2003 BASELINE RTEP REPORT

For the 2004 - 2008 Period

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Table of Contents

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, 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 2004 through 2008 for the PJM "footprint" as it existed in December 2003.

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 2004 through 2008 as the 2003 "baseline" planning period. The existing system plus any planned modifications to the transmission system scheduled to be in service prior to the 2008 summer peak period was chosen as the base system. All new generation and merchant transmission projects in Queues A through I 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 within MAAC to meet the single contingency, second contingency and multiple facility outage contingency tests required by Sections IIA, B and C of the MAAC Reliability Principles and Standards, hereafter referred to as MAAC Criteria. This system was also analyzed for its ability to meet the power transfer requirements of Section III and VII B of the MAAC Criteria and to determine compliance with the Stability Requirements Section IV of the MAAC Criteria.

The PJM system within the ECAR reliability council was planned for 2008 to meet ECAR Reliability Standards 1 and 2. Double circuit tower outages and bus faults, as specified in ECAR Reliability Standard 3, were also evaluated. Delayed clearing of a single line to ground fault of a generator, bus section, or transmission element (ECAR Reliability Standard 3) is still under evaluation.

In addition, a short circuit analysis was conducted to determine fault duties for all 500 kV, 345 kV, and 230 kV breakers on the PJM system. The 2008 system was tested against the same criteria that will be used in the Queue J & K System Impact Studies.

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 J & K 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 J & K. 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 2008 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) In 2008, the Jackson – Baker Tap 115 kV circuit is normally overloaded at 102% of the normal rating (139 MVA). The recommended plan to eliminate the overload is to replace a section of the strain bus at a cost of $15,000.

2) In 2008, the A21 - Chichester 230 kV circuit is overloaded for the loss of the other A21 – Chichester 230 kV circuit at 105% of the emergency rating (904MVA). The recommended upgrade to eliminate the overload is still under review and will be included in an Addendum to the RTEP Baseline Report.

3) In 2008, the Delcotap – Mickleton 230 kV circuit is overloaded for a bus fault at Chichester 230 kV involving the loss of the Foulk – Chichester and Eddystone – Chichester 230 kV circuits. The recommended upgrade to eliminate the overload is still under review and will be included in an Addendum to the RTEP Baseline Report.

4) In 2008, the Meadow Brook 500/138 kV #3 transformer is overloaded at 102% of emergency rating (465 MVA) for a bus fault that results in the loss of the Meadow Brook 500/138 kV #2 and #4 transformers. The recommended upgrade to eliminate the overload is still under review and will be included in an Addendum to the RTEP Baseline Report.

5) In 2008, the Glory – Dixonville 115 kV circuit was overloaded for the loss of the Wayne – Handsome Lake 345 kV circuit at 101% of the emergency rating (124 MVA). The Glory – Dixonville 115 kV circuit overload can be mitigated by replacing the existing 400 amp disconnect switch to a 600 amp disconnect switch. The replacement is estimated to cost $0.1 million.

6) In 2008, the Hudson – S. Waterfront 230 kV circuit is overloaded for the loss of the Hudson – Farragut 345 kV circuit at 107% of the emergency rating (622 MVA). The Hudson – S. Waterfront 230 kV circuit overload can be mitigated by making the Hudson 230 kV bus solid. In making Hudson into a solid bus, 3 breakers become stressed and therefore have to be replaced. The Hudson 230 kV breakers (and associated disconnect switches) requiring replacement are BS 1-2, BS 4-5, and BS 2-3 at an estimated cost of $1.7 million.

7) In 2008, the Linden – Federal Square 138 kV circuit is overloaded for the loss of the Linden – Bayway X 138 kV circuit at 101% of its emergency rating (271MVA). The Federal Square - Newark 138 kV circuit is also overloaded for the loss of the Linden – Bayway X 138 kV circuit at 101% of its emergency rating (271MVA). Both overloads can be alleviated by looping the W-1323 line into the Bayway 138 kV bus**.** The Linden - Federal Square 138 kV circuit is 1590 ACSR from Linden to Bayway. The potheads are at Bayway where the W-1324 becomes U/G cable with a rating of 193/268 MVA continuing to Federal Square. Separating the circuit at the Bayway potheads and connecting each (both the overhead and underground portions) to the Bayway 1-4 bus and installing two new 138kV breakers eliminates the overload on the Linden-Federal Square circuit. This new configuration will cost $4.4 million. The new rating of the overhead portion of the circuit from Linden to Bayway would be 402/481 MVA. The section from Bayway to Federal Square would remain 189/271 MVA.

