



MEETING AMERICA'S FUTURE ELECTRIC NEEDS

Transmitting Electricity vs. Transporting Fuel

I. Executive Summary

As the electric capacity demands of the United States continue to rise, concerns escalate about environmental and land use issues. Americans want a clean environment and they want to be free of the political upheaval often associated with imported petroleum. But they also want low-cost, reliable power. While these goals are likely to never be in lockstep agreement, they can be more closely aligned through proactive, reasoned debate.

This white paper looks at one specific project proposal to assess the various considerations of transmission grid expansion versus local siting of new generation to meet growing electricity demand. On a national level, the U.S. will need a combination of both. But they are rarely interchangeable solutions.

On Jan. 31, 2006, American Electric Power became the first electric utility to employ the 2005 Energy Policy Act in attempting to have a major transmission expansion project deemed a National Interest Electric Transmission Corridor. AEP proposed a 550-mile 765-kV transmission line that would originate in AEP's West Virginia service territory and travel toward the Atlantic Coast, offering opportunities for new generation and transmission expansion along the way. The project would increase transmission capacity by 5,000 MW in one of the most heavily congested regions of the United States. Some opponents of the line – largely those who do not want to look at it in their own communities – have suggested that a more efficient solution would be to build new coal generation plants in New Jersey and take the coal to those plants via existing rail infrastructure.

This is an age-old debate – referred to a century ago as “coal by wire vs. coal by rail.” New renewable generation technologies outmode that term, but the debate continues in a broader context. In an effort to better explain the advantages of, and need for, transmission expansion, this white paper will use the AEP proposal as a prime example of a situation that will undoubtedly repeat itself across the country in coming years. By focusing on one project, abstract concepts become clearer.

This white paper begins with a history of the region’s electric grid, followed by a detailed explanation of AEP’s project and a look at the results of building new coal generation plants in New Jersey, then transporting coal from West Virginia to New Jersey by rail. While the transmission line – silently traversing the Pennsylvania landscape – is designed to blend into the background as much as possible and will be overhead and out of the way, it also will facilitate construction of additional generation sources, including renewables, all along its route. Meanwhile, coal plants constructed in New Jersey would offer a single solution to capacity needs – more coal generation. And rail shipment of coal from West Virginia to New Jersey to produce an equivalent amount of new generation there would increase rail traffic by 115,000 coal cars annually along one of two routes, increasing traffic congestion, noise, pollution and safety hazards throughout the state. Although the white paper assesses one specific project, its conclusions can be extrapolated to other proposals elsewhere.

II. Background

In 1917, American Gas & Electric (now American Electric Power) pioneered the concept of the mine-mouth power plant, generating electricity at the Windsor Plant in Wheeling, West Virginia, and transporting it via a 138-kV line to Canton, Ohio.

AEP partnered to build the steam-driven Windsor Plant at the mouth of the Windsor Mine with West Penn Power Company, a Pennsylvania utility and a predecessor of Allegheny Power. Windsor was a pioneer, to be sure, but was not the first mine-mouth plant. That distinction went to a small generating facility in Hazelton, Pennsylvania, owned by Harwood Electric Co. Prior to the Hazelton and Windsor projects, all power was generated where it would be used – via small coal, oil, hydroelectric or other generating stations located in industrial areas of towns across the country.

Long before the concept of a global market, a community’s ability to prosper was commensurate with its ability to generate abundant, cheap electricity. Those lucky enough to be located near a fuel source would prosper, those communities faced with transporting tons of coal via the railroads would bear significant added expense and therefore prosper less. Thus, the concept of “coal by wire” – the ability to transmit electricity generated elsewhere – was crucial to the prosperity of many communities.

The Windsor Plant was more than a technological pioneer – it also was the first such joint venture for two utilities; the line that took power from there to Canton, Ohio, was the largest of its kind in use at the time, and was the first to provide electricity to three states (Pennsylvania, West Virginia and Ohio.) These accomplishments pale by comparison to the voltages in use today, the distance traveled and the millions of people benefited by a single transmission line. As the U.S. has grown, so have the needs of its electric grid.

Today’s electricity infrastructure is no longer intended to simply provide reliable electric service to local consumers. It supplies bulk power to wholesale markets across the country, stabilizing local economies and localized electricity prices. It also affords increased opportunities for critical developments such as alternative fuels, including wind

farms that span many acres of open land. A robust transmission system allows such projects, generally located in unpopulated spaces, to power load centers – urban areas that traditionally have sprung up in cozy pockets of land, secluded from the wind.

