

How Dominion and Allegheny Power Got It Wrong

The 502 Junction-Mt. Storm-Meadow Brook-Loudoun (TrAIL)
500-kV Transmission Line

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Piedmont Environmental Council
45 Horner Street
Warrenton, VA 20186

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Section 1: Introduction and Conclusions

Dominion Virginia Power (Dominion) and Allegheny Power (Allegheny, through its TrAILCO subsidiary) have applied to the Virginia State Corporation Commission (SCC) to build a 500-kV line through the Shenandoah Valley and Northern Virginia Piedmont. To sell the project, they have said that burdening this area with 165-foot-tall towers and 150-foot-wide rights-of-way is the only way to prevent power blackouts in Northern Virginia. This alarm is false — a scare tactic — coming from:

- Failure to understand that reliable and economic power comes from a combination of power generation, transmission, and management of the quantity and timing of demand; and
- A myopic search for solutions that looks only to transmission from remote plants and ignores new local power sources and demand management.

The SCC should deny the Dominion and TrAILCO request to build this line. It is an unnecessary, risky, high-impact, sub-optimal solution.

In this report, the Piedmont Environmental Council (Piedmont) shows that the sacrifice that Dominion and Allegheny demand of Northern Virginia cannot be justified. Specifically, they have:

- Ignored less costly and less environmentally damaging solutions;
- Misrepresented the need for the proposed transmission line as a local Northern Virginia issue rather than as a regional issue;
- Made wildly unrealistic (but undisclosed) assumptions in analyzing the needs of Northern Virginia and the greater Mid-Atlantic area; and
- Claimed falsely that the proposed transmission line will benefit consumers, when (as they know) studies show that the line is more likely to enrich power generators to the west at the expense of consumers.

For these reasons, authority to build the proposed transmission line should be denied.

Background

This paper analyzes the proposed 502 Junction-Mt. Storm-Meadow Brook-Loudoun 500-kV power transmission line (Loudoun line) that Dominion and Allegheny seek authority to build across Northern Virginia. We analyze their filings with the SCC and related documents from the U.S. Department of Energy (DOE), Dominion, and PJM. PJM operates the electric power system in several eastern states. It also plans the extra-high voltage (EHV) electrical grid in that area.

Some History

May 12, 2005: PJM proposed to the Federal Energy Regulatory Commission (FERC) the Mountaineer concept to provide 5,000 MW of new capacity to transmit predominantly coal-fired electric generation from power plants on the Ohio-West Virginia border through new corridors ending at New York City. This would be PJM's largest initiative ever. PJM did not show the need for 5,000 MW. PJM's objective seems to have been to provide markets for western generation. Strategic alternatives (local generation, demand management, and transmission) and the various trade-offs were not addressed.

August 8, 2005: The President signed the Energy Policy Act of 2005. This gave the DOE authority to define "national interest" transmission corridors and to facilitate new transmission.

March 6, 2006: Allegheny asked the DOE to confer early "national interest" designation on its proposed "TrAIL" 500-kV line, running from western Pennsylvania to northern Maryland. This was the first concrete plan to implement the Mountaineer concept.

June 2006: PJM endorsed the Loudoun line instead of the TrAIL line. The Loudoun line is a revision of the TrAIL line, with a route shift into Virginia. We will show that PJM's analysis of the Loudoun line was superficial. Allegheny now calls its portion of the Loudoun line "the TrAIL line."

August 2006: The DOE released its "National Electric Transmission Congestion Study," which explicitly endorsed the assumptions underlying PJM's Mountaineer concept. The study did not question or analyze PJM's assumptions or conclusions.

Conclusions

Arguments for the Loudoun line are wrong. Dominion, Allegheny, and PJM argue that it is needed to solve a possible voltage problem¹ at Meadow Brook in 2011, possible overloads of the Mt. Storm-Doubs 500-kV line in 2011, and

¹ Voltage in an EHV system may drop below its normal level when a local area draws power from the grid. An excessive drop results in voltage collapse and a local blackout that may cascade.

possible overloads of the Pruntytown-Mt. Storm 500-kV line in 2014. These problems would only occur under certain unlikely contingencies.

- PJM's planning process is biased to find solutions only using transmission lines. The process is incapable of asking for, or finding, optimal solutions that include generation, demand management, and transmission options on a level playing field.
- The threatened overloads are not real. They flow from PJM, Allegheny, and Dominion unrealistically and unreasonably assuming that essentially all new generation will be built in western PJM and essentially none in eastern PJM. To the contrary, there are more than enough proposed generation projects in eastern PJM to avoid the overloads without a new line.
- Voltage may become a real concern at Meadow Brook. But this can be solved at low cost with no environmental impact using conventional technology, *without the Loudoun line*.

