Transmission Upgrades and the Effect on the Energy Supply Mix

Sandra S. Patty
PPRP - Manager, Transmission Projects

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**PJM Overview**

- PJM is a regional transmission organization (RTO)
  - Plans for the growth of the electric grid in its region to ensure that future needs are met for both the reliability and the economic performance of the grid
- PJM operates the world’s largest wholesale electricity market
  - Coordinates the continuous buying, selling, and delivery of electricity in its region
Power Supply Effects of PJM Board-Approved Transmission Projects

• Lower congestion costs in the Eastern PJM region
  – Top 20 congestion points
    • Totaled $1.6 billion in 2007
    • Expected to total $2.1 billion in 2008
  – Transmission upgrades will lower congestion costs by $1.8 billion upon completion
  – Wholesale power prices are expected to fall in the east and rise in the west

• Shift in energy supply to low-cost Western PJM plants
  – 19,662,000 MWh increase in western generation due to these lines
    • AEP accounts for 62% of this increase; fleet is 81% coal-fired generation
    • Allegheny accounts for 12% of the increase; fleet is 95% coal-fired generation
  – 11,482,000 MWh generation decrease in VA, MD, and DE
  – Remaining generation decreases in PA and NJ
Power Supply Effects of PJM Board-Approved Transmission Projects (continued)

- Expansion of west-to-east transmission capability may entail certain undesirable side-effects
  - may discourage development of new, clean generation in the east
  - may inhibit the growth of DSM in the east
  - discouragement of new, clean generation and DSM would carry adverse environmental implications of the region, i.e., heavier reliance on western coal generation
Power Supply Effects of PJM Board-Approved Transmission Projects (continued)

• Excess generation capacity in the Western PJM region may be limited, however
  – As an example, AEP expects to be capacity-deficient in 2012
    • Has requested authorization to construct two base load coal plants in WV
  – A significant consideration when evaluating the potential benefit of west-to-east backbone transmission lines
    • Where will the capacity come from to meet future peak demands in the East?

• Implications of west-to-east transmission lines for siting future generation
  – Increases the potential that generation will be sited in West
  – Access to eastern markets for prospective wind generation
PJMs Backbone Transmission Expansion Plan – West to East Lines

• TrAIL
  – Joint venture of Allegheny Power and Dominion Virginia Power
  – Southwestern Pennsylvania to northern Virginia
  – CPCN application approval in WV and VA. PA has denied a portion of the line in southwestern PA.
  – Target in-service date of 2011

• PATH
  – Joint venture of AEP and Allegheny Power
  – Western West Virginia to central Maryland
  – Applicant plans to file CPCN application in late 2008 in WV and MD
  – Target in-service date of 2012

• Identified by PJM as solutions to reliability criteria violations projected in 2011 and 2012
PJM’s Transmission System Role

• Ensures reliability of the power supply system and plans for system growth

• Coordinates transmission and generation development to maintain reliability

• PJM can direct the construction of transmission facilities for reliability (though not for economic considerations)
  – PJM does identify projects entailing large economic benefits as a means of promoting development

• PJM has not directed the construction of generation or the implementation of DSM
  – authority is not clear and is untested
Approved PJM Backbone Transmission Lines

Source: PJM 2007 RTEP
Proposed Projects Affecting MD

• Mid-Atlantic Power Pathway (MAPP)
  – Pepco Holdings, Inc.

• Potomac-Appalachian Transmission Highline (PATH)
  – Allegheny/AEP Joint Venture
Pepco Holdings, Inc. (PHI)

- 230 miles of 500-kV line through VA, MD, DE, and NJ
  - Affected counties in MD: Charles, Calvert, Prince George’s, Dorchester, and Wicomico

- 177 miles (over 75%) planned on or near existing ROW
  - Entire portion through Southern MD on existing ROW
  - PHI will obtain new 200-foot ROW in Dorchester Co.

- Water crossings planned:
  - Potomac, Patuxent, and Nanticoke Rivers
  - Chesapeake Bay (8-12 miles from Calvert Cliffs to Dorchester Co.)
    - Option to include a DC line (in lieu of AC) from Calvert Cliffs to Vienna is currently being considered
    - Advantages over AC system, but significant project cost increase expected by PHI
**Pepco Holdings, Inc. (PHI)**
(continued)

- **Schedule:**
  - Final routing in Dorchester Co. to be completed this fall
  - PHI plans to file its application in phases
    - Previous CPCN (1970s) – Possum Point to Chalk Point: Notification Letter sent in September
    - New CPCN – Chalk Point to Calvert Cliffs (S. MD) portion filed by end of 2008. Anticipated in-service date June 2011
    - New CPCN – Eastern Shore to Delaware portion filed by 2nd quarter of 2009 and completed by 2013