But 90 years after the concept was first introduced, the question continues as to whether it's better to transmit coal by wire or coal by rail. Due to new concerns about the environmental impacts of coal, some would assert that it's best not to transmit coal at all. However, more than half of the U.S. electric industry currently is powered by coal. It is the only affordable baseload fuel available in the U.S. in significant quantities. And new clean-coal technologies are leading us to a day when coal plants will be emission-free, or nearly so. Used in concert with renewable energy sources such as wind and solar wherever feasible, nuclear, and carbon sequestration techniques to mitigate emission impacts; coal is the fuel required to guarantee the United States a future of energy independence. And the coal of tomorrow is not the coal of yesterday.

III. About AEP

American Electric Power is one of the nation's largest electric utilities, with more than 5 million customers in 11 states, 36,000 megawatts (MW) of generation capacity and 39,000 miles of transmission line. It is the largest generator in the country, with more than 80 generating stations including coal (73 percent of AEP's generation capacity), natural gas (16 percent), nuclear (8 percent), and other – including hydroelectric and wind (3 percent). The company is one of the nation's leading wind generators, with 310 MW of owned wind power capacity, and more than 370 MW of purchased wind power.

AEP is proud to be considered an industry leader for its sound environmental principles. In fact, the company received the top score for the electric utility industry in a Ceres investor coalition report released March 21, 2006, that ranks 100 global companies on their climate change strategies (www.ceres.org). Only five companies – regardless of industry – surpassed AEP's total score in the report. Ceres is a national coalition of investors, environmental groups and other public interest organizations working with companies to address sustainability challenges. In its report, *Corporate Governance and Climate Change: Making the Connection*, Ceres evaluated how companies are addressing climate change through several key factors.

In addition to retrofitting existing power generation facilities with various emission control technologies and retiring less efficient facilities, AEP announced in 2004 it would build the first commercially-operated large scale integrated gasification combined cycle (IGCC) plant in the United States, and committed to one or more 600-MW units of IGCC generation capacity in operation by 2010. IGCC boasts pollutant removal rates well exceeding 90 percent for sulfur dioxide (SO₂), nitrogen oxides (NO_x) and mercury. It is considered by many analysts to be the savior of the coal industry, and America's guarantee of an energy-independent future.

Additionally, AEP is a charter member of the Chicago Climate Exchange, the world's first and North America's only, voluntary, legally binding greenhouse gas emissions

reduction and trading program. As a member of CCX, AEP committed to gradually reduce, avoid or sequester its greenhouse gas emissions by 6 percent below the average of its 1998 to 2001 emission levels by 2010. Through this commitment, AEP will reduce or offset about 46 million metric tons of greenhouse gas emissions by the end of the decade. AEP is achieving its reductions through a broad portfolio of actions, including those mentioned above, biomass co-firing, off-system greenhouse gas reduction projects, reforestation projects and the direct purchase of emission credits through CCX.

AEP has a history of innovation. The only utility in the United States to employ 765-kV technology on a large scale, AEP maintains more than 2,000 miles of the ultra-high voltage lines, which maximize efficiency and minimize environmental impact and land use.

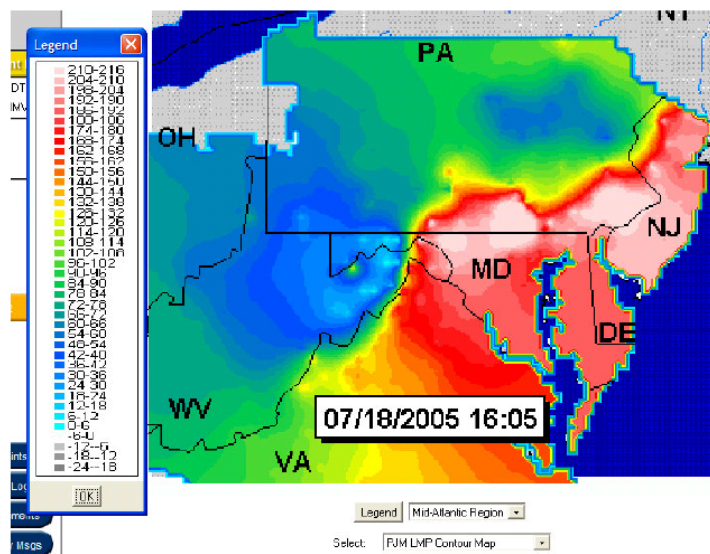
IV. AEP's I-765 Project: The Perfect Example

On Jan. 31, 2006, AEP announced its Interstate Transmission Project, dubbed I-765, a 550-mile stretch of 765-kV transmission line with a proposed route from West Virginia to New Jersey. The project is intended to alleviate severe congestion between Midwest generating units and energy-thirsty load pockets in the eastern U.S. The region's independent transmission organization, PJM Interconnection LLC, has identified as many as four or five new transmission lines needed in this region.

