5.0: Overview

Retool analysis is part of each annual RTEP cycle. This particular retool in PJM’s 2009 cycle allowed PJM to assess the 2011 system under updated system condition forecasts. The retool analysis confirmed the need for the 502 Junction - Loudoun 500 kV line (TrAIL Line) in 2011, currently under construction. Additional discussion regarding TrAIL can be found in PJM’s 2006 RTEP Report, available on PJM’s Web site via the following URL: http://www.pjm.com/documents/reports/rtep-report.aspx.

5.0.1 – Summary of Key Modeling Assumptions

In recognition of the dynamic nature of study assumptions, PJM’s 2009 RTEP analysis included a Baseline Retool assessment of 2011. PJM took into consideration 2011/2012 RPM auction results, load forecast changes, load management, generation interconnection request status, merchant transmission interconnection request status and generation deactivation status.

Generation

With respect to the 2009 RTEP Retool of the 2011 system, all generation expected to be in service by June 1, 2011 was modeled, based on the criteria for inclusion in the RTEP analysis as described in Section 2.3.

Load Forecast

The 2006 RTO load forecast for 2011 was 145,775 MW, while the 2009 RTO load forecast for 2011 was 140,132 MW, a reduction of 5,643 MW (3.9 percent). The 2006 Mid-Atlantic load forecast for 2011 was 63,777 MW, while the 2009 Mid-Atlantic load forecast for 2011 was 62,027 MW, a reduction of 1,750 MW (2.7 percent).

Load Management

PJM’s RTEP process analyses model the impact of load management. This includes the impact of Demand Resources (DR) and Energy Efficiency (EE) that have cleared PJM’s Reliability Pricing Model (RPM) three-year-forward capacity market. Additional discussion of load management concepts can be found in Section 2.2 and Section 3.4.3.

The 2011 retool in PJM’s 2009 RTEP cycle of analyses modeled the impact of the 1,996 MW of load management that was forecasted for 2010/2011 based on DR and ILR commitments for the Mid-Atlantic region through the RPM process, consistent with the 2009 Load Forecast Report. The 1,996 MW included Interruptible Load for Reliability (ILR). The 2006 RTEP included 890 MW of Active Load Management (ALM) for the Mid-Atlantic region, per the respective business rules in place for the respective Load Forecasts for that RTEP cycle.

As a result of recent rule changes, importantly, ILR was treated as a stand-alone resource in RPM auctions for 2011 and all relevant years preceding that point. Subsequent to 2011, ILR is eliminated. A description of recent rule changes can be found in Section 2.2. Additional information is also included in PJM Load forecast reports, available on-line via the following URL link: http://www.pjm.com/planning/resource-adequacy-planning/load-forecast-dev-process.aspx.

Network Topology

In the three years since the 2006 RTEP analysis was completed, many additional transmission upgrades have been approved by the PJM Board. Those upgrades, along with merchant transmission projects that are expected to be in service by June 1, 2011 were incorporated into the 2009 Retool analysis for the 2011 system. A complete list of approved RTEP upgrades is available from PJM’s Web site via the following URL: http://www.pjm.com/planning/rtep-upgrades-status/construct-status.aspx.

Interchange values used in the 2009 Retool analysis of the 2011 system were consistent with approved long term firm transmission service requests in the OASIS system.
5.1: TrAIL In-Service Date Remains 2011

5.1.1 – Background
The Prexy - 502 Junction - Loudoun 500 kV line was originally approved by the PJM Board of Managers in 2006. (See MAP 5.1) The 502 Junction - Loudoun portion of the line (the “TrAIL” project), as noted above, was approved by the regulatory commissions in Pennsylvania, Virginia and West Virginia.

PJM’s 2006 RTEP included the Prexy - 502 Junction portion of the line primarily to address reliability criteria violations on 138 kV facilities in southwestern Pennsylvania. Originally also part of TrAIL, the 502 Junction - Prexy 500 kV line segment, as part of a settlement with the Commonwealth of Pennsylvania was removed from the RTEP. An alternative solution was approved by PJM’s Board that included a set of local 138 kV transmission upgrades to resolve identified Category B and Category C thermal and voltage criteria violations. (PA-PUC approval remains pending as of February 15, 2010.)

5.1.2 – 2011 In-Service Date Re-Confirmed
The 2009 RTEP retool analysis, as in prior RTEP annual analyses, identified reliability criteria violations on the Mt. Storm - Doubs 500 kV line without TrAIL in 2011. The required in-service date for TrAIL remains June 1, 2011. Construction work is underway.