Building the Loudoun line would adversely affect the environment along its route and the economy and reliability of power in eastern PJM. Specifically, the Loudoun line would:

- Directly damage the environment. A line with towers as high as a 16-story building could be seen from at least two miles on either side of the line. A 270-mile line would negatively affect over 1,000 square miles. In addition to damage to birds, other wildlife, habitat and vegetation, land-use damage would be significant, resulting in change to current and planned land uses. These issues are explored in more detail in other Piedmont documents.
- Make eastern PJM even less attractive for new generation than it is now, with more coal-fired generation built in western PJM instead. This would lead to spiraling west-to-east transmission needs.
- Transfer jobs and tax revenues from eastern PJM to western PJM.
- Compound the direct and indirect environmental impacts of transmission. Western coal-fired generation would be much more harmful environmentally than the eastern natural gas-fired generation it displaced.
- Condemn populous eastern PJM to increasing dependence on remote western generation, making PJM more vulnerable to cascading blackouts.
- Increase cost to ratepayers.

References

We quote most often from five sources.

1. RTEP – "Regional Transmission Expansion Plan," a 330-page PJM report, dated February 27, 2007, and available at <http://www.pjm.com/planning/reg-trans-exp-plan.html>.
2. Dominion Filing – an April 19, 2007 six-volume filing Dominion made with the SCC in support of the Loudoun line, and available at <http://www.dom.com/about/elec-transmission/powerline/meadowbrook/sccapp.jsp>

The oft-cited KEMA Report is contained within the Dominion filing at http://www.dom.com/about/elec-transmission/powerline/meadowbrook/application/vol2/kema_report.pdf
3. TrAILCo Filing – an April 19, 2007 filing TrAILCo made with the SCC in support of the Loudoun Line, and available at <http://www.aptrailinfo.com/index.php?page=virginia>
4. Discovery – Dominion answers to discovery by Piedmont and others in the SCC proceeding and available in relevant part on Piedmont's website at <http://www.pecva.org/downloads/powerlines/documents/industry/DominionDiscovery.pdf>.
5. DOE – "National Electric Transmission Congestion Study," a 122-page DOE report, available at http://nietc.anl.gov/documents/docs/Congestion_Study_2006-9MB.pdf

Section 2: Why do Dominion, Allegheny and PJM want to do this?

PJM - a transmission system operator and planner - is predisposed to solve all power challenges with transmission.

Coal-fired utilities in western PJM, including Allegheny, will get lucrative access to eastern markets and ratepayers will pay the freight.

Dominion/Allegheny can invest surplus cash in a low-risk project with guaranteed return – an addition to balance their portfolios.

Hammers and Nails

If you are a hammer, then every problem looks like a nail. PJM is responsible for planning the transmission system. PJM has transmission engineers and the tools and data for transmission planning. This predisposes PJM to meet every problem with a transmission hammer.

Markets for Coal-fired Generators

Western-PJM utilities Allegheny and American Electric Power (AEP) are primarily coal-fired. With only modest internal demand growth, they are actively seeking new markets. The obvious targets are in the East. With the Loudoun line and other proposed west-to-east transmission, western utilities will secure access to these markets, financed by ratepayers throughout PJM.

By burning cheap fuel to sell into high-priced markets, Allegheny, AEP and others may make more money per kWh than by selling to their regulated customers. Sales to the east will let them profit from any spare generating capacity that they may have from time to time. It is no accident that Allegheny and AEP are partners on the proposed Amos-Bedington-Kemptown 765-kV line, and that Allegheny is partner with Dominion to build the Loudoun line.

Low-Risk Addition to Dominion/Allegheny Portfolios

In the past, Dominion invested some of its excess cash in oil and gas exploration and production and in interstate gas pipelines. Some of this investment was speculative and most of it was more risky than electric power transmission.

In fact, the return on all of the investment by Dominion and Allegheny in the Loudoun line is guaranteed.

Section 3: What is the Real Problem?

Dominion, Allegheny, and PJM planners say that two key lines may overload in 2011 and 2014, and that northwestern Virginia may experience voltage problems in 2011. According to the planners, the overloads and voltage problems will occur only in the event of certain known low-probability contingencies.

If these occur, voltage could be low. But the threatened line overloads are not a real risk. PJM's unrealistic and unreasonable assumption that essentially no new generation will be built in eastern PJM fuels the Dominion/Allegheny cries of "Wolf!"

Dominion claims that Northern Virginia load growth requires the line. To the contrary, the Loudoun line is to serve loads in a broader region, of which Northern Virginia is a small part.