Last year alone, PJM posted more than \$2 billion in congestion costs. Congestion is the term used in electric markets to describe the situation in which the transportation of electricity between producer and consumer is constrained by inadequate transmission capacity, leading to higher prices.

The map below (excerpted from PJM's website) shows locational marginal prices for the PJM markets on the afternoon of July 18, 2005. The scale on the left of the image shows the price gradient for this snapshot in time. The highest energy prices are depicted by light pink and red colors, while the lowest prices are the lightest blue color. On this map, the highest prices are more than \$210 per MWh, while the lowest prices – sometimes only 50 miles away – are under \$20 per MWh. These drastic differences over relatively short distances are due to congestion.

AEP's proposed project touts 5,000 megawatts of transfer capacity – the equivalent of two



or three large generating stations. Because of its use of 765-kV technology, the line can ship far more power in far less right-of-way space than others.

AEP used its project proposal to test the Energy Policy Act of 2005, by requesting NIETC designation from the Department of Energy. The EPAct NIETC designation indicates a transmission expansion project intended to alleviate critical infrastructure inadequacies that could negatively impact large population centers if not alleviated. The NIETC designation is intended to help speed the siting process for transmission projects.

In looking at the map above, I-765 would connect the Pennsylvania, Maryland and New Jersey red to the West Virginia blue, levelizing costs in the region and bringing opportunities for new generation development along the length of the line, as well as in other areas. Based on PJM's rate structure in which those consumers who benefit most from a project pay proportionally more than those who benefit less, much of the cost of the I-765 project likely would be borne by consumers in the eastern PJM area – including eastern Pennsylvania and New Jersey.

The specific I-765 route will be determined through PJM's Regional Transmission Expansion Planning (RTEP) process. AEP has suggested a line route based on existing station facilities that could accommodate the additional capacity with the least need for upgrade. The concept of any route through this region came when PJM announced in 2005 what it called "Project Mountaineer" – identifying a region in dire need of additional transmission capacity. According to PJM, the Project Mountaineer area needed a minimum of 5,000 MW of new transmission capacity, which PJM felt would be at least four or five new lines. AEP's I-765 proposal meets nearly all of the Project Mountaineer needs with one line. Allegheny Power has subsequently proposed the Trans-Allegheny Line – a second new transmission project that would complement I-765. The two lines together can accommodate the needs identified by PJM.

