to PJM shift teams, neighboring RCs, PJM TOs, and others by 15:00 CST.

PJM Member Actions:

- Coordinate scheduled transmission outages with PJM Staff.
- Communicate mitigation strategies with system operators.

Attachment A: OATF Scope

A.1 Purpose of Operating Study

The PJM Operations Assessment Task Force (OATF), under the direction of the PJM System Operations Subcommittee Transmission (SOS-T), will conduct a study for the summer or winter "study period" as defined below. The purpose of this study will be to analyze a representation of the PJM system with the transmission and generation configuration approximating the conditions expected to exist during the study period (see Key Assumptions & Model Definition section for more detail). The study will focus on the current PJM RTO boundary and the boundaries of any applicable external companies that will be integrated into PJM prior to the study period at the time the scope for the study is drafted by PJM.

The PJM Operations Assessment Task Force (OATF) consists of representatives from PJM and Transmission Owner members including:

- Atlantic City Electric, American Electric Power, Baltimore Gas & Electric, Commonwealth Edison, Cleveland Public Power, Duke Energy Ohio / Kentucky, Duquesne Light, Dominion, Dayton Power & Light, Delmarva Power, FirstEnergy, PECO, Potomac Electric Power Company, PPL Electric Utilities, Public Service Electric & Gas, Rockland Electric Company, UGI Utilities, Neptune Transmission, Linden VFT, and Eastern Kentucky Power Cooperative (EKPC included effective summer 2013)

A.2 Scope Objectives

- Develop seasonal power flow base case representative of expected system conditions for the study period.
- Identify thermal overloads and voltage limit violations based on AC N-1 contingency analysis as well as switching and/or off-cost requirements for transmission control.
- Determine reactive transfer capability limitations for the current Eastern, Central, Western, Bedington–Black Oak, AP South, AEP-Dominion, and Cleveland interfaces. Identify the PJM limit to west-to-east imports associated with the above reactive transfer capabilities.
- Determine whether, at the conditions studied, the present fixed tap settings on the 500/230 kV transformers permit an acceptable voltage profile.
- Determine the facilities that may limit thermal transfer capability into the major PJM load areas.
- Review and evaluate the effectiveness of existing operating procedures that are used to improve PJM transfer capabilities. Suggest practical system modifications to further improve PJM transfer capabilities. Revise operating guidelines as required.
- Identify conditions where the planned maintenance outages of PJM generation or transmission facilities negatively impact the reliability of the Bulk Power System.
- Identify the impact of delays in the installation of new transmission facilities.

- Perform sensitivity studies as listed in Section A.4 below.
- Perform analysis to determine survivability of maximum credible disturbance facility loss. See Section A.5 below. (Summer study periods only)

A.3 Key Assumptions and Model Definition

A.3.1 Base Case Parameters

- The PJM RTO load will be the sum of all 50/50 non-diversified peak loads of each transmission company zone obtained from the latest PJM Load Forecast Report. Forecasting judgment may be applied to these target loads to determine the actual megawatt load that will be modeled.
- The net PJM interchange level will be modeled to reflect typical seasonal values.
- The Branchburg–Ramapo line flow will be set to a typical megawatt value for the conditions studied.
- The PS–ConEd phase angle regulators will be set to maintain a typical megawatt flow for the conditions studied.
- Neptune HVdc line flow will be set to a typical megawatt value for the conditions studied.
- Linden VFT will be set to a typical megawatt value for the conditions studied.

A.3.2 PJM System Representation

- The reactive load modeled at each of the company load buses should reflect actual experienced data. Whenever possible, the company reactive loads should not be factored from one load level to another.
- Whenever possible, supervisory controlled capacitors should be represented explicitly in the case.
- The power interchanges between companies external to PJM should reflect typical values.
- All major generating units should be modeled on their own low voltage generator buses.
- Generator voltage regulators should:
  - Control remote bus voltages in base case.
  - Control generator terminal voltages in contingency cases.
- All generating units should be modeled with a reactive capacity that accurately reflects the limits experienced during actual operations.
- Any generating unit that is scheduled out for maintenance during the entire study period should be placed out of service in all base power flows.
- Any transmission line scheduled out of service for the majority of the study period should be placed out of service in all base power flows.
- Distribution capacitors, reactors, and synchronous condensers should be represented in the same manner that would be expected in actual system operations.