Line Overloads and Low Voltage

Power system equipment occasionally fails. The power system is therefore planned redundantly and operated conservatively. The goal is to withstand "contingencies" — failures of one or more bulk transmission or generation facilities. Dominion and PJM planners say that under certain contingencies:

1. The Mt. Storm-Doubs and Pruntytown-Mt. Storm 500-kV lines may overload in 2011 and 2014, respectively, and
2. Low voltage may occur near the Meadow Brook substation in 2011.

See Fig. 3.1 for these locations on the Northern Virginia grid.

In addition, utility planners claim that some lower voltage lines and transformers in western Virginia will overload under certain contingencies. Building the Loudoun line would fix some of the problems on the lower-voltage system. But new extra-high-voltage transmission lines are not built to address local problems on the lower-voltage system. Local, cheaper, and less obtrusive fixes are readily available.

Finally, PJM says that under some contingencies many lines in eastern PJM could overload and that voltage problems could occur throughout eastern PJM in 2016. This reflects the gradual growth of electrical demand and PJM's unrealistic assumption that little or no new generation will be built in the area, and that

demand growth will not be moderated by new demand management programs. In recent years, demand has grown at around 2% per year in most of PJM, including Dominion's territory. This modest growth rate is predicted to continue. Planners constantly study future conditions to find where the system needs strengthening.

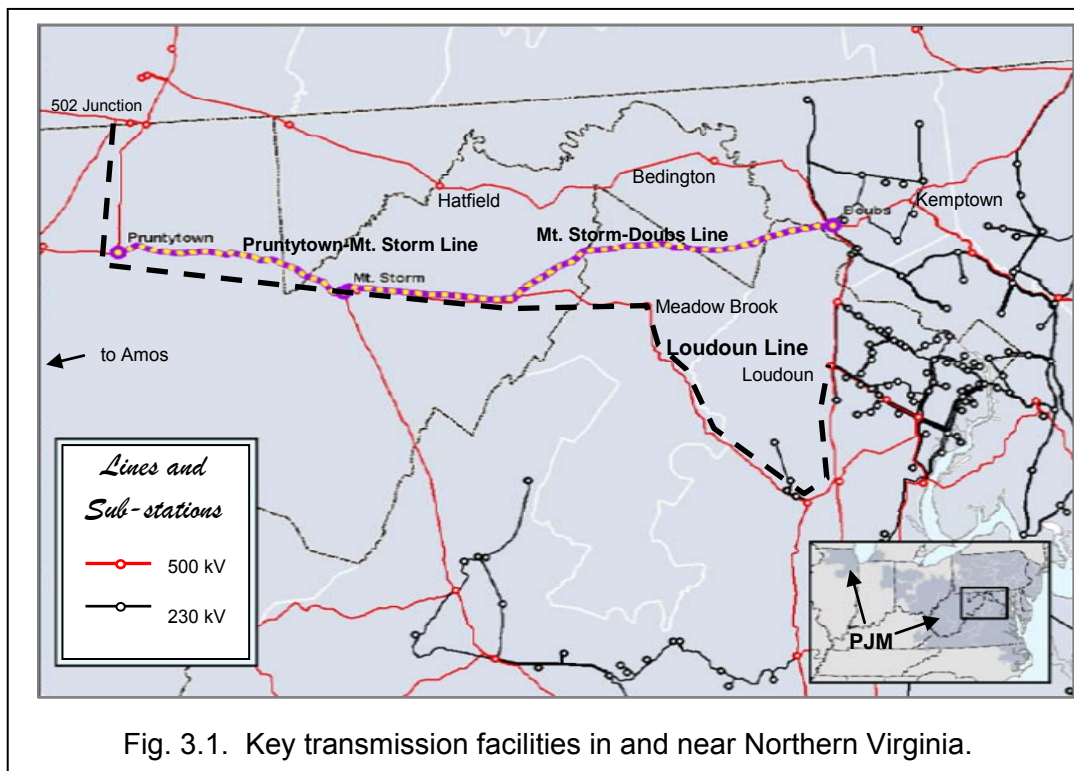


Fig. 3.1. Key transmission facilities in and near Northern Virginia.

The Overloads Reflect a Bad Assumption

The Dominion/Allegheny/PJM projection of overloads on the Pruntytown-Mt. Storm-Doubs 500-kV lines is not supportable. This also is true for many of the problems in 2016. These overloads show up in computer models as a direct result of an unrealistic and unreasonable assumption.

This assumption is that almost no new generation will be built in eastern PJM. PJM databases used for all reliability studies assume, for instance, only 19.8 MW of new generation added in Virginia, Maryland, and the District of Columbia by 2012 and only 640 MW more by 2016.² In contrast, the same databases assume that thousands of MW of new coal-fired generation will be built in western PJM.