8) In 2008, the Branchburg – Flagtown 230 kV circuit is overloaded for the loss of the Atlantic – Smithburg and Atlantic – Larrabee 230 kV tower line outage at 103% of the emergency rating (752 MVA). The Branchburg – Flagtown 230 kV circuit overload can be mitigated by installing a new wavetrap that will increase the emergency rating to 864 MVA at an estimated cost of $80,000.

9) In 2008, the Kearny – Turnpike “D” 138 kV circuit is overloaded at 102 % of the emergency rating (308MVA) for the loss of the Roseland – Kearny 138 kV and Athenia – NJT Meadow 230 kV tower line outage. The Kearny – Turnpike “D” 138 kV circuit overload can be mitigated by reconductoring a 605 ft span of the Kearny - Turnpike "D" 138 kV. The cost is estimated at $0.2 million and will result in a new emergency rating of 370 MVA.

10) In 2008, the Doubs – Montgomery Tap 230 kV circuit is overloaded for the loss of the Doubs – Ringgold 230 kV and Doubs – Monocacy 230 kV tower line outage at 114 % of the emergency rating (512 MVA). The recommended upgrade to eliminate the overload is to replace a line trap. The cost is estimated at $50,000 and will result in a new emergency rating of 593 MVA.

11) In 2008, the South Akron 230 kV substation experiences a greater than 5% voltage drop due to the outage of Brunner – South Manheim 230 kV. To mitigate this voltage drop a second 114 MVAR capacitor is required at South Akron 230 kV along with a second South Akron – Berks 230 kV circuit.

12) A third Mountain 230/69 kV transformer will be installed in 2005 as a Transmission Owner Identified project. No additional system problems were identified with this transformer addition.

Operational Performance

PJM Operations has identified the following three as potential areas of Operational Performance:

- ✓ Bedington – Black Oak 500 kV
- ✓ Wylie Ridge 500/345 kV
- ✓ Hunterstown generation restrictions

An Addendum to the RTEP Baseline Report will provide the metrics used to define Operational Performance issues and will provide recommendations for upgrades, if required.

Generator Retirement

The results in this RTEP baseline report do not include reliability impacts of recent generator retirements or the Branchburg 500/230 kV decreased ratings. Those results will be communicated in an Addendum to the RTEP report.

OBJECTIVE AND SCOPE

The objectives of this study were as follows:

- To identify areas where the system as planned for the period 2004 through 2008 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 J & K.

The scope of this study included analysis for the period 2004 through 2008 to determine compliance with the following sections of the MAAC Reliability Principles and Standards (http://www.maac-rc.org/reference/princstandards.html) , the ECAR Reliability Criteria (http://www.ecar.org/documents/document%201_6-98.pdf), the PJM Generator Deliverability requirements, the PJM Reliability Planning Criteria and the individual Transmission Owner planning criteria.

- MAAC Section IIA and ECAR Standard 1 (pre-contingency analysis).
- MAAC Section IIA and ECAR Standard 2 (single contingency or n-1 analysis).
- MAAC Section IIB and ECAR Standard 5 (second contingency or n-2 analysis)
  Additional voltage analysis for n-2 condition will be completed and any identified problems will be documented in an addendum to this baseline report.
- MAAC Section IIC and ECAR Standard 3 (common mode outages)
  Analysis of delayed clearing of a single line to ground fault of a generator, bus section, or transmission element (ECAR Reliability Standard 3) on the Allegheny system will be included in an Addendum to the RTEP Baseline Report.
- MAAC Section III and Section VII (Capacity Emergency / Load Deliverability).
  The 2008 load deliverability results will be documented in an addendum to the RTEP Baseline Report.
- MAAC Section IV and ECAR Standards 1 through 5 (Stability Requirements).
- Generator Deliverability and Load Deliverability
  The 2008 load deliverability results will be documented in an addendum to the RTEP Baseline Report.
- PJM Reliability Planning Criteria
- Transmission Owner 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 MAAC and PJM Reliability Assessments to verify that the system as planned can indeed be operated in compliance with MAAC and ECAR 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 I Impact Studies were evaluated. Any previously identified reinforcements that are no longer required were documented and removed from the list of RTEP Reinforcements.

