The AEP Interstate Project Proposal

A 765 kV Transmission Line From West Virginia to New Jersey

American Electric Power

January 31, 2006

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EXECUTIVE SUMMARY

The United States economy demands a robust electric transmission interstate system for the 21st century. When President George W. Bush signed the Energy Policy Act on August 8, 2005, he said, “We have a modern interstate grid for our phone lines and our highways. With this bill, America can start building a modern 21st-century electricity grid, as well.”

AEP believes that electric transmission should be developed into our nation’s next interstate system. We believe our highly efficient and reliable 765 kV network should be leveraged to this end. The goal for transmission development must be a higher degree of transparency to enable our nation:

- To allow generators to compete head-to-head, lowering costs to consumers,
- To encourage siting of more fuel-diverse, newer technology, and environmentally friendly generators to achieve a stronger domestic energy position, and
- To provide a higher degree of reliability to foster enhanced national security.

Towards this goal, AEP is proposing that its AEP Transmission Company, LLC, develop a 765 kV transmission line and associated facilities emanating from AEP’s Amos 765 kV station in West Virginia through Allegheny Power’s Doubs Station in Maryland, and terminating at Public Service Electric and Gas’ Deans Station in New Jersey (AEP Interstate Project). The line will be approximately 550 miles long, will employ all available technological advancements to optimize corridor performance, and will cost approximately $3 billion nominally (if built overhead, excluding necessary related upgrades by incumbent utilities). The projected in-service date is 2014 assuming three years to site and acquire rights-of-way, and five years to construct.

The benefit of this major transmission development will be substantial congestion relief as evidenced by our preliminary study conclusions: 1) midwest-to-east transfer capability improvement of approximately 5,000 MW, the published goal of PJM’s Project Mountaineer, and 2) approximately 280 MW peak-hour loss reduction. The line is also expected to reduce energy costs and enhance reliability in the mid-Atlantic area, and will facilitate the development of interim transmission investment by local utilities that will eventually integrate into the 765 kV transmission line once in service.

BACKGROUND

Policy makers and industry leaders have recognized transmission congestion as a major impediment to open competition in electricity markets, reliability and economic development. Calls for transmission improvements have been voiced by the federal government, PJM, and state regulators.

ENERGY POLICY ACT OF 2005 PROMOTES TRANSMISSION

As required by the Transmission Infrastructure Investment provisions of the Energy Policy Act of 2005 (“EPAct 2005”), the Federal Energy Regulatory Commission on November 18, 2005 issued its Notice of Proposed Rulemaking (NOPR) on incentive based (including performance-based) rate treatments for the transmission of electric energy that:

1. Promotes capital investments for the enlargement, improvement, operation and maintenance of transmission facilities, regardless of ownership;
2. Provides return on equity that attracts new investment in transmission;
3. Encourages deployment of advanced transmission technologies;
4. Allows the recovery of prudently incurred costs necessary to comply with Section 215, and all prudently incurred costs related to Section 216; and
5. Provides incentives and rate recovery to transmitting utilities that join a transmission organization.

The Energy Policy Act of 2005 also requires DOE to study and develop a process to designate "National Interest Electric Transmission Corridors" (NIETCs) for FERC "backstop" siting authority. Siting is perhaps the most fundamental prerequisite to transmission development.

PJM CALL FOR TRANSMISSION ENHANCEMENTS

The issue of transmission congestion and possible mitigating measures were discussed in detail at the FERC Technical conference held on May 13, 2005. At that conference, Karl Pfirrmann, President, PJM Western Region, introduced the concept of major west-to-east transmission corridors by proposing "Project Mountaineer" in his filed testimony, the key points of which are summarized below.

1. "*The 'R' in "RTO" means benefits for this region* - The integration of American Electric Power ("AEP"), Allegheny Energy, Commonwealth Edison, Duquesne Light and Dominion into PJM, most of which occurred during the last several months, has already increased market opportunities for the region's generation resources. Interregional power flows have increased by approximately 35%, representing off-system sales that potentially benefit both the mid-Atlantic area and the consumers in the area;

2. *"An unprecedented level of interregional coordination has commenced* - The agreement reached between PJM and the Midwest ISO, as well as between those two entities and TVA have established the foundation for an unprecedented level of coordinated planning and interregional coordination;

3. *"'Project Mountaineer' is an example of how the region can take coordinated regional planning to the next level* - By way of example, PJM outlines the scope of transmission project that would be needed to significantly enhance the ability of coal based resources to reach eastern markets. Transmission enhancements include potentially 550 to 900 miles of new backbone 500 or 765 kV transmission at an approximate cost of $3.3 to $3.9 billion. Although a large number, if such cost is spread to all customers within the PJM footprint, the cost to a typical retail customer would amount to only one mill/kWh.