The right-of-way route shown on this map is for illustrative purposes only and may not depict the actual route that may eventually be chosen. Substation locations may also be modified if more beneficial connections are determined by PJM.
5.1.3 – Prexy Replacement Upgrades

The alternative solution includes the set of local 138 kV transmission reconductoring upgrades and capacitor installations shown on Map 5.2. Importantly, the alternative solution did not resolve several Category C thermal and voltage criteria violations outside the contested area of the settlement, requiring upgrades (also shown on Map 5.2) that the Prexy - 502 Junction segment would have also otherwise resolved.

Overall, absent Prexy - 502 Junction, the entire approved set of 138 kV upgrades, necessary to resolve identified reliability criteria violations in this area, included the following:

- Reconfiguration of the Peters to Bethel Park 138 kV line and Elrama to Woodville 138 kV line to create a 138 kV path from Woodville to Peters and a 138 kV path from Elrama to Bethel Park. Reconductor both Collier - Woodville 138 kV lines and add static capacitors at five substations in the area. Total estimated cost for these upgrades is $10.2 million.

- Construction of a new Osage - Whiteley 138 kV line at an estimated cost of $21 M. Installation of a 500/138 kV transformer at 502 Junction Substation at an estimated cost of $27.2 million.

- Install a second 502 junction - Whiteley 138 kV line and a rebuild of the Whiteley - Franklin 138 kV line to double circuit at an estimated cost of $17.1 million.

- Construction of a new 502 Junction - Osage 138 kV line at an estimated cost of $4.2 million.

- Construction of 138 kV Braddock substation to connect the Charleroi - Gordon 138 kV line, Washington - Franklin 138 kV line, the Washington - Vanceville 138 kV line and a 66 MVAr capacitor, at a total estimated cost of $15.1 million.

- Increasing the size of the shunt capacitors at Enon 138 kV substation at an estimated cost of $4.2 million.

- Raising three structures on the Osage - Collins Ferry 138 kV line to increase the line rating, at an estimated cost of $0.4 million.
5.2: EMAAC Deliverability

2011 retool analysis conducted as part of PJM’s 2009 RTEP process, identified the following EMAAC deliverability issues and required RTEP modifications. The upgrades discussed below are shown on Map 5.3.

5.2.1 – Voltage Issues

Eastern PA / New Jersey Area
The 2006 RTEP identified widespread voltage problems for EMAAC load deliverability in 2010. The approved solution was to install a 400 MVAR capacitor at Branchburg 500 kV. Updated 2011 analysis using 2009 RTEP assumptions indicates that this upgrade can be deferred until 2012.

5.2.2 – Thermal Analysis

Northern New Jersey
In the 2006 RTEP, The Athenia - Saddlebrook 230 kV was overloaded for EMAAC load deliverability in 2011. The recommended solution is to reconductor the line. The 2009 RTEP Retool analysis has determined that this upgrade can be deferred until 2012.

SE Pennsylvania
Solutions for reliability criteria violations on several facilities in southeastern Pennsylvania overloads have been modified:
- The Jarrett - Heaton 230 kV line was overloaded for Eastern Mid-Atlantic load deliverability in 2011. The recommended solution is to reconductor the line. The 2009 RTEP Retool analysis has determined that this upgrade can be deferred until 2012.

Western Pennsylvania 500 kV
The 2006 RTEP also identified thermal overloads on Keystone - Jack’s Mountain and Keystone - Conemaugh 500 kV lines for EMAAC load deliverability in 2009. The approved solutions are to replace the wave trap and upgrade a bus section at Keystone on the Keystone - Jack’s Mountain section and to replace a wave trap and relay at Conemaugh and a wave trap at Keystone on the Keystone - Conemaugh 500 kV line. Updated analysis of 2011 using this year’s RTEP assumptions indicate that this upgrade can be deferred until 2012.

- The Whitpain - Jarrett 230 kV was overloaded for Eastern Mid-Atlantic load deliverability in 2010. The recommended solution is to reconductor the line. The 2009 RTEP Retool analysis has determined that this upgrade can be deferred until 2012.

- The Warrington - Hartman 230 kV was overloaded for Eastern Mid-Atlantic load deliverability in 2011. The recommended solution was to reconductor the line. Updated analysis of 2011 using this year’s RTEP assumptions indicates that the scope of the upgrade can be changed to replace terminal equipment only.

*NOTE*

“EMAAC” is a term used in PJM deliverability analysis to refer to the portion of PJM that includes Atlantic City Electric Company (AE), Delmarva Power and Light (DPL), Jersey Central Power and Light (JCP&L), PECO Energy (PECO) and Public Service Electric and Gas (PSEG) transmission owner zones.
Map 5.3: 2011 Retool: EMAAC Deliverability Issues
5.3: MAAC Deliverability

2011 retool analysis conducted as part of PJM’s 2009 RTEP process, identified the following MAAC deliverability issues and required RTEP modifications. The upgrades discussed below are shown on Map 5.4.