The stability section of this report was primarily based on results from previous stability analysis that was completed during System Impact Studies. Both transient ("first swing") and oscillatory stability of proposed generation projects in Queues A through I along with the stability of existing units in close electrical proximity to the proposed interconnection projects were assessed.

A complete short circuit analysis of the 500 kV, 345 kV and 230 kV systems was conducted to establish breaker short circuit duties and identify any overdutied breakers for 2004 through 2008.

ANALYSIS METHODOLOGY

Load flow simulation was based on a representation of the 2008 forecast peak load, existing capacity resources, and all proposed interconnection projects in Queues A through I that executed a Facility Study Agreement. All firm transmission services committed for the 2008 period were represented in the base case (see below). In addition, any transmission reinforcements planned to be placed in service by 2008 summer were represented.

RTEP 2008 – INTERCHANGE

FROM	TO	MW
PJM	DLCO	-125
PJM	VP	-960
PJM	NYPA	-38
PJM	CONED	400
PJM	FE	352
PJM	NYISO	942
PJM	AEP	276
PJM	VP	308
PJM	AEP	-281
Total		874

A load flow base case was developed for 2008 representing projected diversified summer peak loads across the PJM Control Area. All existing PJM capacity resources were dispatched at 93% of the installed capacity value to simulate an average generator unavailability. Sufficient Queue A through I generation projects were also modeled at 93% of their queued MW value such that the PJM interchange equaled the committed firm transmission service. All remaining Queue A through I 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 a multitude of dispatch patterns were analyzed. A complete description of the Generator Deliverability procedures is contained in Attachment E of PJM Manual M14B.

The 2008 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 was 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 were compared to breaker interrupting capability provided by the transmission owners for each breaker. All breakers having ratings less than the calculated fault currents were identified.

RESULTS

The results of the baseline analysis for the 2004 – 2008 period are presented below.

Pre-Contingency and Single Contingency Results (n-0 and n-1)

The 2008 system was tested for compliance with MAAC Criteria Section IIA and ECAR Standards 1 and 2. All facilities monitored by PJM Operations were also tested against the PJM Reliability Criteria. 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.

Three areas of the PJM system were found to not be in compliance for the 2004 – 2008 study period.

- ✓ In 2008, the Delcotap – Mickleton 230kV circuit is overloaded for a bus fault at Chichester 230 kV involving the loss of the Foulk – Chichester and Eddystone – Chichester 230 kV circuits. The circuit is overloaded at 103% of its emergency rating (566 MVA). The recommended upgrade to eliminate the overload is still under review and will be included in an Addendum to the RTEP Baseline Report.

- ✓ In 2008, the Meadow Brook 500/138 kV #3 transformer is overloaded at 102% of emergency rating (465 MVA) for a bus fault that results in the loss of the Meadow Brook 500/138 kV #2 and #4 transformers. The recommended upgrade to eliminate the overload is still under review and will be included in an Addendum to the RTEP Baseline Report.

- ✓ In 2008, the South Akron 230 kV substation experiences a greater than 5% voltage drop due to the outage of Brunner – South Manheim 230 kV. To mitigate this voltage drop a second 114 MVAR capacitor is required at South Akron 230 kV along with a second South Akron – Berks 230 kV circuit.

Second Contingency Test Results (n-2)

The 2008 system was tested for compliance with MAAC Criteria Section IIB and ECAR Standard 5 by taking n-2 outages on the 500 kV, 345 kV and 230 kV systems. Flows on remaining facilities following the second contingency outage(s) were monitored for flows exceeding 100% of short time emergency ratings. Post contingency voltages were also monitored at all 500 kV, 345 kV, and 230 kV buses to identify any voltages that exceeded the existing voltage limits used in PJM Operations.