> "In closing, PJM pledges to work with the Commission, the states and transmission owners in this region as well as with other interested persons to further explore the potential for enhancing interregional trade and finding solutions that pay benefits to consumers in this region as well as throughout the Eastern Interconnection."[1]

CALLS FROM STATE REGULATORS FOR TRANSMISSION IMPROVEMENTS

The Energy Policy Act of 2005 and the PJM testimony are clear calls for the urgent development of bulk transmission reinforcements that will benefit the nation. In addition, state regulators have recognized the need for transmission improvements. For example, a key statement from the Public Service Commission of Maryland demonstrates this concern:

> "The upgrades listed above [Interim improvements proposed by PJM] are expected to improve transfer limits. However, most engineers concede that congestion between western PJM and central and eastern Maryland will continue until a new transmission line is built or substantial base load generation is installed."[2]

AEP RESPONSE TO CALLS FOR TRANSMISSION ENHANCEMENTS

In response to overall goals of the Energy Policy Act of 2005, the call from PJM to enhance transfer capability from the Western Region to the Mid-Atlantic Region of PJM, and the concerns expressed by state regulators, AEP is proposing that its AEP Transmission Company, LLC, develop a 765 kV transmission line and associated facilities emanating from our Amos 765 kV station in West Virginia through Allegheny Power's Doubs Station in Maryland, and terminating at Public Service Electric and Gas' Deans Station in New Jersey (AEP Interstate Project). The technical details and performance characteristics of this proposed project are highlighted in the following sections of this report.

RATIONALE FOR PROJECT

Because of the strong 765 kV backbone within the existing AEP System, transmission capacity already exists to support increased power transfers from resources within MISO, AEP, and other systems interconnected with AEP, to the eastern border of AEP. What is lacking is sufficient transmission capacity east of the AEP System that can reliably and economically deliver that power to the eastern markets. The AEP Interstate Project will provide the needed transmission capacity to enable power resources to traverse the AEP System and reach the eastern markets.

In developing this proposal, several possible approaches to establish a new transmission path from the eastern border of the AEP System to the eastern markets were considered. The Amos 765 kV station was selected as the most appropriate connection point for the proposed 765 kV line for the following reasons:

[1]Excerpted from the Executive Summary of remarks of Karl Pfirrmann, President PJM Western Region.

[2] Excerpted from the Ten Year Plan (2005-2014) of Electric Companies in Maryland prepared by the Public Service Commission of Maryland in December 2005.

1. Amos is the strongest and most reliable source near the eastern border of AEP, being the terminus of three existing 765 kV connections and the Amos generating facility.
2. The station provides an integral connection point to over 8,000 MW of generating resources in the area today, which are expected to be over 10,000 MW by the time the project is completed.
3. Due to the low impedance of the 765 kV network, even geographically distant generators are still electrically “close” to the Amos 765 kV station.
4. Amos is one of the terminals identified by PJM as part of its conceptual Project Mountaineer initiative.

The AEP Interstate Project will also bring 765 kV into the jurisdictions of many utilities for the first time. Using this new 765 kV foundation, other companies will have the opportunity to develop additional transmission in nearby areas. For example, the transmission additions may present the potential for connections that provide transmission support to the Baltimore and Washington, D.C. areas. This project is envisioned as a significant step in the development of a national interstate 765 kV transmission network.

RATIONALE FOR 765 kV

The AEP Interstate Project was weighed against other methods of power delivery, including HVDC, adding generation in eastern PJM, and lower voltage transmission. The many favorable characteristics of 765 kV transmission led to its selection as the best approach for large-scale support to eastern PJM. The advantages of 765 kV transmission are more fully described below by comparison to other alternatives.

1. <u>Localized Generation Addition:</u> Generation addition, in this particular situation, does not provide the same level of performance and flexibility and would cost much more to achieve comparable benefits. Typically, generation is available about 85% of the time as compared to the availability of over 99% for a 765 kV line. Other factors to be considered are: a generating facility offers a less rapid response when needed to respond to transmission emergencies; generation is unidirectional as compared to the transmission line that can freely allow power flow in either direction; generation does not provide the flexibility for local area support that could be realized with intermediate transmission stations.

2. <u>HVDC:</u> HVDC transmission facilities do not lend themselves to future connections. They are best suited to allow for point-to-point transfer of power over a long distance. To establish an intermediate station, either for system reliability or for economic development, the cost is prohibitive and in many cases such intermediate connections are not even technically feasible. Depending on the magnitude of AC/DC station conversion requirements, the cost ratio can be as high as three to four times the cost of a comparable AC station.

3. Voltages Less Than 765 kV: 765 kV transmission has significantly higher capacity than lower voltage classes for long distance transmission. For long distance transmission of over 100 miles, Surge Impedance Loading (SIL) is used to measure and compare power carrying capability. To illustrate this point, **Exhibit 1** compares the number of lines needed and the resulting right-of-way needs for the transmission of a large block of power (2,400 MW) over a distance of 100 miles or more. Additionally, lower voltage EHV (and even some 138 kV) lines would still require certification and acquisition of right-of-way. Because so much more right-of-way is required, even for 500 kV, the route selection and right-of-way acquisition process could be substantially more difficult than for 765 kV.

TRANSMISSION LINES NEEDED TO TRANSMIT 2,400 MW OVER 100 MILES

	765 kV	500 kV	345 kV	138 kV (2-Circuits)
Phase Conductor	6-795 ACSR	3-954 ACSR	2-954 ACSR	1-795 ACSR
SIL	2400 MW	910 MW	390 MW	101 MW
# Required	1	3	6	24
ROW Required	200 ft.	525 ft.	900 ft.	2400 ft.
Cost/Mile/Circuit	$2.3 M	$1.7 M	$1.04 M	$0.9 M
Total Cost (100 mi)	$230 M	$510 M	$624 M	$2,160 M

Exhibit 1: Lines required for 2,400 MW transmission over 100 miles for various voltages.