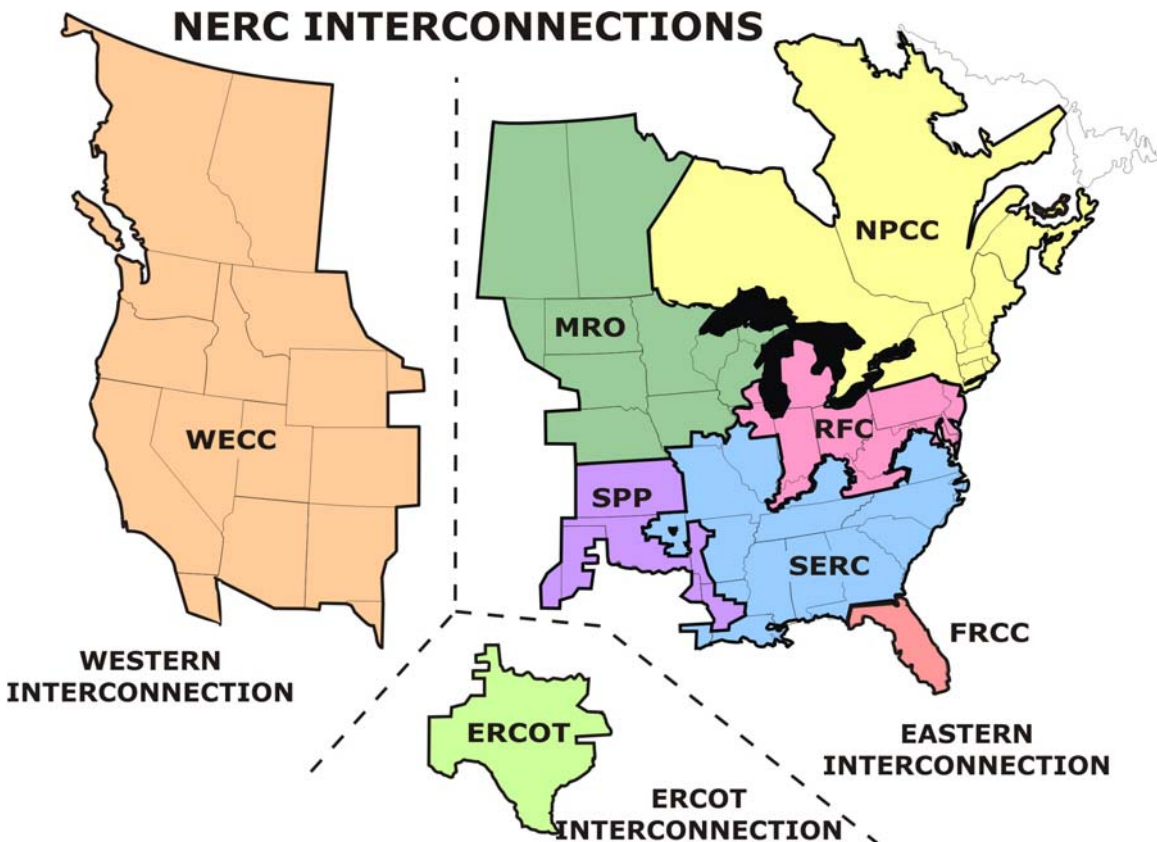
AEP's project has an ambitious schedule toward a 2014 line in-service date. Several tangential points increase the significance of the start-up target.

- 1) All generation sold across the I-765 line will be scheduled by PJM. AEP will not determine what generation is transmitted, although the line is currently proposed to begin at Amos Substation, connected to AEP's largest generation facility – Amos Plant, a 2,900-MW coal-fired unit.
- 2) Like many other utilities, most of AEP's existing generation capacity is already committed to native load customers. While AEP does sell excess capacity into the open market, it is not a merchant generator and does not generate large quantities of power for the sole purpose of open-market sale.
- 3) With a 2014 service date, the I-765 project will be transmitting electricity generated via much cleaner methods than those used today. Plant emission control retrofit projects now underway will be completed, emissions standards already on the books will be in effect, and others still under consideration by the nation's lawmakers may also be in effect at that time.

These factors matter because it's important to understand that this transmission line is urgently needed to ensure the reliability of the nation's power grid. AEP has stepped to the plate with its proposal because AEP has the experience and the expertise to build the kind of significant transmission needed to bring economic benefits to the eastern grid. The existence of the I-765 project will not mean dramatic increases in emissions in the regions it traverses. In many ways, it will offer increased opportunities for fuel diversity, as explained in Section VI.

V. Regional Reliability: Why We Need to Care About Neighboring Markets

The eastern U.S., from the Rocky Mountains to the Atlantic Ocean, operates on one integrated electric transmission grid. Although independent markets operate regionally, they all are interconnected. The map below, created by the Energy Information Administration of the U.S. Department of Energy, illustrates North America's three independent transmission grids. Within each of these grids, all systems are connected.



Reliability concerns in one area can impact those in another, as evidenced in the blackout of Aug. 14, 2003, which took out more than 50 million consumers, in some places for many days. A lengthy investigation conducted by the U.S.-Canada Power System Outage Task Force determined that inadequate tree-trimming under transmission lines in northern Ohio was the cause of the outage, which might have rolled even farther across the

continent had it not been stopped by PJM and by AEP's 765-kV transmission grid. It's unlikely that the millions of Manhattan workers who were forced to walk home to New Jersey that day would have assumed their hardships were caused by wayward tree limbs in northern Ohio. The map below shows the area impacted by the blackout.



Source: CNN

Evolution of the electric utility industry has created an environment in which we cannot afford to worry only about our own prospects – we are interconnected and reliant on each other. Isolationist attitudes are a dangerous ghost of the past. Initially, the country's transmission infrastructure was developed by local electric companies to serve local consumers. Some neighboring companies interconnected to assist each other in serving their native load customers in cases of storm outages or other emergency situations. Other than that, systems were pretty independent.