- The PJM system transmission line ratings used should be the seasonal normal and approved short-term emergency MVA line ratings consistent with each company's operating philosophy.
- The voltage schedules used should represent those expected to be followed during the study period for all controllable buses. This includes both generator and LTC (Load Tap Changers) regulated buses.
- An accurate representation of all power systems external to PJM should be merged with the PJM power flow model.

A.3.3 PJM Dispatch

- All generator economic dispatch data will be derived from historical bid data from the previous comparable season. This data includes must run and minimum generation requirements.
- Base load units will be modeled as must run.
- Dual fuel units should be priced for the fuel most likely to be used per individual fuel contracts.
- Discrete unit outages for the study period will be determined based on an average obtained from unavailable generator MW (maintenance and unplanned) on ten days from the previous comparable season that are at or near the load level to be studied.
- Non-Utility generation shall follow the same guidelines whenever the appropriate data is available.
- Hydro-generation and wind generation will be modeled at typical levels expected during the study period.
- Significant Demand Response (DR) will be incorporated into the dispatch when appropriate, and modeled consistent with real-time system operations. The granularity of the DR modeling will be based on the available data and any software limitations.

A.4 Sensitivity Studies

Sensitivity studies will be performed on facilities identified by the SOS-T as potential IROL facilities.

Sensitivity study will be performed on Baltimore/PEPCo import capability for the summer study period only.

Additional sensitivity study will be performed by monitoring external facilities and applying external contingencies which are located electrically close to the PJM border. This additional study will help prevent issues along the seams of PJM and its neighbors.

Analysis of specific N-2 conditions will also be performed to avoid situations where cascading outages could occur due to an N-1 contingency followed by relay-induced line tripping resulting from insufficient time for Operations to react.

Due to the study timeline of work and deliverables, PJM may not be able to accommodate certain sensitivity studies requested by members of the OATF. In general, PJM cannot accommodate sensitivity studies involving:

- Analysis of load conditions that significantly diverge from the peak load for the study period (e.g. light load and shoulder period conditions)
- Analysis of a localized issue affecting only one company transmission zone

A.5 Maximum Credible Disturbance Study

A maximum credible disturbance 'max-cred' is defined as having a reasonable possibility of occurring (being credible) and also of being outside the normal N-1 contingency criteria. For the purpose of assisting Generator Owners (GO) and Transmission Owners (TO) in determining critical assets pursuant to NERC Critical Infrastructure Protection (CIP) Standard CIP-002-2, PJM will perform analysis to determine the survivability of max-cred facility loss for the summer study period only. GO shall communicate Common Mode Impact contingencies to PJM and the affected Transmission Owner through the PJM SOS-T (contacting PJM Chairman and Transmission Owner Representative) for inclusion in the PJM Summer OATF Maximum Credible Disturbance Contingency Analysis. TO shall review current set of maximum credible disturbance contingencies and supply changes to the PJM OATF representative prior to finalizing the OATF Scope for the summer study period. PJM will communicate max-cred contingencies that are not survivable to the impacted asset owner.

References:

1. PJM TO/GO Critical Asset Identification Guidelines (http://www.pjm.com/markets-and-operations/compliance.aspx)

2. NERC CIP-002-4 Standard (http://www.nerc.com/files/CIP-002-4.pdf)

Attachment B: Transmission Reliability Analysis Procedure

Documentation Sources:

PJM Manual M-03

NERC Standards FAC-011-1, IRO-004-1, IRO-014-1, TOP-002-2

Program access requirements for Outage Analysis

- eDART (PowerBuilder) – For viewing/revising transmission and generation outage tickets
- eDART Intranet - For the eDART-to-EMS Outage Bridge and editing/creating Impact Associations
- F5 Networks VPN Client – EMS firewall authentication and tracking application. Requires VPN key fob synchronized passcode
- EMS Production servers
- SIEMENS ODV Client – For accessing the SIEMENS Homepage Web Application
- FDB access – For load forecasts and Day-Ahead generation commitment bridge
- DMT/SCED – For additional generation information
- EES – Enhanced Energy Scheduler

B.1 Initial Preparation/Information Gathering:

- Obtain the load forecast for the study period.
  - Utilize the PJM Load Forecast Spreadsheet Application
  - Or, use the following web address: http://oasis.pjm.com/doc/projload.txt
- Obtain weather data for the PJM footprint and neighboring areas during the study period in question.
- Obtain the list of internal transmission and generation outages that will occur on the study date from the eDART Outage Scheduling Application.
- Obtain External Outage information via the following:
  - The MISO daily outage reports.
  - The RC Day-ahead spread sheet application to pull SDX Generation and Transmission Outage information.
- Obtain Interchange information via the following:
  - Utilize the EES program to review the PJM schedule interchange values
  - Utilize the SDX data to review the external BA-to-BA schedule interchange values
- Check for any current and/or projected System conditions that may impact the outages scheduled.

