2004 BASELINE RTEP REPORT

For the 2005 - 2009 Period

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INTRODUCTION

The PJM Regional Transmission Expansion Planning (RTEP) Process requires that cost responsibility for facility enhancements be established. There are three types of facility enhancements for which cost assignment must be made:

- Attachment Facilities required solely to interconnect a new generation or merchant transmission project,
- Network Facilities that are required to enhance the network solely or in part because of a proposed project, and
- Network Facilities required to support load growth.

In order to establish a starting point for development of Regional Transmission Expansion Plans and determine cost responsibility for expansion facilities, a 'baseline' analysis of system adequacy and security is necessary. The purpose of this analysis is threefold:

- to identify areas where the system, as planned, is not in compliance with the applicable reliability standards (for purposes of this report, "applicable reliability standards" will refer to NERC, MAAC, ECAR, SERC, MAIN, PJM and the individual transmission owner reliability standards). The baseline system will be analyzed using the same criteria and analysis methods that will be used for assessing the impact of proposed new interconnection projects. This will ensure that the need for system enhancement of the baseline system and enhancements due to interconnection projects are determined in a consistent and equitable manner.
- to bring those areas into compliance, develop and recommend facility expansion plans, including cost estimates and estimated in-service dates.
- to establish what will be included as baseline costs in the allocation of the costs of expansion for those generation and merchant transmission projects proposing to connect to the PJM system.

The system as planned is tested for its compliance with applicable reliability standards and PJM design standards to accommodate the forecast demand, committed resources, and commitments for firm transmission services for a specified time frame. Areas not in compliance with the standards are identified and enhancement plans are developed to achieve compliance.

The 'baseline' analysis and the resulting expansion plans serve as the base system for the conduct of Feasibility Studies and Impact Studies.

This report presents the results of the 'baseline' analysis from 2005 through 2009 for the PJM "footprint" as it existed in May 2005.

EXECUTIVE SUMMARY

PJM has responsibility for the development of a Regional Transmission Expansion Plan (RTEP) for the PJM system that will meet the needs of the region in a reliable, economic and environmentally acceptable manner. PJM also is responsible for recommending the assignment of any transmission expansion costs to the appropriate parties. In order to carry out these responsibilities, it is necessary to establish a starting point or 'baseline' from which the need and responsibility for enhancements can be determined.

In order to establish that baseline, PJM has defined the five (5) year period from 2005 through 2009 as the 2004 "baseline" planning period. The existing system plus any planned modifications to the transmission system scheduled to be in service prior to the 2009 summer peak period was chosen as the base system. All new generation and merchant transmission projects in Queues A through L that executed a Facility Study Agreement were also included in this baseline system along with any associated transmission enhancements as identified in the Impact Studies. Any Transmission Owner identified transmission enhancements independent of those associated with new generation or merchant transmission projects were also included. Only firm transmission service currently committed for the period was represented.

PJM has conducted a comprehensive load flow analysis of the ability of the PJM system to meet all applicable reliability planning criteria which are listed below:

- NERC Planning Standards ftp://www.nerc.com/pub/sys/all_updl/pc/pss/ps9709.pdf
- MAAC Reliability Principles and Standards (http://www.maac-rc.org/reference/princstandards.html) will be applied for all facilities included in the MAAC Compliance Facility list (http://www.maac-rc.org/reports/eia_ferc_nerc/downloads/comp-facil.pdf).
- ECAR Reliability Criteria (Document No. 1) (http://www.ecar.org/documents/document%201_6-98.pdf) will be applied to all ECAR networked transmission systems rated 100 kV or higher.
- MAIN Reliability Criteria **(http://www.maininc.org/bg/bgidx.htm)** will be applied to all MAIN networked transmission systems rated 100 kV or higher.
- SERC Reliability Criteria (http://www.serc1.org/Pages/ComplianceContentPage.aspx?ID=25) will be applied to all SERC networked transmission systems rated 100 kV and higher.
- PJM Reliability Planning Criteria as contained in Manual M14B Attachment G (http://www.pjm.com/contributions/pjm-manuals/pdf/m14bv04.pdf)
- Transmission Owner Reliability Planning Criteria as filed in their respective FERC 715 filing.

This report documents all analysis completed as of May 2005. Additional studies to evaluate NERC category C contingencies in the PJM Western Region and the PJM Southern Region are continuing. Several load deliverability areas, such as Eastern Mid-Atlantic, are also still under evaluation. Once all system upgrades are identified for the preceding sets of analysis, a short circuit analysis of the 2009 system will also be completed. Results of these ongoing studies will be included in an Addendum to this report.