As illustrated by AEP's mine-mouth generation breakthrough that connected a plant with a load pocket more than 50 miles away, most early generation was relatively close to the customers. By the end of the 20th century, that era was long gone. When companies became more integrated for reliability reasons, economists and market analysts began to look toward wholesale electric competition as a means to bring about lower prices. Regulations were changed to facilitate wholesale competition and transactions across vast regions became commonplace. Suddenly, the number of transactions on the nation's transmission grid increased exponentially and the lines began to suffer.

Without proper infrastructure, the result of competition often was not a cost savings. Sometimes significantly more dollars were being spent for electricity – price signals indicating problem areas and shortages. But in order to encourage new market entrants, the regulations had been written in such a way that their unforeseen result was a disincentive for transmission owners to construct new lines. The number of transactions on the U.S. transmission grid grew from 25,000 in 1995 to 2 million in 1999 – an increase of almost 8,000%, with no significant new transmission construction. A large percentage of that increase was due to the rapid rise of merchant generation in the country. Merchant generators increased their production by 52% from 1998 to 2000. And

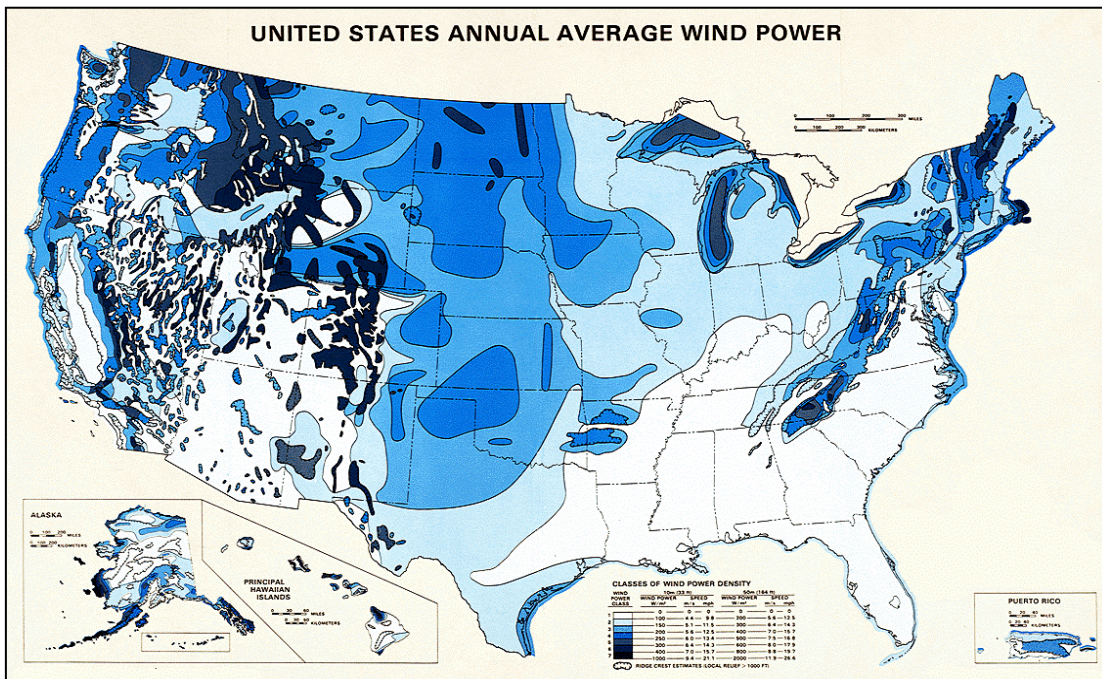
the only way for a merchant generator to move its power to a consumer is through someone else's transmission lines.

The Energy Policy Act of 2005 took a giant step toward alleviating congestion problems. Transmission owners now can receive tax incentives for new transmission construction, and permitting processes have been streamlined. AEP's project was the first proposed under the new rules and will serve as a milestone for others.

VI. Option 1: Transmitting Electricity

More than half of the U.S.' electricity is generated by coal. It is North America's most abundant fuel source and our ticket to energy independence. New clean-coal technologies have made it a viable option for environmentally responsible electricity generation going forward. Enormous strides are being made in emissions control. Clean coal is one of a variety of solutions to environmental issues such as global climate change. It is the most reliable, inexpensive source of baseload generation. But renewables are playing an increasing role in a quest for a diverse energy portfolio in the United States.