  - Example: System wide peak loads, Heavy Load Voltage Schedule Alerts, SMDs, etc.
- PJM will cancel scheduled outages, regardless of submittal time, if the outage could jeopardize system reliability.

B.2 Study Case Set-up and Verification:

EMS Study Case Set-up:

- The Real Time EMS study package is used to search for a State Estimator saved case with load levels that are as close as possible to the peak (or valley) forecasted Balancing Authority loads for the study period in question.
- Following selection of the base case, utilize the EMS study package to load the saved State Estimator Solution into your power flow study.
- Make any changes to transmission equipment (lines, breakers, caps, reactors, etc) that are expected to occur between the present and the start of your study period (i.e. Transmission line outages or returns).

  Note: The intranet eDART application may be used to import the transmission outages and returns to your selected study starting point.

- Make any changes to generation that is expected to occur between the present and the start of your study period.
  - Utilize the EMS automation to load the forecasted PJM wind generation into the study case.

    Note: Generators returning from an outage are not guaranteed to be on-line for the study date in question. Use the load forecast in conjunction with the Unit Price information from DMT to make an engineering assessment of whether or not the unit will be on-line. If unsure, the analysis should be performed with the unit on and off-line to determine its impacts.

- To account for the MISO wind impacts:
  - Utilize the MISO Wind Output/Forecast webpage
  - From the webpage, note the actual MISO wind output at the time of the initial SE saved case snapshot
  - Note the peak MISO wind forecast for the study date
  - Due to ~85% of the MISO wind being physically remote from the PJM system, the wind farm units are not explicitly modeled. However, their net effect can be reflected in the tie flows between PJM and the 'WEST' equivalent area in the EMS Model. Therefore, adjust the net interchange in the WEST area to reflect the MISO wind forecast as shown in the following example.
    - <u>Example</u>: The SE Base Case had 2000MWs of wind output in the MISO footprint. The forecast indicates 3000MWs of wind in MISO. Scale the PJM EMS 'WEST' area generation up by 1000MWs to account for the additional wind.

- The saved state estimator case retrieved may have CTs that were running for congestion, reliability, etc. These CTs should be turned off. Appropriate generation may need to be adjusted for this.
- Adjust the Rating Temperature Sets for each transmission zone to reflect the highest expected temperatures for the study date.
- Verify that all Balancing Authority loads match their respective peak load forecasts. Utilize the EMS "Company (Scale Load or Generation)" function to manually scale the loads to match the forecasts if required.
- Adjust generation both internally and externally as needed to incorporate the projected scheduled interchange into the case.
- Using the EMS study package, update contingency definitions by pulling in the Real-Time Contingency List; taking care to update that list, as needed, for changes in system conditions between the current time and your study period.

B.3 EMS Study Case Verification:

- Run Power Flow to verify that the case converges and make adjustments if necessary.
- Run Security Analysis to verify the results. Determine if there are any pre-existing overloads and/or voltage issues that are not a result of the outages to be studied.
- The case shall be adjusted to control for any thermal or voltage violations before analyzing future outages in the study.
- Run TLC to verify the results. Adjust Case to bring transfers within tolerances.

B.4 Outage Analysis:

- Perform Thermal and Voltage (AC) analysis for all transmission and generation outages, occurring during your study period, individually.

B.5 Internal Outage Review Process:

- Consider the outage submittal status according to PJM rules ((i.e.) is it on-time, late, emergency, etc)?
- Determine if any temporary switching is required to outage the facility, or return it to service, and if this switching may impact the transmission system.
- Determine if there are any operating procedures associated with the outage:
  - Review the Transmission Owner's description of work and "System Impacts Associations" located on the eDart Ticket.
  - Review PJM Transmission Operations Manual M-03 Section 5 to determine if any procedures are predefined that will require special contingencies to be active to address operational or stability concerns. Special contingencies may include the impact of pre-defined Special Protection Schemes.