All conditions where the system was not in compliance with the applicable reliability standards were documented and system reinforcements required to bring the system into compliance were identified along with estimated cost and lead-time to implement them.

Those areas that were found to be non-compliant with applicable reliability standards establish the need for reinforcement in those areas independent of any future interconnection projects not included in the baseline analysis. This fact and the identified reinforcements to bring the system into compliance will be used in evaluating the impact of the projects in Queues M & N that qualify and elect to proceed with the impact studies. The extent to which reinforcements identified in the baseline analysis are advanced, deferred, modified or eliminated will be used in determining cost responsibility for the final plans in the RTEP.

It should be recognized that the reinforcements proposed in this baseline analysis might be modified or eliminated as a result of generation or merchant transmission projects being added to or removed from the system. The development of the RTEP for PJM is an ongoing process, which will include the conduct of impact studies and development of plans to accommodate the new interconnection projects in Queues M & N. Upon completion of the impact studies some projects may elect not to proceed. When it is determined which projects will commit to proceed, a new baseline RTEP will be developed to meet the needs of the region, including the accommodation of all new projects committed to connect, during the next 5 year period. That RTEP will be recommended to the PJM Board of Directors for approval of proposed enhancements and will serve as the baseline for the next Queue of proposed projects.

The PJM Transmission Owners may identify the need to build additional system reinforcements that are not identified as required through the RTEP analysis.

KEY FINDINGS

The following areas of the system as planned through 2009 were found to be non-compliant with applicable reliability standards without additional reinforcement. These areas are described below along with any identified reinforcements to achieve compliance. The detailed descriptions of the conditions that result in non-compliance are reported in the Results section of this report.

1) The 14304 Wolfs – Oswego 138 kV circuit is contingency overloaded for the loss of the parallel circuit. The recommended upgrade is to reconductor the line with 636 ACSS at an estimated cost of $2 million.

2) The Mt Storm – Doubs 500 kV circuit was contingency overloaded at 103% of its emergency rating (2271 MVA) for the loss of the Black Oak – Bedington 500 kV circuit. The overload can be eliminated by retensioning the existing circuit. The new emergency rating will be 2400 MVA.

3) The Black Oak – Bedington 500 kV circuit exceeds the reactive limit (voltage problem) for the outage of Pruntytown – Mount Storm 500 kV circuit. PJM is continuing to work with AP to identify the appropriate system upgrade.

4) The Black Oak 500/138 kV transformer is contingency overloaded at 130% for the outage of Hatfield – Black Oak 500 kV. PJM is working with AP on a possible operating procedure to open the Black Oak 500/138kV transformer for the loss of the Hatfield – Black Oak 500kV circuit.

5) The North Shenandoah 138/115 kV transformer is contingency overloaded at 111% for the outage of Mt. Storm – Meadowbrook 500 kV. PJM is working with AP on a possible operating procedure to open North Shenandoah 138/115 kV transformer for the loss of Mt. Storm – Meadowbrook 500 kV.

6) All in-service Dominion generation was found to be deliverable. This represents about 110 generators with total MWs of approximately 22,250 MW. The list of all deliverability generators is found in Attachment 1.

OBJECTIVE AND SCOPE

The objectives of this study were as follows:

- To identify areas where the system as planned for the period 2005 through 2009 would not be in compliance with applicable reliability standards.
- To develop and recommend preliminary facility expansion plans, including cost estimates and estimated in service dates, to bring those areas into compliance.
- To establish what will be included as baseline expansion costs for the allocation of the costs of expansion for those projects included in Queues M & N.

The scope of this study included analysis for the period 2005 through 2009 to determine compliance with the all applicable reliability planning criteria.

Other than as required for the PJM Reliability Planning Criteria or an individual transmission owner criteria, the system was not analyzed under non-peak load flow conditions on the basis that the system can and will be dispatched to remain within first contingency operating limits. Transmission constraints on market dispatch are economic constraints. Economic constraints are not considered violations of reliability criteria as long as the system can be adjusted to remain within reliability limits on a pre-contingency basis. Performance of the planned system under intermediate and light load conditions will be analyzed in the PJM Reliability Assessments to verify that the system as planned can indeed be operated in compliance with the applicable planning criteria at all load levels. This will include a determination that the generation resources in PJM are sufficient and are appropriately dispersed so that the generation dispatch can be adjusted to maintain the system within established thermal equipment ratings and voltage criteria limits under intermediate and light load conditions.