None of the utilities publicly acknowledges this assumption or its implications. The thousands of MW of generation projects proposed for eastern PJM belie the assumption. See Table 3.A. Most of this is gas-fired generation with in-service dates of 2011 or earlier.

² Dominion's Response to Discovery (Bates No. DOM000558)

Table 3.A does not include the proposed 600-MW CPV gas-fired Warren plant to be built near Meadow Brook by 2010. The plant reportedly has obtained all needed permits and has had an interconnection agreement with Dominion for several years. It was put on hold temporarily but the developers told Dominion and PJM in 2006 that they now would go forward. Remarkably, it is not in any of the databases.

With modest demand growth, but essentially no new generation in eastern PJM through ten years, of course imports from western PJM would grow. *Of necessity* the computer models using this assumption will show west-to-east lines overloading, and the 2016 voltage problems, too.

Table 3.A New generation in local PJM queues Source: PJM RTEP	
<u>Location</u>	<u>MW</u>
Delmarva	980
MD + DC	5,170
Dominion	3,209

If even some — not necessarily all — of the generation in Table 3.A materializes, major new transmission will not be needed in 2011.

Mirant Mid-Atlantic is one of the largest independent power producers in PJM, with 5,000 MW of capacity in the Washington DC area. "Mirant has been analyzing the [Loudoun line] Our analysis shows that facility overloads are highly sensitive to . . . [generation] assumptions used in the model." Mirant says that this may amount to "perhaps 2 MW of transmission flow for every [1] MW of generation."³ Mirant complains that PJM made independent and far-reaching assumptions about Mirant plants.

The real problem, then, is the need for new generation in eastern PJM. In the past, generation development in the area lagged. In 2006 Joseph T. Kelliher, Chairman of the Federal Energy Regulatory Commission, placed the blame squarely on a broken PJM market.⁴ Since then some fixes have been made, and more than the needed amounts of new generation are in the pipeline for eastern PJM. But PJM, Dominion, and Allegheny still assume that almost none will be built.

A Regional Issue – Not a Northern Virginia Issue

Dominion claims that the Loudoun line is for Northern Virginia. This is a political claim advanced to overcome local opposition to the line. It is not a fair description of the primary purpose of the line.

The supposedly overloaded Pruntytown-Mt. Storm-Doubs 500-kV path begins near huge coal plants on the Ohio River. It connects them and West Virginia's Mt. Storm coal-burning plant to an important transmission substation in Maryland,

³ Robert E. Driscoll, CEO, Mirant Mid-Atlantic LLC, letter to Steve Herling, Vice President Planning, PJM (June 7, 2007). <http://www.pjm.com/committees/teac/downloads/20070509-mirant-comments.pdf>

⁴ Joseph T. Kelliher, statement on PJM Reliability Pricing Model (Apr. 20, 2006).

north of Washington DC. Most of the power on this and a parallel line serves Washington DC, Baltimore, and their Maryland suburbs. Some of it finds its way north and east to Philadelphia and Delaware. Only a small fraction flows south to Northern Virginia.⁵

In the RTEP report, PJM concedes that the Loudoun line will serve needs in Pennsylvania, Delaware, Maryland, the District of Columbia, and possibly other load centers, in addition to Northern Virginia.⁶

Dominion also claims that Northern Virginia load growth causes the threatened overloads, and hence the need for the Loudoun line. This also is false. Table 3.B shows that Northern Virginia demand is only 19% of the load that, according to PJM, the Loudoun line would serve.⁷

Table 3.B Northern Virginia accounts for a small fraction of the demand (in megawatts, MW) that the Loudoun line is supposed to serve.			
	<u>2006</u>	<u>2011 Forecast</u>	<u>Increase</u>
Northern Virginia	6,368	6,833	465
PECO Energy Co. - PA	8,337	8,904	567
Delmarva Power & Light - DE, MD	3,994	4,403	409
Baltimore Gas & Electric - MD	7,212	7,703	491
PEPCO Holdings - DC	6,953	7,474	521
Totals	32,864	35,317	2,453
Sources:			
Northern Virginia: Dominion filing, Attachment I.B.3			
All others: RTEP report			

Northern Virginia's projected load growth of a mere 465 MW obviously does not require a new 3,000 MW line. The real problem is regional.

⁵ KEMA Report, pp. 23-33.

⁶ PJM RTEP, pp. 171, 215, 270, 297.

⁷ Table 3.B actually overstates Northern Virginia's fraction of the load to be served by the Loudoun line. The table does not include Allegheny Power's customers in Northern Maryland, who are served from the Doubs and Bedington substations and would be served by the Loudoun line. We do not know their demand since PJM lumps it with that of other AP customers further west, but the KEMA Report indicates that it might be 2,200 MW in 2011.