5.3.1 – Voltage Issues

**Western PA**

The 2006 RTEP included a 300 MVAR capacitor at Conemaugh 500 kV to resolve voltage problems for MAAC load deliverability in 2011. Updated analysis using the 2009 RTEP assumptions indicates that this upgrade can be deferred until 2012 and will be reduced in size to a 250 MVAR capacitor due to space limitations.

5.3.2 – Thermal Issues

**Central Pennsylvania**

PJM’s 2009 retool of 2011 identified overloads on the South Akron 230/69 kV transformer #3 for the loss of South Akron - South Manheim 230 kV line with a stuck breaker at South Akron and the South Akron 230/69 kV transformer #4 for the loss of South Akron - Millwood 230 kV line with a stuck breaker at South Akron, the cost estimate is $0.4 million, with an in-service date of June 1, 2011.

The retool also identified an overload of the Frackville 230/69 kV transformer #2 for the loss of Frackville - Eldred 230 kV line with a stuck breaker at Frackville and of the Frackville 230/69 kV transformer #3 for the loss of Frackville - Columbia 230 kV line with a stuck breaker at Frackville. The recommended solution is to install motor operators on disconnects at Frackville by June 1, 2011 at a cost of $0.05 million.

**Southeastern PA**

Generation deliverability analysis retool identified an overload on the Tunnel - Parrish 230 kV transmission line. The recommended solution is to reconductor the line. The 2009 RTEP Retool analysis has determined that this upgrade can be deferred until 2012.

*NOTE*

“MAAC” is a term used in PJM deliverability analysis to refer to all Mid-Atlantic Transmission Owner zones: Atlantic City Electric Company (AE), Baltimore Gas and Electric (BGE), Delmarva Power and Light (DPL), Jersey Central Power and Light (JCPL), Metropolitan Edison Company (METED), Neptune, PECO Energy (PECO), Pennsylvania Electric Company (PENELEC), PEPCo Holdings (PEPCo), PPL Electric Utilities Corporation (PPL), Public Service Electric and Gas (PSEG), Rockland Electric (Rockland) and UGI Corporation (UGI).
Map 5.4: 2011 Retool: MAAC Load Deliverability Issues
5.4: NERC Category C

2011 retool analysis conducted as part of PJM’s 2009 RTEP process, identified the following NERC Category C type violations and required RTEP modifications. The upgrades discussed below are shown on Map 5.5.

5.4.1 – Category C Reactive Issues

**Western Pennsylvania**
The 2006 RTEP identified a voltage problem at Altoona for a NERC Category C-3 type contingency in 2011: the loss of the Conastone - Hunterstown 500 kV and Johnstown - Altoona 230 kV circuits. The approved solution is to install a 50 MVAR capacitor at Altoona 230. Updated analysis of 2011 using 2009 RTEP assumptions indicates that this upgrade can be deferred to 2012.

5.4.2 – Category C Thermal Issues

**Southeastern Pennsylvania**
PJM’s 2006 RTEP originally identified a North Philadelphia - Waneeta 230 kV line overload in 2011 for a NERC Category C-1 type violation: the loss of the Plymouth - Whitemarsh - Pulaski 230 kV facilities, as shown on Map 5.5. The recommended solution is to reconductor the line. PJM’s 2009 RTEP retool analysis has determined that this upgrade can be deferred until 2012.

Northern New Jersey / Eastern Pennsylvania
PJM’s 2006 RTEP originally identified a Portland - Kittatinny 230 kV overload in 2011 for a NERC Category C-5 tower contingency violation: the loss of the Portland - Greystone and Gilbert - Morristown 230 kV transmission lines, as shown on Map 5.5. The recommended solution is to replace a disconnect switch at Portland. The 2009 RTEP Retool analysis has determined that this upgrade is not required in 2011 and can be deferred until 2012.

PJM’s 2008 RTEP also originally identified a Branchburg - Bridgewater 230 kV line overload in 2011 for a NERC Category C type violation, (See Map 5.5). The approved solution is to reconductor the Branchburg - Flagtown - Somerville - Bridgewater 230 kV circuits. PJM’s 2009 RTEP retool analysis has indicated that this upgrade can be deferred until 2012.

PJM’s 2008 RTEP also originally identified a Linden - North Avenue 138 kV line overload and a PVSC - Bayonne 138 kV line overload for a NERC Category C type violation. (See Map 5.5). The recommended solution is to add a new Essex - Kearny 138 kV circuit and a Kearny 138 kV bus tie. PJM’s 2009 RTEP retool analysis has indicated that this upgrade can be deferred until 2012.
Map 5.5: 2011 Retool: Category C Issues