Additionally, 765 kV circuits are constructed using large/multiple conductors to obtain acceptable corona and audible noise performance. This conductor arrangement provides considerable power carrying capability. Summer normal ratings of typical 765 kV lines, including circuit terminal equipment, exceeds 4,000 MVA and virtually eliminates the risk of thermal overloads even under severe operating conditions.

In summary, 765 kV transmission has the following beneficial attributes:

- High electrical power carrying capability.
- Minimal right-of-way versus lower voltage lines for the same level of electric power carrying capacity.
- Maximizes economies of scale for the required capacity.
- Enhanced regional reliability and security.
- Ease of interconnectivity with lower voltage systems.
- Existing experience and expertise that will expedite implementation.
- Comparable or lower cost than alternatives.
- Leverages the existing 765 kV transmission infrastructure to facilitate future expansion.

PROJECT TECHNICAL DETAILS

LINE DETAILS (See Exhibit 2)

This section of the report provides technical details on the AEP Interstate Project. AEP is committed to work with PJM, the local transmission owners, and state and federal siting authorities to optimize the specific routing of the project.

States Traversed: West Virginia, Maryland, Pennsylvania, and New Jersey

Service Territories Traversed or Near: American Electric Power, Allegheny Power, Baltimore Gas & Electric, Metropolitan Edison, PECO Energy, PPL Electric Utilities, and Public Service Electric & Gas.

Line Length:	Amos – Doubs:	Approx. 287 miles
	Doubs – Deans:	Approx. 263 miles
	Total Length:	**Approx. 550 miles**

Voltage: 765 kV

Right-Of-Way: 200 ft. width

Conductor: 6-795 mcm ACSR bundle per phase, 2-OPGW

Line Impedance (per mile in per unit): R = 0.0000034, X = 0.0000863, BC = 0.049923

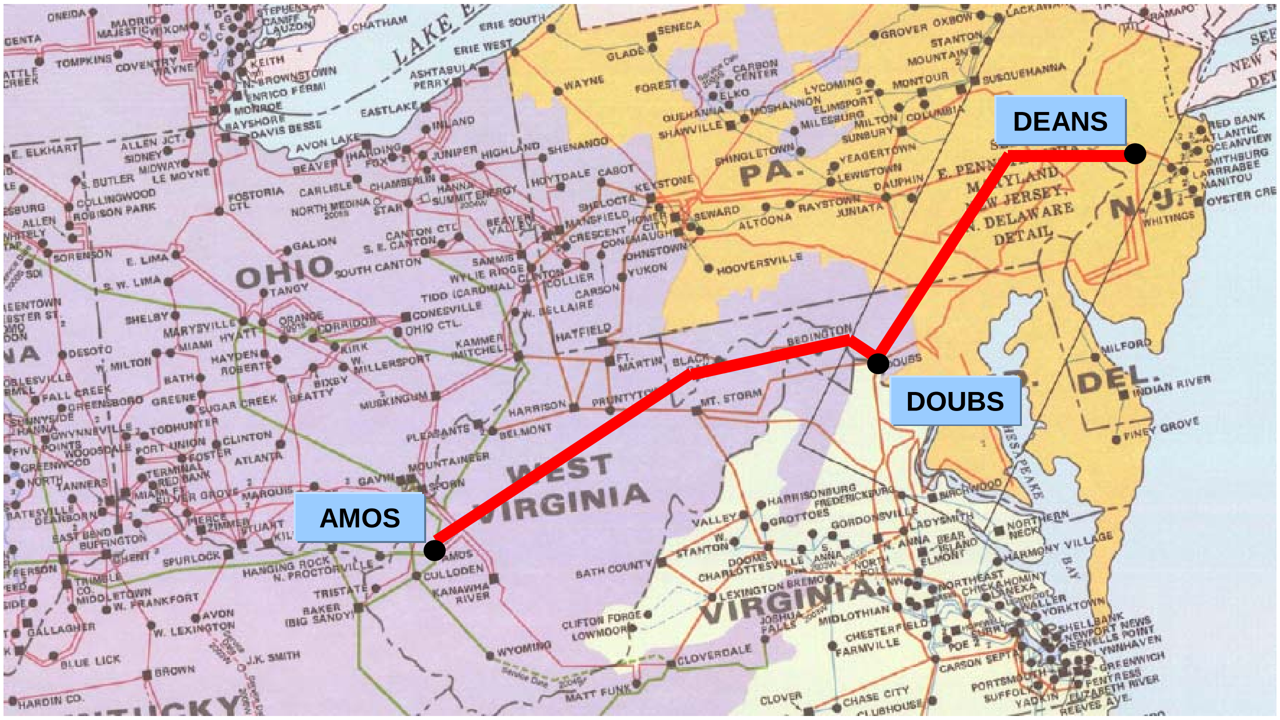

Exhibit 2: Map of the Proposed AEP Interstate Project 765 kV Line Route.
(Line route is conceptual and subject to change under regulatory and PJM Regional Transmission Expansion Plan (RTEP) processes)

STATION DETAILS (See Exhibits 3-5)

This section of the report provides technical details on the three stations that will connect to the proposed 765 kV line.