Section 4: Did they Look at the Right Solutions?

Dominion and PJM purport to have studied four alternatives to the Loudoun line. But three of the four were straw men, set up to be knocked down.

Inadequate voltage can be solved inexpensively and with no environmental impact, using conventional technology.

Line overloads have many real solutions. The most important is to build local power plants in proximity to demand instead of siting them remotely in western PJM and then needing transmission, too. Demand management could contribute. And there are real transmission alternatives to the Loudoun line.

Solutions they Claim to Have Considered

Dominion and PJM considered four putative alternatives to the Loudoun line.

1. A second Mt. Storm-Doubs 500-kV line;
2. A Mt. Storm-Loudoun 500-kV line;
3. Reconductoring the existing Mt. Storm-Doubs 500-kV line; and
4. The originally proposed 502 Junction-Mt. Storm-Kemptown 500-kV line – Allegheny's original TrAIL.

Of these, only the last is a real alternative. The first two obviously would make the Pruntytown-Mt. Storm overloads worse. The third, reconductoring, would require taking the Mt. Storm-Doubs 500-kV line out of service for a long period. That would be risky and reconductoring might not appreciably increase transfer capability.

Solutions not Considered

If load grows, then *power plants* must be built somewhere. Transmission lines don't generate power. Transmission options are really "new western coal-fired power plants, plus transmission." The real choice is between these options and "new eastern power plants, without major new transmission." See Appendix A for more details on the options below.

1. *Build power plants in eastern PJM.* PJM power markets need to be repaired so that they support continued operation of existing generation and induce investment in new generation in eastern PJM, near urban load

- centers and other demand. PJM has recently undertaken some encouraging efforts to fix its market.⁸ New generation, including gas-fired power plants near Washington, DC, has been announced recently beyond what is included in Table 3.A and retirements have been postponed. Even the continued operation of Mirant's plant in Alexandria, near demand centers in the District of Columbia and Northern Virginia, would represent a major change in the assumptions used by the utilities. Similar efforts have recently met with success in New England.
2. *Develop demand-side resources.* Dominion's demand-side management (DSM) efforts to date have been minimal. Even moderate development of DSM resources could make a significant contribution to power supply in Virginia and eastern PJM, as documented in a recent study by Summit Blue Consulting. A 10% reduction (more than 3,500 MW) in eastern PJM is feasible, though perhaps not quite by 2011.
 3. *A 525-MVAR static VAR compensator (SVC⁹) at the Meadow Brook substation.* This would fix the only real problem that Dominion advances as justification for the Loudoun line, low voltage near Meadow Brook. It would cost about \$35 million, with no environmental impact. In contrast, the Loudoun line would cost more than \$850 million and have a devastatingly destructive impact on a historically important and largely pristine environment.¹⁰
 4. *A phase-angle regulator (PAR) on the Pruntytown-Mt. Storm line.* It would direct some flows away from the Pruntytown-Mt. Storm-Doubs lines onto lines that are less heavily loaded.
 5. *The proposed Amos-Bedington-Kemptown 765-kV line.* Allegheny and American Electric Power propose to build a huge line from the Ohio River to a point just north of Washington, DC. According to PJM, even with the Loudoun line, this 765-kV line is needed to solve serious problems in the region beginning in 2012. But our studies show that if it is built, the Loudoun line will not be needed.

There are other options, conventional as well as innovative, for meeting needs in 2011, 2016, and beyond. But Dominion, Allegheny, and PJM investigations into alternatives thus far have been very shallow.

⁸ The Federal Energy Regulatory Commission chairman blames apparent generation shortages on a broken PJM market. See Joseph T. Kelliher, Chairman, Fed. Energy Regulatory Comm'n, Statement on PJM Interconnection, LLC Reliability Pricing Model (Apr. 20, 2006).

⁹ SVCs are widely used devices that control voltage by supplying or absorbing reactive power, or VARs. They are controlled by solid-state valves, which have no moving parts. They are used in place of older, larger rotating devices whose footprint was as large as a house

¹⁰ If there were a drop in water pressure at your house the water company could consider two alternatives. It could install a giant new pipe all the way back to the reservoir - tearing up hundreds of miles of ground. Or it could put a small pump near your house. If it chose the former, you would guess that they had some other use for all that water.

KEMA, Inc., a consulting firm, evaluated demand-side and generation options for Dominion.¹¹ KEMA was not part of the planning process. Its evaluation was done months after Dominion had already committed to the Loudoun line. KEMA was hired to bolster Dominion's filing with the SCC.