In some cases, localized load is interrupted by design following the second contingency. Load shedding may occur as a result of the physical arrangement of connections at a substation, undervoltage relay schemes or special purpose relay schemes. Such post contingency controlled load shedding following a second contingency is not considered a violation of ECAR or MAAC Criteria. However, those cases where the amount of load that would be interrupted exceeds 250 MW were identified and will be addressed in the MAAC Reliability Assessment.

The PJM system was found to be compliant for the 2004 – 2008 study period.

Common Mode Outages

The 2008 system was tested for compliance with MAAC Criteria Section IIC and ECAR Standard 3. Post contingency flows on all remaining facilities were monitored for flows exceeding 100% of short time emergency ratings. Generally, the short time rating for lines is the 4-hr rating. However, shorter time ratings may be used for facilities with thermal inertia, such as transformers and cables, provided procedures are in place to reduce loading within the applicable emergency rating for the duration of the outage. Voltage analysis was completed based on existing voltage limits used in PJM Operations.

Three areas of the PJM system were found to not be in compliance for this test in the 2004 – 2008 study period.

- ✓ In 2008, the Branchburg – Flagtown 230 kV circuit is overloaded for the loss of the Atlantic – Smithburg and Atlantic – Larrabee 230 kV tower line outage at 103% of the emergency rating (752 MVA). The Branchburg – Flagtown 230 kV circuit overload can be mitigated by installing a new wavetrap that will increase the emergency rating to 864 MVA at an estimated cost of $80,000.

- ✓ In 2008, the Kearny – Turnpike “D” 138 kV circuit is overloaded at 102 % of the emergency rating (308MVA) for the loss of the Roseland – Kearny 138 kV and Athenia – NJT Meadow 230 kV tower line outage. The Kearny – Turnpike “D” 138 kV circuit overload can be mitigated by reconductoring a 605 ft span of the Kearny - Turnpike "D" 138 kV. The cost is estimated at $0.2 million and will result in a new emergency rating of 370 MVA.

- ✓ In 2008, the Doubs – Montgomery Tap 230 kV circuit is overloaded for the loss of the Doubs – Ringgold 230 kV and Doubs – Monocacy 230 kV tower line outage at 114 % of the emergency rating (512 MVA). The recommended upgrade to eliminate the overload is to replace a line trap. The cost is estimated at $50,000 and will result in a new emergency rating of 593 MVA.

Stability Tests (MAAC Section IV and ECAR Standards 1 through 5)

In general, most projects in Queue G, H and I generation projects and existing units complied with MAAC and ECAR stability requirements (the exceptions to this are listed below). However, the addition of some new generation projects on the system with a concurrent lack of transmission reinforcements yielding system impedance changes is resulting in reduced transient

and dynamic stability margins. Thus, existing units will experience rotor angle swings of larger amplitude and longer duration for faults on the bulk power system, with subsequently similar effects to system flows and voltages.

In addition, with the prevalence of combined cycle generation blocks being used in the new generation projects, a change in the PJM system inertial response characteristic can be expected. Further, the high concentration of new generation in certain locations may result in the development of characteristic frequencies, which could lead to unexpected oscillatory responses.

In general, the bulk power system throughout PJM was found to be in compliance for this test in the 2004 – 2008 study period.

The results that follow summarize stability issues that were identified during Queue G, H and I System Impact Studies (refer to the 2000 through 2002 RTEP Baseline Report for stability issues identified during Queue A - F System Impact Studies).

- ✓ G51_W60 (Ronco) Total output of the Ronco generation should be limited to maximum of 200 MW when Yukon-Hatfield, Hatfield-Ronco or Ronco-Ft. Martin 500 KV line is out of service.

- ✓ G51-W62 (Eastalco) When one of the Eastalco-Doubs 230 KV line is line is out of service, Eastalco generation will be tripped if the other Eastalco – Doubs 230 KV line trips.