Amos Station (AEP): 2-765 kV circuit breakers
1-600 MVAr 765 kV line shunt reactor (2-100 MVAr per phase) and associated circuit breaker

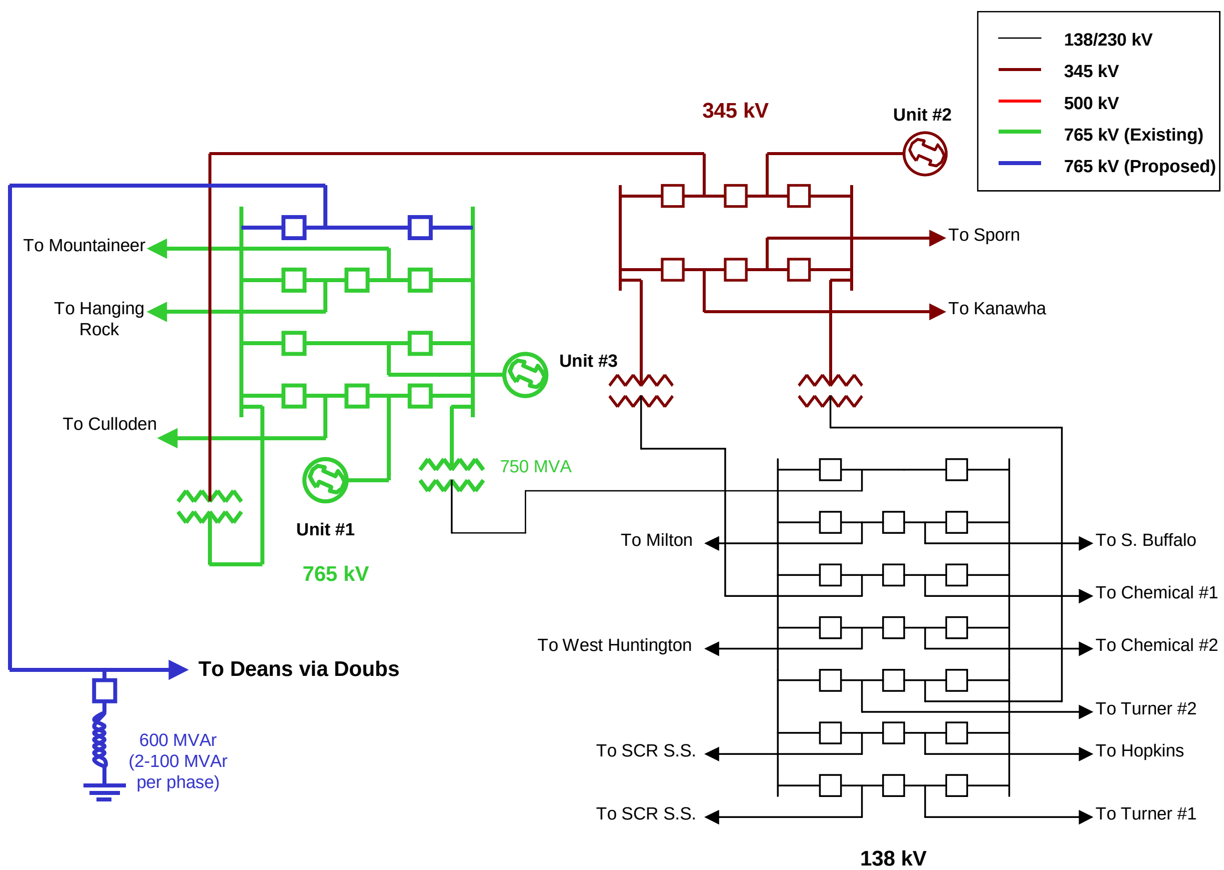

Exhibit 3: Proposed simplified one-line for Amos Station (AEP).
(Station configuration is conceptual and subject to change under the PJM Regional Transmission Expansion Plan (RTEP) process)

Doubs Station (AP):

1-2250 MVA 765/500 kV transformer
765 kV SVC (+1000/-500 MVAr)
6-765 kV circuit breakers
1-500 kV circuit breaker
2-600 MVAr line shunt reactors (2-100 MVAr per phase) and associated circuit breakers