KEMA did not consider viable demand and generation options. Furthermore, KEMA ignored transmission, generation, and demand management options that could in combination displace the Loudoun line.

KEMA's analysis was overly simplistic. Its conclusion that a massive new transmission line is the best solution is not justified. See Appendix B for details.

¹¹ KEMA Report, pp. 69-70.

Section 5: Did they find the Best Solution?

The objective of Dominion, Allegheny, and PJM is to maximize reliability at the lowest cost. But the planning process ignores important generation, demand-side, and transmission alternatives as well as environmental protection and regional development issues.

PJM claims that its *transmission* decisions are optimal because it only acts when generators have failed to solve problems. This remarkable fallacy has it just backwards. PJM has evaluated very few of the generation proposals for service before 2011 and hence ignores them for planning purposes – "the generators have failed to act!" PJM is only now beginning to accept generation study requests for 2014. PJM's decision to build the Loudoun line, if approved, will foreclose future generation decisions in a self-fulfilling prophecy.

What Is "Best"?

What is "best" is measured in relation to some criterion. The utilities' criterion is reliability (in this case, maximum improvement in transmission capability) at minimum cost.¹² This limited perspective virtually ensures that Dominion's choices will not be "best" in relation to many important criteria.

Environmental protection plays no role in PJM's transmission planning. *It seems to be an add-on after the major decisions are made.* Table 5.A summarizes word searches of PJM's 330-page RTEP. On average, forms of the words "reliable," "economic," and "cost" appear more than twice per page.

Table 5.A
Word occurrences in the RTEP report reflect PJM's priorities

Various forms of	Occurrences
reliable	444
economic	141
cost	131
environment	12
cultural	1
historic	0
scenic	0

**"Historic" was never used in the context "historic site." It was used ten times in the context "past and continuing operation of the power system."

¹² For instance, see Dominion Application, testimony by Scott Gass, pp. 17-18.

Ten of the twelve uses of the word "environment" referred to power plants. Only one referred specifically to transmission. It did so only to bemoan the difficulty of siting transmission lines due to environmental concerns.

By contrast, Virginia places a great deal of importance on the environment. The State Code reflects that in § 56-46.1 which states that, "As a condition to approval the Commission shall determine that the line is needed and that the corridor or route the line is to follow will reasonably minimize adverse impact on the scenic assets, historic districts and environment of the area concerned." This evaluation should be done when the planners are evaluating the various alternatives. It should not be an afterthought, done after the key decisions have been cast in concrete.¹³

The focus of Dominion and Allegheny is the same as PJM's. They failed to consider the relative environmental impacts of alternatives. A line with towers as high as a 16-story building could be seen for miles on either side. The 270-mile line Loudoun line would visually mar over 1,000 square miles. Wildlife, vegetation, and other land-use damage would be substantial.¹⁴

PJM, Dominion, and Allegheny have ignored other important considerations as well. They failed to consider the effect a transmission line has on a number of environmental attributes, including air quality. The Loudoun line would bias generation plans, encouraging new coal-fired generation in western PJM and discouraging new natural gas-fired generation in the east. Coal-fired plants are much more environmentally damaging than natural gas plants.

Selection among Alternatives

"We can order transmission owners to build lines, but we cannot order generation to be built," admits a PJM spokesman. "So if we are seeing overloads developing, the only thing we can order is power lines."¹⁵ From this crabbed perspective, PJM concludes: "When PJM proposes a transmission upgrade . . . to resolve a reliability issue or transmission constraint, by virtue of the market's *inaction* regarding other potential solutions, the . . . transmission solution becomes the most economical option."¹⁶

¹³ The Electric Power Research Institute developed a multi-objective method to find out how much transmission a system needs. One of the objectives of this analytical framework was to minimize "corridor impact." EPRI, *An Approach for Determining Transfer Capability Objectives*, EPRI EL-3425, Mar. 1984. PJM utilities and engineers were heavily involved in this work.

¹⁴ "Comments of the Piedmont Environmental Council" Statement of Catherine Gilliam, Attachment A, filed with DOE July 6, 2007. (Comments regarding the DOE's National Interstate Electric Transmission Corridors.)

¹⁵ Mark Clayton, *Cheap Power to Northeast US: a mixed blessing*, The Christian Science Monitor, May 9, 2007, at p. 4.

¹⁶ PJM RTEP, p. 121. See also p. 40.

This flagrant non sequitur shines the light on PJM's (and Dominion's) myopia. Compared to nothing — inaction — any course of action can be pawed off as optimal.

PJM does not recognize a proposed plant in its transmission studies until (1) a Generation Interconnection Feasibility Study, (2) a System Impact Study, and (3) a Facilities Study have been completed and (4) an Interconnection Service Agreement has been executed.