The necessity of all system reinforcements previously identified in the previous RTEP Baseline Reports and the Queue A through L Impact Studies were evaluated. Any previously identified reinforcements that are no longer required were documented and removed from the list of RTEP Reinforcements.

ANALYSIS METHODOLOGY

Load flow simulation was based on a representation of the 2009 forecast peak load, existing capacity resources, and all proposed interconnection projects in Queues A through L that executed a Facility Study Agreement. All firm transmission services committed for the 2009 period were represented in the base case (see below). In addition, any transmission reinforcements planned to be placed in service by 2009 summer were represented.

RTEP 2009 – INTERCHANGE		
FROM	**TO**	**MW**
PJM	AMRN	-39
PJM	CIN	-399
PJM	EKPC	-70
PJM	FE	1040
PJM	IP	-1506
PJM	LGEE	-66
PJM	OVEC	-1390
PJM	ALTW	314
PJM	ALTE	216
PJM	CPLE	276
PJM	CPLW	250
PJM	DUK	150
PJM	MEC	1420
PJM	MECS	1079
PJM	NIPS	400
PJM	NYIS	1342
PJM	WEC	910
Total		**3927**

A load flow base case was developed for 2009 representing projected diversified summer peak loads across the PJM Control Area. All in-service PJM capacity resources were dispatched at approximately 90% of the installed capacity value. All remaining Queue A through L generators were initially modeled at 0 MW.

Study of all voltage limits was completed using this base system. For analysis pertaining to thermal limits including Generator Deliverability and Load Deliverability a multitude of dispatch patterns were analyzed. A complete description of the Generator and Load Deliverability procedures is contained in Attachment E of PJM Manual M14B.

The 2009 base case was also used to analyze network transfer capability. To maintain reliability in a competitive capacity market, resources must contribute to the deliverability of electricity in the Control Area in two ways: 1) energy must be deliverable from the aggregate of resources available to the Control Area to load in portions of the Control Area experiencing a localized capacity emergency, or deficiency, 2) capacity resources within a given electrical area must, in aggregate, be able to be exported to other areas of the Control Area within some bounds that separate the reliability requirements of the Control Area from the reasonable economic function of the market place. PJM has developed two methods for evaluating the adequacy of network transfer capability for each of these deliverability requirements. These methods are described in

more detail in Attachment E of PJM Manual M14B.

The CETO/CETL method will be used to determine if the Capacity Emergency Transfer Limit (CETL) to each of the various electrical areas of PJM is sufficient to deliver each respective area's Capacity Emergency Transfer Objective (CETO). The results of this analysis will be included in an Addendum to the RTEP Baseline Report.

The PJM Generation Deliverability procedure was used to determine if Network Transfer Capability was adequate to deliver all capacity resources out of defined areas to the network.

Finally, a short circuit analysis will be performed to determine if any of the 230 kV, 345 kV, or 500 kV breakers are overdutied. Calculated single phase to ground and three phase fault currents will be compared to breaker interrupting capability provided by the transmission owners for each breaker. All breakers having ratings less than the calculated fault currents will be identified.

RESULTS

The results of the baseline analysis for the 2005 – 2009 period are presented below.

PJM Generator and Load Deliverability Results

The PJM generator and load deliverability analysis were completed as defined in the procedures of Manual M14B. In general these tests involve n-0 (pre-contingency) and n-1 (single contingency) analysis to determine the sufficiency of transfer capability between generation resources and load within the PJM system. The Load Deliverability test assures that there is adequate import capability to serve load pockets experiencing a capacity emergency condition while the Generator Deliverability test assures that PJM capacity resources will not be bottled at peak load conditions.

Five areas of the PJM system were found to not be in compliance for the Generator Deliverability test for the 2005 – 2009 study period.

1) The 14304 Wolfs – Oswego 138 kV circuit is contingency overloaded for the loss of the parallel circuit. The recommended upgrade is to reconductor the line with 636 ACSS at an estimated cost of $2 million.

2) The Mt Storm – Doubs 500 kV circuit was contingency overloaded at 103% of its emergency rating (2271 MVA) for the loss of the Black Oak – Bedington 500 kV circuit. The overload can be eliminated by retensioning the existing circuit. The new emergency rating will be 2400 MVA.

3) The Black Oak – Bedington 500 kV circuit exceeds the reactive limit (voltage problem) for the outage of Pruntytown – Mount Storm 500 kV circuit. PJM is continuing to work with AP to identify the appropriate system upgrade.