Transformer Impedance (per unit): R = 0.00007, X = 0.00728

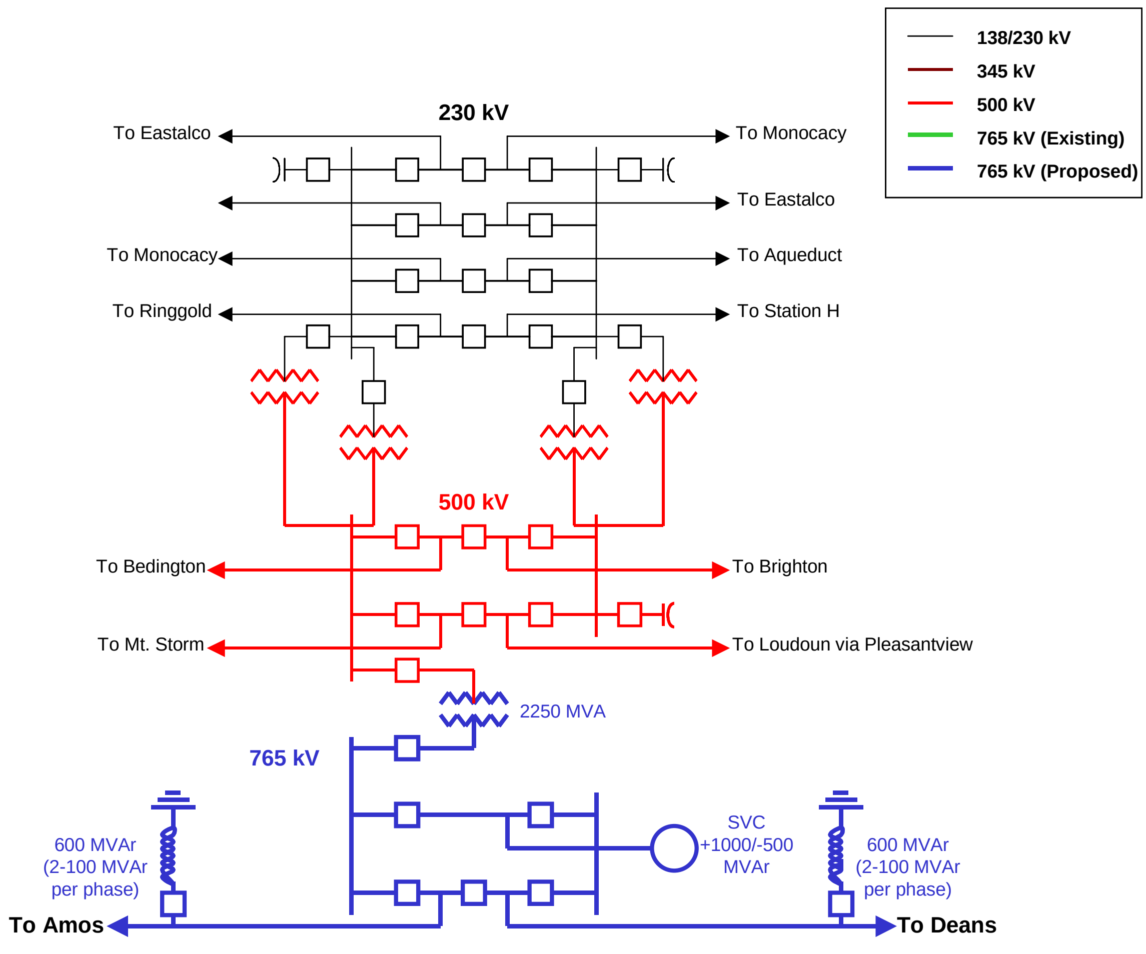

Exhibit 4: Proposed simplified one-line for Doubs Station (AP).
(Station configuration is conceptual and subject to change under the PJM Regional Transmission Expansion Plan (RTEP) process)

Deans Station (PSE&G): 2-2250 MVA 765/500 kV transformers
765 kV SVC (+1000/-500 MVAr)
6-765 kV circuit breakers
2-500 kV circuit breakers
1-600 MVAr line shunt reactor (2-100 MVAr per phase)
and associated circuit breaker