- **Website:** [www.powerpathway.com](http://www.powerpathway.com)
Allegheny/AEP Joint Venture

• 244 miles of 765-kV line
  – John Amos to Bedington substations (WV)

• 46 miles of twin-circuit 500-kV lines
  – Bedington to a proposed substation near Kemptown, MD (southeast of Frederick)
  – The circuits will be separated and will follow different routes

• Affected counties in MD:
  – Washington and Frederick
Allegheny/AEP Joint Venture

- Allegheny has identified draft routing “segments”
  - Includes crossings of Appalachian Trail and the C&O Canal
  - Maps available on-line: www.pathtransmission.com

- Schedule:
  - Routing study to be completed in November 2008
  - AE plans to file CPCN application by December 1st
  - Target date for completion is June 2012
Transmission Lines and Air Quality

• Building new transmission lines (e.g., PATH and MAPP) increases the potential for more new generation from power plants outside the Maryland region.

• PPRP is investigating the effect the changing emissions resulting from this shift (considering different rates of emissions per MW) will have on air quality related environmental impacts in Maryland.
Energy Projects: Transmission and Generation

**TrAll Transmission Line**
Power transmission line linking the D.C. regional grid to a substation in southwestern Pennsylvania, providing power from Pennsylvania and the Midwest.

**PATH Transmission Line**
Power transmission line linking the D.C. region's grid with power plants and transmission lines in West Virginia. Exact route has not been determined.

**Wise County Coal Plant**
Dominion has proposed a coal-fired plant in southwest Virginia, to burn mainly coal mined nearby.

**Warren County Plant**
A natural gas-fired plant has been proposed in Charles County, north of Front Royal, Va.

**Mirant Alexandria Plant**
Alexandria is seeking to close down this decades-old coal plant. Mirant wants to keep it open.

**Buzzard Point and Bonning Plants**
Pepco plans to close these decades-old plants in the District, which now provide power only during times of peak demand, by 2012.

**Energy projects**
- **Transmission**
- **Generation**

**MAPP Line**
Transmission line linking Prince William County with Southern Maryland, then crossing under the Chesapeake Bay to the Eastern Shore. *Route approximate.*

**Calvert Cliffs Expansion**
A third nuclear reactor has been proposed for the Calvert Cliffs nuclear power plant in Lusby. It would produce almost as much power as the first two reactors combined.

Illustrations of the Effects of Electrical Generation Shifts

- Healthy Air Act legislation in Maryland requires reductions of NO$_x$, SO$_2$, and mercury from seven coal-fired power plants in Maryland
  - NO$_x$ emissions reductions (from 2002 baseline):
    - Phase I: approx. 70% reduction in 2009
    - Phase II: total of 75% reduction by 2012
  - SO$_2$ emissions reductions (from 2002 baseline):
    - Phase I: 80% reduction in 2010
    - Phase II: 85% reduction by 2013
  - Mercury emission reductions (from 2002 baseline):
    - Phase I: 80% reduction in 2010
    - Phase II: 90% reduction by 2013

- Illustrations show the effect on PM2.5 Concentrations in Maryland of generating 1,000 MW at a (typical) Maryland coal-fired generating station, before and after HAA, and (typical) coal-fired generating stations in Ohio and West Virginia
Effects of Electrical Generation Shifts on PM2.5 Concentrations

PM2.5 24-hr Concentrations

PM2.5 Nonattainment Boundary

MD Power Plant Before HAA

Scale in kilometers

PM2.5 Monitor Location

PM2.5 Concentration (ug/m³, 24-hr)
Effects of Electrical Generation Shifts on PM2.5 Concentrations
Effects of Electrical Generation Shifts on PM2.5 Concentrations

PM2.5 24-hr Concentrations

West Virginia Power Plant

PM2.5 Nonattainment Boundary

PM2.5 Monitor Location

Scale in kilometers

0 25 50 75 100

PM2.5 Concentration (ug/m³, 24-hr)
Effects of Electrical Generation Shifts on PM2.5 Concentrations

PM2.5 24-hr Concentrations

Ohio Power Plant

PM2.5 Nonattainment Boundary

PM2.5 Concentration (ug/m³, 24-hr)

Scale in kilometers

PM2.5 Monitor Location
**Air Quality Impact Summary**

- Shift of generation from Maryland to distant sources generally will result in greater air pollutant emissions.

- Emission reductions from current levels at power plants outside of Maryland are likely to occur under federal programs (such as the one that will replace CAIR at some point in time), however may not be source-specific.

- If greater emissions occur due to generation shift, the potential exists for rolling back some of the air quality gains in Maryland resulting from the Healthy Air Act.
Conclusions

• High voltage interstate transmission will provide potential benefit to the west-to-east backbone transmission

• However, this will undoubtedly require new generation to the west

• Will result in degraded air quality in Maryland, potentially reversing gains achieved by HAA