Except for large new projects, like nuclear units and (western) coal-fired plants, PJM will not allow a proposed generator to begin this process more than seven years before its in-service date. The study queues for 2011 were therefore not open until 2004. The transmission planning data bases used to analyze the Loudoun decision were developed in 2005 or early 2006. Few generators had had time to complete the interconnections studies by then. Proposed generators are still entering the study queues for in-service in or before 2011. In fact, interconnection studies have not yet been completed for most of the power plants proposed for service in eastern PJM between 2007 and 2011.

PJM is only in 2007 beginning to allow proposed generators to enter the study queues for 2014 in-service. The queues for 2016 will not open for two years.

Thousands of MW of generation projects were and are pursuing this process in good faith. But in PJM's "Chicken Little" approach, "The sky is falling; the generators have failed to act; therefore we will build the Loudoun line, and our decision is optimal!" Joseph Heller calls this "Catch-22."

If the line is built, it will cause prices on the eastern PJM bulk electricity market to drop. This will discourage new generation in that region. PJM can then say, "See, we were right!" in a self-fulfilling prophecy.

The true optimal course is to fix the PJM market so that it induces desired actions, such as maintaining and refurbishing existing generation and attracting investment in new, clean generation and demand management where it is needed in eastern PJM. By taking these options off the table, and committing only to transmission solutions, PJM, Allegheny, and Dominion foreclose or bias decisions on demand management, new generation, and refurbishing older power plants.

Section 6: What if the Line is Built?

If the Loudoun line is built:

- The PJM system will be inherently less reliable and more vulnerable to cascading blackouts.
- PJM studies show that consumers will pay more and generators (primarily in western PJM) will profit more.
- Changes in marginal cost will discourage new generation in eastern PJM and encourage it in western PJM.
- This will cause a spiral of more and more major west-to-east transmission.
- Related jobs, investments, and tax revenues will migrate from the east to the west.
- Environmental damage will be greater.

Consumer Costs

If the Loudoun line is built, regional transmission congestion may be reduced. But a PJM study shows that ratepayers will pay more for power and generators will make more profits.¹⁷ To demonstrate this we must analyze the PJM study and the Byzantine PJM market process. We regret that these are complex. The complexities have kept people from understanding what will really happen.

When congestion occurs in PJM, the price of electricity in the bulk markets goes up dramatically. To keep generators from reaping windfall profits, and to protect ratepayers, part of the price increase is captured by PJM and reimbursed to the ratepayers through "financial transmission rights" or FTRs. The FTR payments reduce the net costs of congestion to ratepayers.

In a 2010 test year, the PJM study shows that ratepayer payments to generators (summed throughout PJM) will increase by \$169 million if the line is built, even though congestion is reduced. (One would think that reduced congestion would mean lower payments. The increase is due to defects in market processes.)

In addition, generator production costs (fuel costs) will go down by \$140 million. This saving, though, is not passed through to ratepayers. Rather, the generators

¹⁷ "Market Efficiency Analysis Preliminary Results," PJM TEAC committee report, Feb. 21, 2007. Later versions of this report analyze a more distant future in three scenarios. Depending on assumptions about new generation, the benefits of the Loudoun line may accrue to generators or consumers. In the most likely scenario, the benefits accrue to the generators, at the cost of the ratepayers, as in 2010.

as a whole (but mainly those in western PJM) will be \$309 million richer (\$169 million more in revenue plus \$140 million less in fuel cost). See Table 6.A.

Dominion publicly argues that gross payments by the ratepayers will go down by "more than \$600 million" (the number is actually \$621 million, according to the PJM study), implying that the ratepayers would save this.¹⁸ In fact, PJM admits that \$790 million *less* will flow back to the ratepayers through financial transmission rights (FTRs) if the line is built. Ratepayers' *net* costs therefore will go up by \$169 million (\$790 million minus \$621 million) if the line is built. See Table 6.B.

Table 6.A
The Loudoun line will make generator income increase (2010 PJM test year)

\$ 169,000,000	Increase in revenue
<u>140,000,000</u>	Decrease in production (fuel) cost
\$ 309,000,000	Net increase in generator income

The ratepayers also will pay for the line itself – an average "mortgage payment" of \$200 million per year for the life of the line, according to PJM. So the ratepayers will pay a total of \$369 million more (\$169 million plus \$200 million) in the 2010 test year PJM studied if the Loudoun line is built. This will affect ratepayers in the west as well as in the east.