Transformer Impedance (per unit): R = 0.00007, X = 0.00728

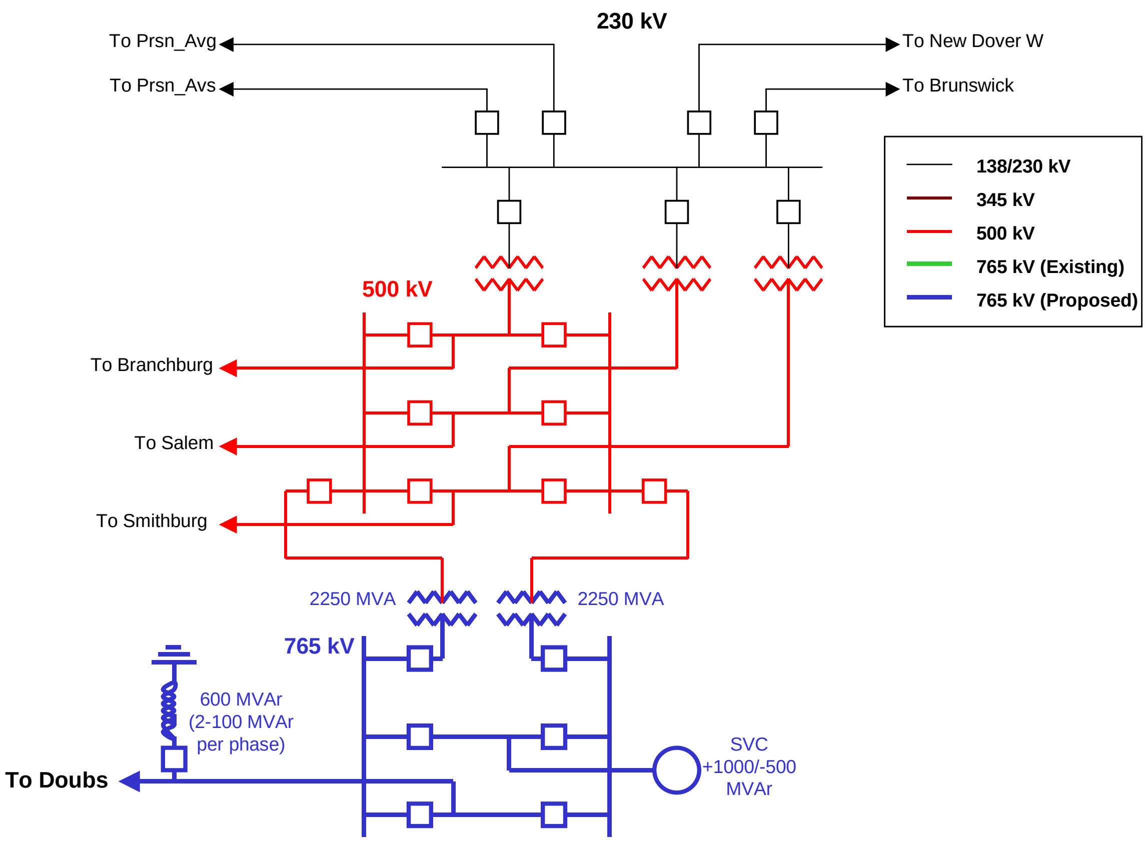

Exhibit 5: Proposed simplified one-line for Deans Station (PSE&G).
(Station configuration is conceptual and subject to change under the PJM Regional Transmission Expansion Plan (RTEP) process)

PERFORMANCE CHARACTERISTICS

The proposed AEP Interstate Project is being submitted for consideration under the PJM Regional Transmission Expansion (RTEP) process. Consequently, the performance characteristics of the project were evaluated from that perspective. Based on this evaluation, the proposed project was found to increase power transfer capability from the Western Region to the Mid-Atlantic Region of PJM by approximately 5,000 MW as shown in **Exhibits 6a and 6b**. The improved power transfer capability across these regions that have experienced significant and frequent congestion should provide significant economic benefits to the retail customers.

Specifically, **Exhibit 6a** illustrates the transfer capability from the Western Region to the Mid-Atlantic Region of PJM, without the proposed project in service. Incremental transfers are expected to be limited to 700 MW for the conditions modeled in the PJM RTEP 2010 power flow base case. The next two limits are also shown to better illustrate impediments that are likely to be encountered when transferring power from west-to-east across the PJM system. In developing this table, limits that were not responsive to this transfer or are not along its west-to-east path are not shown in Exhibit 6a. Limits involving transmission facilities that are expected to be upgraded in the near future are also not shown.

FCITC (MW)	Limiting Facility	Contingency	Rating (MVA)	PTDF (%)	LODF (%)	OTDF (%)
700	Black Oak-Bedington 500 kV	Pruntytown-Mt. Storm 500 kV	2744	8.4	30.7	11.7
1500	Mt. Storm-Doubs 500 kV(1)	Mt. Storm-Meadowbrook 500 kV	2598	10.5	34.7	12.4
1900	Hatfield-Black Oak 500 kV	Pruntytown-Mt. Storm 500 kV	2744	7.3	26.4	10.1

(1) This facility can overload under other contingencies at power transfers lower than the next limit.

Exhibit 6a: Transfer capabilities without the AEP Interstate Project.

Exhibit 6b illustrates the transfer capability for the same transfer scenario (from the Western Region to the Mid-Atlantic Region of PJM), but with the proposed project in service. The incremental transfers are now expected to be limited to 5,600 MW. The transfer capability improvement of approximately 5,000 MW is also reflected in the next two limits that are documented in Exhibit 6b.

FCITC (MW)	Limiting Facility	Contingency	Rating (MVA)	PTDF (%)	LODF (%)	OTDF (%)
5600	Mt. Storm-Doubs 500 kV(1)	Amos-Doubs 765 kV	2598	8.0	17.8	12.3
5700	Black Oak-Bedington 500 kV(1)	Amos-Doubs 765 kV	2744	6.7	16.5	10.5
6400	Doubs-Brighton 500 kV	Doubs-Deans 765 kV	2684	16.8	32.2	24.2

(1) This facility can overload under other contingencies at power transfers lower than the next limit.

Exhibit 6b: Transfer capabilities with the AEP Interstate Project.

In addition to the improvement in transfer capability, the efficiency of the entire PJM Region will also be greatly enhanced since transmission losses across PJM are expected to be reduced by over 280 MW during peak load conditions as shown in **Exhibit 7**. This reduction in transmission losses will not only reduce overall energy consumption across PJM, but also the need for generating capacity additions, resulting in a significant reduction in capital requirements and fuel consumption.

CASE	TOTAL LOSSES (MW)	CHANGE (MW)
WITHOUT PROJECT	17661	-
WITH PROJECT	17375	-286

Exhibit 7: Losses without and with the AEP Interstate Project.

As previously noted, these performance characteristics were determined using the 2010 PJM RTEP power flow base case that was made available by PJM in late 2005. It is recognized that more detailed analyses will need to be conducted under the PJM RTEP process using the latest system models and study assumptions. All analyses conducted by AEP will be made available for review in the PJM RTEP process.

PROJECT COST AND TIMELINE

The costs and timeline noted in this section of the report were prepared by AEP using the latest information from AEP's most recent 765 kV project in West Virginia and Virginia. These estimates are considered nominal dollars and conceptual since several variables and assumptions still need to be addressed.

The following are cost estimates for each component of the project:

Amos Station:	Station Equipment & Construction	$30,000,000
Doubs Station:	Station Equipment & Construction	$154,000,000
	Property	$2,500,000
Deans Station:	Station Equipment & Construction	$169,000,000
	Property	$2,500,000
765 kV Line:	Siting and Certification	$94,000,000
	Right-Of-Way	$516,000,000
	Line Equipment & Construction	$1,968,000,000

TOTAL PROJECT COST (ROUNDED): $3,000,000,000

The project is expected to require eight years to complete. The first three years are set aside primarily for line siting, certification, and to obtain the majority of the required right-of-way. Station and line work is projected to begin in year three, predominantly with engineering and equipment ordering. The construction of the station and line facilities will commence and continue for another five years until all facilities are completed in year eight. The year-by-year cost projection is shown in **Exhibit 8**.