Wind power, for instance, is emission-free. Because the electric grid must remain in perfect balance every nanosecond, with exactly the same amount of load being taken off the grid as generation is being added on, wind cannot be a reliable baseload fuel because its intensity can change unpredictably and rapidly. But it can be a substantial contributor. Siting is the challenge of wind power. Wind is only present in quantities substantial enough for electricity generation in wide-open spaces. These spaces might be the midst of the Dakota plains, a sea or large lakeshore, or atop a mountain range. But it almost never is in population pockets. The map below shows wind potential in the United States, with the darkest blue areas being the ones with the greatest wind generation potential.



In the eastern U.S., wind energy could be productive along the Great Lakes and Atlantic shorelines, and atop the Smoky, Blue Ridge, Allegheny, Green and White Mountains. These sites could offset the need for additional coal generation, but only if transmission exists to move the electricity from the mountaintops to the consumers.

One distinct advantage of transmission expansion as a means to increase electricity capacity is the ability to access a transmission line at various points along its route. In the case of AEP's I-765 line, three substations have been identified along the route proposed. Those may well change as PJM's assessments determine the exact route. They were identified as key points in the original proposal, offered as an RTEP starting point.

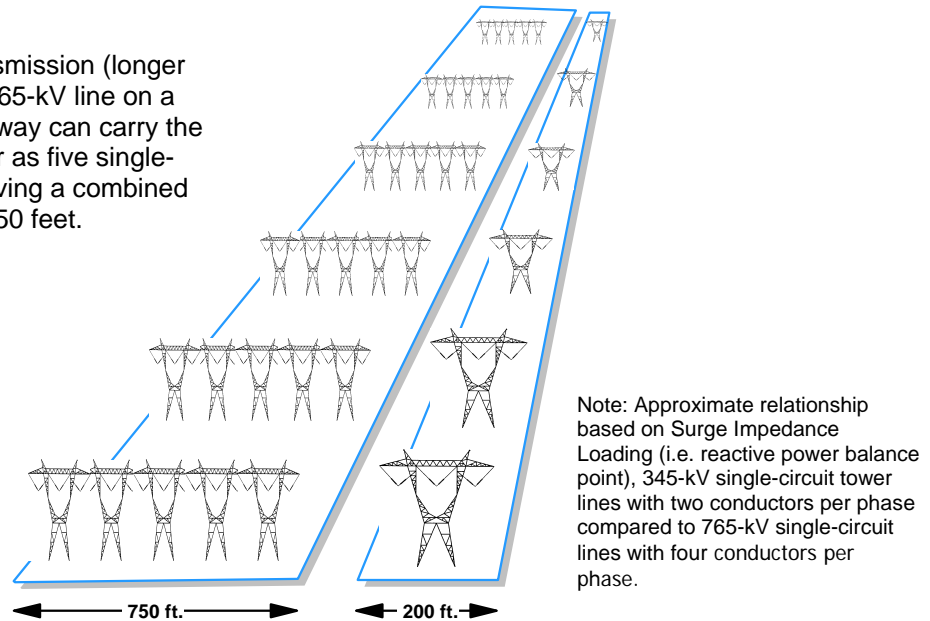
Regardless, the stations identified (Amos in West Virginia, Doubs in Maryland and Deans in New Jersey), were not the only access points along the proposed route. They were the largest stations at key junctures. But a number of stations along the entire route will create access points to the transmission line. The presence of the line, which will spur upgrades of existing facilities owned by other companies, will create many opportunities for new generation – whether renewable such as wind, IGCC, or more traditional technologies – along the full length of the route.

Once the exact route is determined, those opportunities can be more readily identified and located. Before that can happen, however, a two-step process will determine the best route for the line. First, PJM will determine within a somewhat wide area the best general route for the line, based on capacity and consumption needs. Then, AEP will conduct environmental impact studies and land use assessments within the route outlined by PJM. At this point, the public will have opportunities for input, and that input combined with the impact studies will set the course for line construction.

AEP's studies will look at historic site preservation as well as ecosystems, the potential presence of endangered species that must be protected, and human use trends.

One of the beauties of 765-kV lines is the limited right-of-way required to transmit a large quantity of energy. Due to technological efficiencies, one six-conductor phase bundle 765-kV line with a single 200-foot-wide right-of-way carries as much electricity as numerous towers for lower voltage lines – each with their own right-of-way requirement. The graphic below illustrates the dramatic land use savings achieved with 765-kV.