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5) The North Shenandoah 138/115 kV transformer is contingency overloaded at 111% for the outage of Mt. Storm – Meadowbrook 500 kV. PJM is working with AP on a possible operating procedure to open North Shenandoah 138/115 kV transformer for the loss of Mt/ Storm – Meadowbrook 500 kV.

Load deliverability studies are being completed for the Eastern Mid-Atlantic zone and the results will be posted as an Addendum to this report.

NERC Category A & B Contingency Results - the PJM system was studied with all facilities in service and also for the loss of a single generator, transmission circuit, or transformer.

The 2009 system was tested for compliance with PJM, Transmission Owner, and Regional Reliability council application of all NERC category A & B contingencies. All facilities

monitored by PJM Operations were also tested against the PJM Reliability Criteria for n-0 and n-1 conditions. Where the physical design of connections or breaker arrangements resulted in the outage of more than the faulted facility when the fault was cleared, such additional facilities were also outaged in the load flow. For example, if a transformer is tapped off a line without a breaker, both the line and transformer were outaged as a single contingency event.

Facilities with pre-contingency flows equal to or higher than 100% of the normal rating and facilities with post contingency flows equal to or higher than 100% of the 4-hour emergency rating were identified. In addition, voltages were monitored based on the existing voltage limits used in PJM Operations.

All areas of the PJM system were found to be in compliance for the 2005 – 2009 study period.

NERC Category C Contingencies

For the nine NERC Category C contingencies, no problems have been identified in all studies completed to date. There is remaining category C analysis for 2009 ongoing and results of those studies will be documented in an Addendum to this report.

Attachment 1
Dominion Deliverable Generators

Unit Commercial Name	MW
Buxton and Ocracoke	18
Bath County 1	420
Bath County 2	505
Bath County 3	420
Bath County 4	420
Bath County 5	505
Bath County 6	420
Bellemeade	255
Birchwood	238
Bremo 3	71
Bremo 4	156
Buggs Island	138
Charles City Landfill	24
Chesapeake 1	111
Chesapeake 2	111
Chesapeake 3	156
Chesapeake 4	217
Chesapeake GT 1	15
Chesapeake GTS	129
Chesterfield 3	100
Chesterfield 4	166
Chesterfield 5	310
Chesterfield 6	658
Chesterfield CC 7	197
Chesterfield CC 8	200
Chesterfield(Shoosmith) LF	24
Clover 1	441
Clover 2	441
Cogentrix	93
Cushaw	2
Darbytown GT1	76
Darbytown GT2	76
Darbytown GT3	76
Darbytown GT4	76
Dinwiddie5	3
Edgecomb	116
Elizabeth River	312
Fauquier County Landfill	2
Fluvanna	912
Four Rivers 1	170
Four Rivers 5	606
Gaston 1	56
Gaston 2	56
Gaston 3	56
Gaston 4	57
Gosport	30
Gravel Neck GT3	73
Gravel Neck GT4	73
Gravel Neck GT5	73
Gravel Neck GT6	73

Gravel Neck GTS	37
Hall Branch	71
HCF	337
Hurt	80
Kerr Dam	240
Kitty Hawk GT1	22
Kitty Hawk GT2	22
Ladysmith GT1	155
Ladysmith GT2	155
Lake Kingman	115
LanierRd	4
Louisa	465
Lowmoor GTS	60
Maplewood Landfill	16
Marsh Run	522
Mt. Storm 1	535
Mt. Storm 2	535
Mt. Storm 3	523
Mt. Storm GT1	12
Mt. Trashmore Landfill	16
North Anna 1	945
North Anna 2	938
North Branch 1	74
Northern Neck GTS	64
Nottoway	4
Ogden Martin	80
Petersbrg1	3
Pointon	4
Polyester 1	71
Possum Point 3	101
Possum Point 4	221
Possum Point 5	786
Possum Point G6S	573
Possum Point GTS	78
Remington GT1	155
Remington GT2	155
Remington GT3	155
Remington GT4	155
Richmond6	3
Roanoke Rapids 1	26
Roanoke Rapids 2	25
Roanoke Rapids 3	25
Roanoke Rapids 4	23
Roanoke Valley 1	165
Roanoke Valley 2	44
Rockville4	7
Rosemary	165
South Anna 1	109
South Anna 2	109
Southhampton 1	71
Spruance 1	116
Spruance 2	94
Surry 1	842
Surry 2	842
WeaklyRd	7
Yorktown 1	159

Yorktown 2	167
Yorktown 3	818