765 kV PROJECT COST ASSUMPTIONS (3% INFLATION ADJUSTED)

	LINE CERTIFICATION & SITING	R/W & PROPERTY ACQUISITION	STATION EQUIPMENT & CONSTRUCTION	LINE EQUIPMENT & CONSTRUCTION	=	SUM YEAR
2007	$74,000,000					$74,000,000
2008	$20,000,000	$219,000,000				$239,000,000
2009		$225,000,000	$56,000,000	$248,000,000		$529,000,000
2010		$77,000,000	$92,000,000	$499,000,000		$668,000,000
2011			$66,000,000	$513,000,000		$579,000,000
2012			$61,000,000	$529,000,000		$590,000,000
2013			$39,000,000	$114,000,000		$153,000,000
2014			$39,000,000	$65,000,000		$104,000,000
TOTALS	$94,000,000	$521,000,000	$353,000,000	$1,968,000,000	=	**$2,936,000,000**

Exhibit 8: Yearly projection of cost allocations for the AEP Interstate Project.

IMPACT ON OTHER TRANSMISSION OWNERS

AEP recognizes that the project could impact the local utilities at or near the Doubs and Deans connecting points. Short circuit duties on existing circuit breakers and thermal overloads on local facilities will have to be addressed through more detailed studies to be conducted in cooperation with PJM and the impacted local utilities. AEP is committed to work with PJM and the impacted local utilities through the PJM RTEP process to ensure the viability of this project. AEP expects that local utilities will benefit from the knowledge that the AEP Interstate Project will be built because they can direct improvements in the intervening years to integrate well with the eventual completion of the 765 kV line.

DEPLOYMENT OF ADVANCED TECHNOLOGIES

Being a leader in transmission technologies, AEP is committed to deploy state of the art technologies to maximize the performance and benefits of the proposed project. Some of the technologies that may be utilized to further improve the performance of the project may include:

1. Single-phase switching – this will enhance the availability and stability of the line by only interrupting one phase to clear temporary single line-to-ground faults, which make up over 98% of temporary faults experienced by 765 kV lines;
2. Single-phase static VAr compensators – this will permit phase voltage balancing, boost line loadability, and improve the overall voltage performance of the line;
3. Fiber-optic wire(s) – facilitates the use of differential line protection;
4. Open ground wire to reduce line losses; and
5. Switchable shunt reactors to improve voltage control.

AEP does not preclude the consideration of higher AC voltages as AEP has conducted extensive tests of voltages beyond 765 kV that indicate the viability of developing transmission systems operating at voltages up to 2,000 kV.

PROJECT BENEFITS

Completion of the AEP Interstate Project will significantly improve transfer capability from the Western Region to the Mid-Atlantic Region of PJM. PJM anticipates several billion dollars in congestion costs over the next several years. The AEP Interstate Project, given the improvement to transfer capability and line losses, will likely reduce congestion costs substantially, thus lowering consumer costs. This new line will also provide a significant backbone transmission platform to integrate new technology generation having a diversity of fuel characteristics that may be developed across the broad geographic area traversed by the project, thus improving the nation’s energy position.

As **Exhibit 9** illustrates, the eastern AEP Transmission System, in addition to being highly integrated internally, is also the most interconnected transmission system in the Eastern Interconnection. It is directly connected to eighteen neighboring utility transmission systems at

127 interconnection points, of which 50 are at or above 345 kV. The total capability of the 127 interconnections is over 71,000 MVA, of which over 59,000 MVA is at 345 kV and above.

Through these interconnections, the eastern AEP Transmission System provides highly diversified access to the PJM, MISO, and non-RTO portions of the Eastern Interconnection. Specifically,

- There are 37 interconnections (12 at or above 345 kV) with five PJM-Member utilities, with a total capability of over 20,300 MVA (over 17,400 MVA at or above 345 kV);
- There are 63 interconnections (27 at or above 345 kV) with eight MISO-Member utilities, with a total capability of over 34,300 MVA (over 28,800 MVA at or above 345 kV); and
- There are 27 interconnections (11 at or above 345 kV) with five non-RTO-member utilities, with a total capability of over 16,300 MVA (over 12,500 MVA at or above 345 kV).

These interconnections serve as an electric highway system to strongly integrate the AEP System with these surrounding utilities, thus providing access to off-system resources, as well as a delivery mechanism to adjacent companies.

The AEP Interstate Project will also provide a significant opportunity to improve the reliability of local utilities along its path. This 765 kV line could be tapped to provide a strong and dependable transmission source to mitigate reliability concerns in major load centers. For example, this new line could be tapped and extended to provide additional transmission reliability to major metropolitan areas such as Washington, D.C., Philadelphia and Baltimore to support additional load growth or to mitigate retirement of local generation that may no longer be economically or environmentally viable. Specifically, the Doubs Station, located in Maryland, could be used as a potential source to reinforce the Baltimore and Washington, D.C. area transmission system. This reinforcement might become more critical as the economic or environmental viability becomes questionable.