  - Review PJM Transmission Operations Manual M-03 Section 5 to determine if any predefined procedures require reduction to transmission or voltage limits to maintain system security.
- Implement/suppress any contingencies in the study case as required to model any special operating procedures.
- According to PJM Transmission Operations Manual M-03 Section 4, Transmission Owners must notify PJM of planned Hotline, Protective Relay, and Protection System Outages by submitting these planned outage requests to eDART. All unplanned outages of this type are communicated to PJM Dispatch and subsequently submitted to eDART. Review these Hotline, Protective Relay, and Protection System Outage requests to identify any changes to normal fault clearing. Model any identified changes to normal fault clearing within the PJM EMS by modifying the applicable PJM Security Analysis Contingencies to accurately study the system impact of Hotline, Protective Relay, and Protection System Outages.
- Determine if a morning load pick-up or multiple time/load studies need to be performed.
- Make any changes necessary to your case as a result of your outage review. E.g. make contingency adjustments, implement special/operating/emergency procedures, make generator adjustments due to stability limits, etc.

B.6 Internal Outage Analysis Process:

- Implement the submitted (both planned and emergency) transmission and generation outages, one at a time, in the EMS study case.
- Process reactive tickets (d-curve changes and voltage regulator outages).
- Analyze generator reactive lead/lag tests.
- Run powerflow and security analysis to determine any thermal, voltage, SOL, or IROL impacts arising from the outages and projected system conditions.
- Run the EMS Study Transfer Limit Calculator (TLC) to determine projected IROL facility operating limits.
- Perform an Open-Ended voltage study, based on projected system condition for the time of switching, for all long-line EHV outages. Note any changes to start times that may be required due to a high instantaneous voltage rise.
- Resolve thermal overloads, voltage, SOL, and/or IROL violations with non-cost operations first, such as system reconfiguration, then by adjusting generation, if required. Refer to PJM Manual M03 for additional details regarding thermal and voltage controlling actions.
- Initiate contact with the affected Member TOs and/or External Reliability Coordinators to coordinate possible system reconfiguration options; inform them of outage conflicts, the potential for off-cost operations, and/or possible outage denial based on PJM Market rules and/or Reliability Concerns.

Note: The outage submittal designation - “late”, “on-time”, “past deadline”, or “emergency” - will help to determine what actions shall be taken, if any, to resolve the issues that develop in your study.

- Verify generator availability for expected off-cost operations. Check start-up times, no-load/start-up costs, etc. to ensure the System Reliability can be maintained.
- Likewise, verify corresponding generator outage tickets have been submitted in eDART for all transmission outages that restrict generator output.

B.7 Analyze External Outages:

- Review and implement the External SDX Transmission and Generation changes in the EMS Study Case. Run powerflow and security analysis to determine any thermal or voltage impacts arising from the outages.
- Analyze the overloads and or voltage issues for possible solutions. Contact with RC (MISO, TVA, NYISO, etc) may be required at this point to inform them of possible issues arising from internal and/or external outages.
- Verify if additional peak, off-peak, morning load pick-up, or other studies need to be done. If so, obtain an appropriate case and repeat the process for any or all outages in question.
- Run the Transfer Limit Calculator (TLC) and check for impacts to transfer limits as a result of any of the outages.

B.8 Day-Ahead Market Coordination:

- Submit a copy of the PJM Transmission Log to the Day Ahead Market Operator by 10:00 hours. The following information must be submitted in the report:
  - Note any outage that is projected to cause congestion and is submitted on time. (late outages causing congestion shall be denied/cancelled)
  - Note any outage submitted as an emergency.
  - Note any outage requiring pre-contingency switching, including pre-contingency switching solution.
- When the Day Ahead Market Commitment is finished, use the EMS to bridge all Day Ahead Committed generation data into the EMS Study Case.
- Re-run your analysis to determine the impacts of the Day Ahead Committed Generation.
- Based on the Study Results, determine any additional generation that must be called on Day Ahead to maintain transmission system reliability. Document required Combustion Turbines with notification + start-up times > 2 hours.

B.9 Non-Market BES Facilities:

Outage Approval Process

Reliability Engineers will evaluate and approve transmission outages consistent with the PJM Transmission Operations Manual (M03), PJM Balancing Operations Manual (M12), PJM Reliability Coordination Manual (M37), and PJM Operations Planning Manual (M38) ensuring reliability is maintained on all BES facilities. Additional coordination may be required with the Transmission Owner for non-market BES facilities to ensure contingency results are consistent in real-time operations:

- For planned outages, the differences in contingency analysis results should be rationalized in advance and instruction provided to real-time operations as to which EMS analysis is more accurate (PJM or TO).
- An operating plan shall be agreed upon in advance, which may require the advanced scheduling of long-lead time generation at the expense of the Transmission Owner.
- The agreed upon controlling actions should be documented and communicated to PJM and TO or GO Dispatchers.
- Under certain conditions, a generator may violate GSU limits upon the loss of another facility. A generator will be permitted to operate above their emergency limits so long as a post-contingency reduction plan has been agreed upon. Pre-contingency reductions would be required in the absence of an agreed upon plan.

