8.0: Background

PJM’s footprint includes approximately 30 percent of the transmission infrastructure of the U.S. Eastern Interconnection. PJM’s Regional Transmission Expansion Plan (RTEP) process seeks to maintain a safe, reliable transmission system to support robust, competitive markets.

One important element of PJM’s RTEP process is risk evaluation aimed at anticipating and mitigating the impact of potential transmission loss events. PJM integrates aging infrastructure decisions into its ongoing RTEP process: analysis, plan development, stakeholder review, PJM Board approval and implementation.

This approach permits PJM to assess the risk of transmission facility loss and to mitigate operational and market impacts of such losses.

8.0.1 – Aging Transformers

In 2006, PJM completed a Probabilistic Risk Assessment (PRA) initiative to address an aging 500/230 kV transformer fleet. Over the course of the several years prior, the PJM system experienced transformer failures and loss-of-life degradation, impacting reliability and causing hundreds of million dollars of congestion. Based on the outcome of the transformer PRA, PJM’s Board approved the addition of seven new spares to enhance system reliability and mitigate congestion.
costs in the event of transformer failure. The PRA also revealed that spares increase the acceptable risk limit for transformer units already operating, permitting extension of their service lives.

Each year, PJM conducts an update to its initial transformer PRA analysis to assess any need to modify original plans to maintain adequate spares under the aegis of PJM’s RTEP process. These subsequent annual PRA analyses have shown that the initial spares approved and installed through the RTEP continue to mitigate transformer failure risk.

8.0.2 – Mt. Storm – Doubs 500 kV Line Rebuild
Initially focused on an aging 500/230 kV transformer fleet, PJM has begun to examine aging 500 kV lines, some more than 40 years old. A number of them have been identified as constraints in recent RTEP baseline deliverability analyses. PJM’s 2010 transmission expansion plans have begun to address the extent to which aging lines must be reconductored (i.e. new wires installed) or replaced to solve identified reliability criteria violations.

Mitigating risk is in part driving the need to rebuild the Mt. Storm - Doubs 500 kV line, in-service since 1966. Aging towers and other structural degradation make consideration of this rebuild a priority.

The Mt. Storm - Doubs line is nearing the end of its life. Rebuilding it will improve regional reliability and reduce congestion along a major corridor that feeds power to the Mid-Atlantic region of PJM.
8.1: Mt. Storm – Doubs 500 kV Line Rebuild

8.1.1 – Aging Structures
The Mt. Storm to Doubs line – approximately 100 miles long – was built in 1966. Over the course of the ensuing 45 years, despite ongoing maintenance efforts, tower structures, foundations and conductor hardware have deteriorated to the point where the line is approaching its end-of-life and is at risk of major failure.

Field tests have confirmed that corrosion has eroded tower structures and grillage foundations, requiring extensive repair and remedial action to maintain structure integrity.

Replacement of individual tower members has been ongoing since 1999 in light of inspections in 1984 and 1998 that revealed significant steel thickness loss. Moreover, climbing inspections have revealed even more significant fatigue cracking, requiring the replacement of arm hanger members since the 1990s.

In addition, insulation system deterioration and 200+ conductor tension line splices are all near end-of-life and need to be replaced as well.
8.1.2 – Scope of Rebuild
The rebuilt line will utilize a combination of guyed and self supporting structures and will remain within the existing 150 foot right-of-way. The new line will utilize taller structures as seen in Figure 8.2 and line hardware such that the rebuilt line will have a rating of approximately 4,300 MVA, increasing the existing 2,598 MVA line rating by approximately 65 percent.

8.1.3 – RTEP Operational Performance

Significance
The Mt. Storm to Doubs 500 kV line is a significant west to east transmission conduit that has been a major driver of RTEP upgrades since first identified as a NERC criteria limiting contingency in the 2006 RTEP.

The TrAIL project was added to the RTEP in 2006 primarily to address overloads on the Mt. Storm to Doubs line. The PATH line was added to PJM’s RTEP as part of 2007 RTEP analysis to address further overloads on the line. Even with the TrAIL and PATH lines included, long-term planning studies conducted as part of the 2010 RTEP showed Mt. Storm - Doubs line loading levels that exceed 95 percent of applicable rating, by 2025.

Operational Performance
If the Mt. Storm - Doubs line should fail, given its deteriorating physical condition, an extended outage would be required before the facility could return to service.

This poses a significant operational performance issue for PJM. Baseline RTEP studies conducted in 2010 indicate that the Mt. Storm - Doubs line will continue to be a limiting system element even after major backbone additions like TrAIL and PATH are completed.

Consequently, the PJM Board approved PJM’s recommendation to add the rebuild to the PJM RTEP as an operational performance upgrade. The cost of the project is estimated at $370 million.

8.1.4 – Schedule for Rebuild Completion
Extended outages of the line will be required to complete the rebuild. PJM assumes an eight week window availability each spring and fall annually to accommodate extended outages of this magnitude. Mt. Storm - Doubs outages will be scheduled in the Fall outage window from September through December and the Spring outage window from February through May. The first outages are anticipated to begin in the fall of 2011 after the TrAIL line is placed in-service.

Transmission owners Dominion and Allegheny have been requested to use best efforts to complete the project by 2015. However, given the potentially limited availability of outage windows, the line could take up to nine years to complete. Longer outage windows may become available following the installation of the TrAIL and PATH projects. Each requested outage will be evaluated on a case-by-case basis in light of then-available generation and transmission facilities.