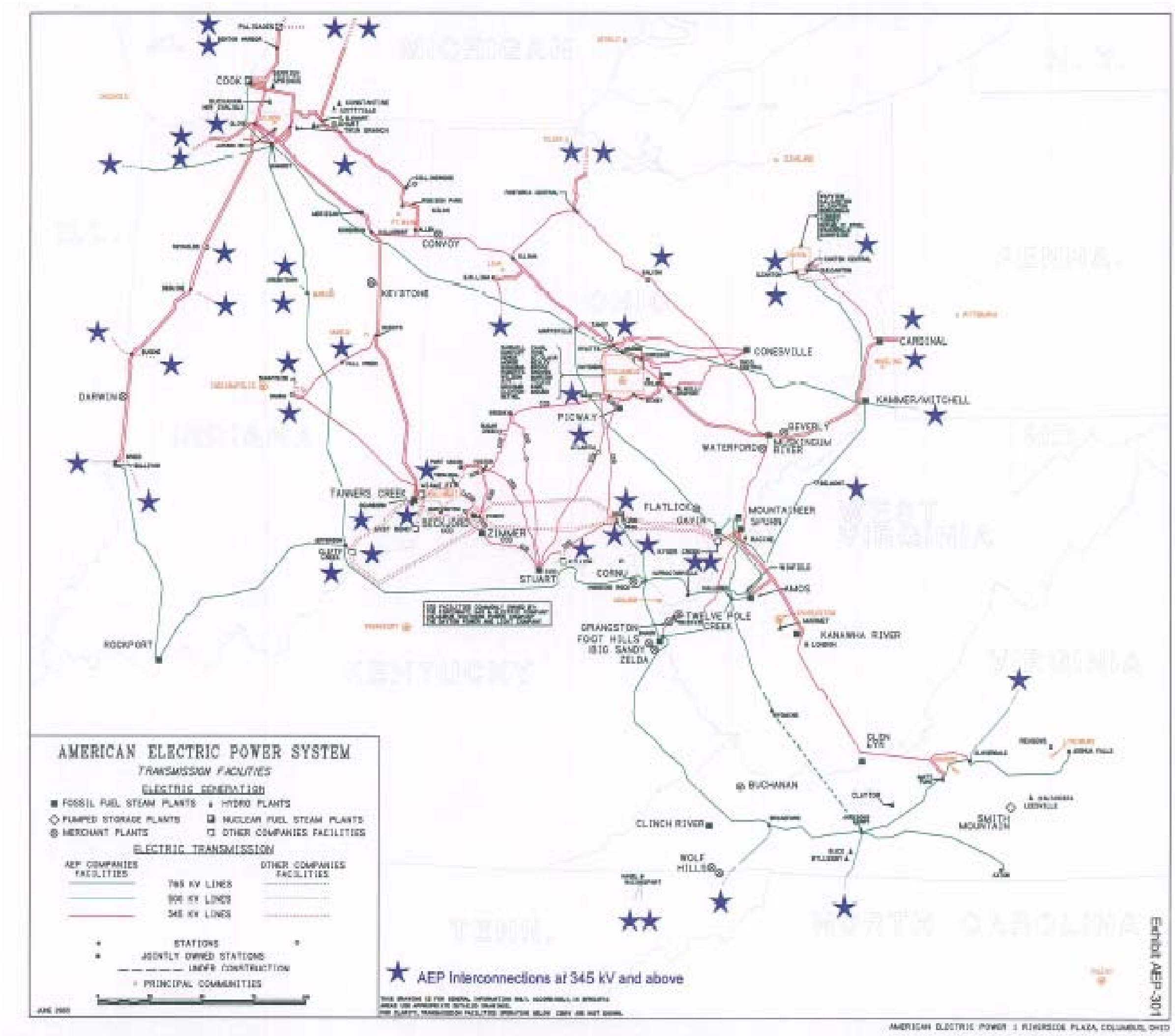

Exhibit 9: Eastern AEP interconnections at 345 kV and above.

CONCLUSION

AEP believes that the proposed project will effectively address the objectives outlined in the Energy Policy Act of 2005, the conceptual goals stated by PJM, and the concerns expressed by state regulators. Consequently, AEP stands ready to cooperatively work with other transmission owning utilities, federal, state, and local authorities, and PJM and its stakeholders to bring the AEP Interstate Project to fruition.

GLOSSARY OF TERMS

ACSR_______Aluminum Conductor Steel Reinforced
AEP________American Electric Power
AP_________Allegheny Power
EPAct_______Energy Policy Act of 2005
DOE________Department of Energy
FCITC______First Contingency Incremental Transfer Capability
FERC_______Federal Energy Regulatory Commission
HVDC______High Voltage Direct Current
LODF_______Line Outage Distribution Factor
MISO_______Midwest Independent System Operator
NIETC______National Interest Electric Transmission Corridors
NOPR_______Notice of Proposed Rulemaking
OPGW______Optical Ground Wire
OTDF_______Outage Transfer Distribution Factor
PJM________PJM Interconnection, LLC
PSE&G______Public Service Electric & Gas
PTDF_______Power Transfer Distribution Factor
RTEP_______Regional Transmission Expansion Plan
RTO________Regional Transmission Organization
SIL_________Surge Impedance Loading
SVC________Static VAr compensator
TVA________Tennessee Valley Authority