For long distance transmission (longer than 100 miles), one 765-kV line on a 200-foot-wide right-of-way can carry the same amount of power as five single-circuit 345-kV lines having a combined right-of-way width of 750 feet.



The towers used for the I-765 project will be 135 feet tall. They will be made of specially designed steel that is etched on the surface to encourage oxidation. In this process, tower steel starts out a dark, dull gray, eliminating sunlight reflection. The etching then causes the towers to quickly develop a coat of rust, at which point they fade into the background for onlookers, especially in wooded areas. Additional technological advances have minimized noise and static electricity often noticed around older 765-kV lines. The new six-bundle technologies will eliminate the line's disruption of broadcast and telephone reception for residents in close proximity.

VII. Option 2: Transporting Coal By Rail

In the case of AEP's I-765 proposal, some transmission line opponents suggest that if New Jersey is short on energy and wants to benefit from low-cost coal, that state should build its own coal plants rather than stringing transmission lines through neighboring states to buy electricity from West Virginia generators. That sounds good on the surface.

Such an assertion ignores the fact that the transmission line will provide power access all along the route, not just at the terminus. It also ignores the fact that eastern Pennsylvania shares New Jersey's dramatic need for more low-cost electricity, and will also benefit from the line. But for the sake of clarity, the possibility of shipping coal from West Virginia to New Jersey, without regard to needs in between, will be compared with the option of transmitting electricity by wire along the same route. Here are some facts specific to the I-765 project, but they are points that should weigh into any discussion about the pros and cons of new transmission infrastructure in the U.S.

AEP's transmission project would have a transfer capacity of 5,000 MW. Based on consumption rates of AEP generation facilities, if the transmission line were not built and New Jersey added power plants to generate 5,000 MW of new capacity there, the state would require an estimated 13.8 million tons of coal annually to fuel those plants. A

standard coal mine offloading system is designed to accommodate 100-car sets. A total of 1,150 100-car trains would be needed to transport coal from West Virginia to New Jersey. That's 96 a month or just over three additional trains a day to equal the power transmitted overhead.

While three extra trains a day may seem insignificant; transporting such a large quantity of coal across Pennsylvania's countryside would add safety, noise, pollution, and traffic congestion problems in a region already battling with significant issues in many of those areas. These are problems not created by transmission lines overhead.

Currently, two rail companies transport coal from West Virginia. Each has a logical route it would take, based on existing infrastructure. One has an easterly route through West Virginia, Virginia, Washington, D.C., Maryland, Delaware and Pennsylvania (including Philadelphia) and into New Jersey near Trenton. The other takes a route north from West Virginia to Pittsburgh, then across 400 miles of Pennsylvania (including Harrisburg), into New Jersey at Phillipsburg. These two routes happen to include Pennsylvania's most congested areas in terms of road traffic and population. In an era when the state is working hard to attract new businesses and industries, the coal transportation plan would exacerbate existing problems, increasing tactical challenges of doing business there while decreasing quality of life.

Before assessing what infrastructure improvements might be needed to accommodate a little over three additional coal trains daily, we must assess the existing infrastructure in the states through which the trains would travel. The data in the table below are from the American Society of Civil Engineers' 2005 Infrastructure Report Card. West Virginia did not include road data in its report card and therefore is not included in the table.

	DE	MD	NJ	PA	VA
Percentage of major urban roads that are congested	26	49	51	23	29
Percentage of major roads in poor or mediocre condition	29	45	71	46	26
Percentage increase of vehicle travel on highways, 1990-2003.	23	15	12	24	28
Annual cost per driver (in \$) of driving on roads in need of repair (extra vehicle repairs and operating costs)	273	402	554	333	248
Annual congestion cost (in \$) per person (excess fuel and lost time)	N/A	866* 1212 **	N/A	241*** 716**** 210*****	272

* Metropolitan Baltimore

** Metropolitan Washington, D.C.

*** Metropolitan Allentown

**** Metropolitan Philadelphia

*****Metropolitan Pittsburgh

In addition to the above data, Pennsylvania has other road condition concerns. The Pennsylvania Department of Transportation has a \$2.3 billion maintenance backlog for roads and an \$8 billion maintenance backlog for bridges. The bottom line: roads already are in less-than-desirable condition in each of the states impacted by the additional rail traffic. And congestion already is a problem everywhere.