- ✓ H04-W64 (Henry) Henry wind generation project will be tripped without any intentional time delay if the voltage on its 138 KV bus drops to 0.8 or below and its output is more than 75 MW.

- ✓ H18 and H19 (Hope Creek) To avoid instability due to breaker failure, a redundant 500 KV breaker will be added between the Bus sections 2 and 3 at Hope Creek., and a new operating guide will be developed during the facility study phase to determine MW and MVAR limits during various operating conditions.

- ✓ I03_W74 (Savage) A capacitor bank will be installed to avoid instability of this wind generation project.

- ✓ I04 (Stonycreek) The wind project will be tripped for outage of Pride-Summerset 115 KV line to avoid instability.

- ✓ I12 (Grand Point) The excitation controls for this generation project will need to be properly tuned to improve damping.

- ✓ I13 (Hooversville) This will generation will be tripped whenever its tie to the Hooversville 115 KV bus is tripped.

Capacity Emergency / Load Deliverability (MAAC Criteria Sections III and VIIB and PJM RAA Requirement)

Compliance with MAAC Section III and VIIB was evaluated using the PJM CETO/CETL Deliverability procedures as defined in Attachment E of PJM Manual M14B.

CETO/CETL Deliverability tests

A comprehensive study of all CETO/CETL Deliverability (Load Deliverability) areas for PJM will be completed and included in an Addendum to the RTEP Baseline Report.

Generator Deliverability

Five areas of the PJM bulk power system were found to not be in compliance for the 2004 – 2008 study period.

- ✓ In 2008, the Jackson – Baker Tap 115 kV circuit is normally overloaded at 102% of the normal rating (139 MVA). The recommended plan to eliminate the overload is to replace a section of the strain bus at a cost of $15,000.

- ✓ In 2008, the A21 - Chichester 230 kV circuit is overloaded for the loss of the other A21 – Chichester 230 kV circuit at 105% of the emergency rating (904MVA). The recommended upgrade to eliminate the overload is still under review and will be included in an Addendum to the 2003 RTEP Baseline Report.

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- ✓ In 2008, the Linden – Federal Square 138 kV circuit is overloaded for the loss of the Linden – Bayway X 138 kV circuit at 101% of its emergency rating (271MVA). The Federal Square - Newark 138 kV circuit is also overloaded for the loss of the Linden – Bayway X 138 kV circuit at 101% of its emergency rating (271MVA). Both overloads can be alleviated by looping the W-1323 line into the Bayway 138 kV bus**.** The Linden - Federal Square 138 kV circuit is 1590 ACSR from Linden to Bayway. The potheads are at Bayway where the W-1324 becomes U/G cable with a rating of 193/268 MVA continuing to Federal Square. Separating the circuit at the Bayway potheads and connecting each (both the overhead and underground portions) to the Bayway 1-4 bus and installing two new 138kV breakers eliminates the overload on the Linden-Federal Square circuit. This new configuration will cost $4.4 million. The new rating of the overhead portion of the circuit from

Linden to Bayway would be 402/481 MVA. The section from Bayway to Federal Square would remain 189/271 MVA.

Three locations on the PJM bulk power system required the use of existing PJM Operating Procedures to mitigate potential areas of non-compliance.

- In 2008, the Blairsville 138/115 kV transformer is overloaded for pre-contingency conditions. There is an existing operating procedure to open the Blairsville - Social Hall tie with AP pre-contingency to relieve this overload. With this tie open no additional problems were identified.
- In 2008, Warren – Falconer 115 kV is overloaded under pre-contingency conditions. As per existing operating procedures, the Warren – Falconer 115 kV circuit was opened.
- In 2008, Shade Gap - Roxbury 115 kV is overloaded for pre-contingency conditions. There is an existing operating procedure to open the Roxbury - Greene circuit. There were no negative impacts identified with this tie open.

Short Circuit Duty Tests

The short circuit analysis identified three 230 kV circuit breakers at Hudson 230 kV (BS2-6, BS2-8, BS5-6) that exceeded their interrupting capabilities. The breakers will require replacement at a cost of $1.7 million.