Resolving Modeling Differences:

For planned outages, the differences in PJM and TO EMS Security Analysis results should be rationalized in advance and instruction provided to real-time operations.

Real-time Controlling Actions:
Real-time controlling actions to Non-market BES facilities are prioritized as follows:

1. Non-cost measures including:
   A. PAR adjustments
   B. Transformer Tap Adjustments
   C. MVAR adjustments
   D. Switching Capacitors / Reactors in/out-of-service.
   E. Switching Transmission facilities in/out-of-service.
   F. Curtailing Transactions “Not-Willing-to-Pay” congestion
2. Issuing a Post-Contingency Local Load Relief Warning (PCLLRW)
3. If the contingency overload is over its Emergency rating but <u>below its Load Dump rating</u>, PJM will manually direct the redispatch of effective generation at the request of the Transmission Owner. The effective generation will be cost-capped but not permitted to set LMP since the facility is not a “Market” facility. PJM will commit effective generation in order to minimize the total MW committed to control the constraint.

4. If the contingency overload is over its Load Dump rating, PJM will manually direct the redispatch of effective generation to control the overload. The effective generation will be cost-capped but not permitted to set LMP since the facility is not a "Market" facility. PJM will commit effective generation in order to minimize the total MW committed to control the constraint.
5. Controlling to GSU Limits: Under certain conditions, a generator may violate GSU limits upon the loss of another facility. A generator will be permitted to operate above their emergency limits so long as a post-contingency reduction plan has been agreed upon. Pre-contingency reductions are required in the absence of an agreed upon plan.

Maintaining System Reliability

PJM is required to ensure system reliability is maintained; ensuring there is an operating plan for all BES facilities. If PJM or a TO analysis indicates that an planned facility outage would result in non-converged contingencies, post-contingency voltages below LD voltage limits, post-contingency voltage drop violations, actual voltages below normal limits or actual flows in excess of normal ratings after all non-cost measures are exhausted, the TO will be required to schedule generation or the planned outage cancelled.

Note: A PCLLRW is not an acceptable controlling measure under system conditions where there are pre-contingency violations to operating criteria or when there is insufficient time to dump load post-contingency.

B.10 Information Dissemination:

For outage approval studies:

- Approve outage tickets in eDart by 14:00hrs two-business days prior to the start of the outage.

For Day-Ahead studies:

- Update the OASIS "Forecasted Constraints" webpage.
- Prepare the RC Day-Ahead report and e-mail it to all internal TOs, SOS-T Representatives, and external RCs by 15:00 hours CST.
  - The report consists of outages, contingencies, mitigation strategies, interchange schedules, study results, voltage regulation, MVAR testing schedule, and TLC Limits.
  - Report internal (PJM) outages 100 kV and above that may impact internal or external facilities, outages causing congestion on market BES facilities and Outages impacting non-market BES facilities.
- Commit additional needed generation for specific constraints.
- Review the Day Ahead Report with the PJM Dispatchers, as well as the PJM Shift Supervisor.

Revision History

Revision 06 (10/12/2011):

- Revised Attachment A: OATF Scope revised to include Duke Energy Ohio / Kentucky.
- Revised Attachment A: removed 50/50 diversified sensitivity study from OATF Scope

Revision 05 (05/01/2011):

- Annual Review
- Revised Attachment A: OATF Scope revised to include Cleveland Public Power (CPP) and the Cleveland reactive interface.
- Revised Attachment B: Transmission Reliability Analysis Procedure Section B.2 to include specific steps to capture the impacts of MISO wind in the study case.

Revision 04 (01/01/2010):

- Attachment B: Added details to incorporate Wind Power Forecast.

Revision 03 (06/26/2009):

- Annual Review
- Reformatted to assist in compliance tracking.

Revision 02 (02/10/2009):

- Section 3 and Attachment B: Provided clarifying details.
- Updated Attachment B: Transmission Reliability Analysis Procedure

Revision 01 (06/01/2008):

- Updated document to include reference to Bulk Electric System (BES)
- Modified Section 1: Seasonal Operating Studies, Subsection Interregional Studies and Assessments.
- Updated Attachment A: OATF Scope.
- Updated Attachment B: Transmission Reliability Analysis Procedure

Revision 00 (05/15/2007):

- New manual