The amount of freight transported by railroads already is growing exponentially, according to the U.S. Department of Transportation. During the next 20 years, it is expected to double on the national level, and train volumes at some grade crossings will more than double. The DOT reports, “coupled with expected increases in auto and truck traffic, highway delay is likely to increase significantly at highway-rail grade crossings. The delay to motorists and pedestrians could reach unacceptable levels in many communities, blocking emergency vehicles, disrupting local commerce, inconveniencing residents and creating societal divisions.” (*Status of the Nation’s Highways, Bridges and Transit: 2002 Conditions and Performance Report*, DOT.)

Rail lines are struggling to keep up with their own infrastructure, facing much the same situation the nation’s electric transmission grid faced in the 1990s. The Association of American Railroads reported in March 2006 that Class I freight railroads will spend more than \$8 billion on infrastructure improvements and new equipment in 2006 – a 21% increase over 2005 expenditures. Freight railroads are at or near the top of U.S. industries in terms of capital intensity, according to the AAR.

Meanwhile, deliveries of Powder River Basin coal in Wyoming fell 20 million tons short of commitments in 2005, largely due to deteriorated rail infrastructure there. The Edison Electric Institute reported in March 2006 that 2005 rail deliveries of coal fell anywhere from 10 to 25 percent short of commitments.

The DOT study also assessed the infrastructure improvement costs anticipated to bring the nation’s railroad crossings to a more serviceable level based on anticipated increases

Putting greenhouse gases into comparative context

According to the Federal Bureau of Transportation Statistics, drivers in metropolitan Philadelphia wasted 60 million gallons of fuel due to congestion in 2003, in Pittsburgh, they wasted 8 million and in Allentown they wasted 4 million. In Baltimore, MD, they wasted 39 million gallons and in metropolitan Washington, D.C., they wasted 88 million gallons of fuel sitting in traffic, for a total of 199 million gallons wasted – just in this metroplex corridor, just by cars stuck in gridlock.

These are the cities through which these new coal trains would pass, adding to road congestion and hours of time for drivers idling at railroad crossings, spewing out their own greenhouse gas emissions.

And according to the Environmental Defense Fund (www.fightglobalwarming.com), a gallon of burned gasoline creates 25 pounds of CO₂. Therefore – even before adding in the additional traffic congestion caused by 1,150 extra 100-car trains a year, this region of the country annually contributes almost 2.5 million tons of CO₂ into the air – more than all of AEP’s coal plants added together (1.73 million tons in 2003) – just from idling engines stuck in traffic. This does not include emissions created during productive drive time, nor does it include the emissions generated by the train engines themselves.

in rail traffic. Railroad companies are legally responsible for maintaining the condition of the tracks themselves, as well as the condition of the right-of-way and the pavement between the tracks at a crossing. The road on either side of a crossing is the responsibility of local or state governments (depending on the road), funded through tax money.

Warning signs and signal systems are funded by states with federal money. That federal money has remained at a stagnant level for a number of years. Unlike the PJM transmission line projects in which the project benefactors pay the additional costs incurred, when added rail traffic increases wear and tear on crossings, taxpayers all share the bill. State and local governments also have the responsibility of enforcing traffic laws at highway-rail grade crossings.

Train noise has been an additional problem of rising national scope in recent years. In 1994, Congress passed a law that, among other things, required the Federal Railroad Administration to issue a rulemaking regulating the use of train whistles and horns at crossings. In 2003, the FRA issued a rulemaking that allowed for local communities to identify quiet zones where train whistles would be either eliminated or executed at a reduced volume. This may improve the noise levels in areas immediately surrounding the tracks, however 300-400 persons die in the U.S. each year in car-train collisions. The quieter neighborhoods add nothing to safety statistics.

While the addition of three trains a day through any given area would likely make an insignificant blip on numbers of this magnitude, the added stress on drivers in those areas as well as the lost productivity for employees who can't get to work also must be considered.

VIII. Conclusion

Solving the eastern U.S. electric capacity constraints by building new coal plants in New Jersey and transporting coal there from West Virginia by rail is far from a zero-sum solution.

Coal by rail not only eliminates the flexibility and potential for generation expansion through renewables and clean-coal technologies, it creates or exacerbates a number of unrelated societal issues on the ground. These include traffic congestion, pollution, noise and safety considerations that are absent when capacity problems are resolved with an overhead transmission line of significant capacity.