Table 6.B
The Loudoun line will make customer costs increase (2010 PJM test year)

\$ 621,000,000	Decrease in gross customer payments
<u>790,000,000</u>	Decrease in FTR reimbursements to customers
\$ 169,000,000	Net increase in customer costs
<u>200,000,000</u>	Annualized cost of the line itself
\$ 369,000,000	Total increase in customer costs

In summary, building the Loudoun line may make congestion go down. But because of imperfections in the PJM market processes, PJM's study shows that the line will make generator profits and customer costs go up.

Generation Market Effects

If the Loudoun line and other new east-to-west lines are built, then market prices and revenues to generators in eastern PJM will drop, as will output from those generators. Conversely, prices and revenues to western generators as well as output from western generators will rise. As discussed earlier, PJM studies show that revenues to generators as a whole will increase. Constellation Energy, a major eastern PJM generating company, pointed out that "it would simply be imprudent to make an investment [in eastern PJM] that had no opportunity to recover its fixed costs" after new lines are built.¹⁹ For the same reason, older generators in the east will tend to be retired instead of cleaned up and

¹⁸ Dominion Application, testimony by Steven R. Herling, p. 19.

¹⁹ Letter from Divesh Gupta, Counsel for Constellation Energy to PJM Board (June 15, 2007), (available <http://www.pjm.com/committees/teac/downloads/20070509-pjm-letter.pdf>)

refurbished. New cleaner generation will not be built in eastern PJM. Dirtier coal-fired generation will be built in western PJM instead.

Job and Investment Transfers

If the Loudoun line is built, jobs building and running power plants will be in the west, not the east. Western communities and school districts, not eastern ones, will get the high property taxes on power generation that will be paid (as part of their rates) by eastern consumers.

Line after Line

If the Loudoun line is built, then major urban centers in eastern PJM, including Washington DC, will become increasingly dependent on imported power. More and more transmission will be needed resulting in an "aluminum sky."

Environmental Quality

If the Loudoun line is built, it will scar some of the most scenic and historically important parts of the country. Many of these lands are held in permanent conservation easements. Wildlife (including endangered species) and its habitat will be injured. The resulting transmission spiral will make environmental damage spiral too.

New power plants will burn coal in western PJM instead of natural gas in eastern PJM. The local (western PJM) environmental impact of new coal plants will be much greater than the local (eastern PJM) environmental impact of new natural gas plants. In addition, coal plants emit more greenhouse gases and other airborne pollutants than do natural gas plants.

A Less-Reliable System

If the Loudoun line is built — leading to spiraling dependence on long-distance power plants — then PJM will become more vulnerable to cascading blackouts. Depending on long-distance energy transfers is less reliable (all else being equal) than relying on local generation or local conservation.

The province of Quebec epitomizes this. Hydro-Québec, the provincial power company, gets much of its power from huge, remote hydroelectric plants. As a result, the system has been so highly prone to blackouts that all of Hydro-Québec's interconnections are expensive direct-current links that effectively quarantine the province from its neighbors to prevent cascading failures.

Quebec didn't have much choice — you have to put the dams where the water is. PJM has a choice. Choosing to depend on transmission from remote generation is imprudent and will create unnecessary risks.

Appendix A: Alternatives to the Loudoun Line

This appendix contains some details on alternatives to the Loudoun line that should have been but were not considered by Dominion/Allegheny and PJM. We emphasize that this is a partial list. There are many other options, conventional as well as innovative.

Some of the options listed cannot meet all of the need by themselves. But they can do so in combination with other options.

1. *More power plants in eastern PJM.* PJM and Dominion/Allegheny carefully ignored this obvious and central option. Thousands of MW of new power plants are proposed for eastern PJM. If they are not built, it will be because of failure of the PJM market. In 2006, FERC Chairman Kelliher said in very strong terms that the PJM market is broken. New generators, especially in the East, cannot make a sufficient profit to attract investment. He told PJM to fix the market or else he would.²⁰ PJM is making efforts to do so and early results are encouraging.²¹

We noted above the proposed CPV Warren plant to be built near Meadow Brook by 2010. The plant reportedly has obtained all needed permits and has had in place an interconnection agreement with Dominion for several years. It was put on hold, but in 2006 the developer told Dominion and PJM that they were going forward with it. Remarkably, however, it is not in the PJM databases from which PJM and Dominion forecast overloads and voltage problems.

Also, in July 2007 CPV announced a proposal for another 600 MW gas fired plant in Charles County, MD, near Washington, DC. According to CPV, "the new facility will generate enough electricity to power 600,000 homes and use state-of-the-art technology to produce electricity efficiently and cleanly to help meet the region's demand for energy."²²

2. *Demand-side resources.* Energy Information Administration data for 2005 shows that Dominion is ranked 39th overall in spending on demand-side management. It spends the least of any company with a similar level of sales. A serious effort in this area needs to be part of the eastern PJM energy portfolio. PJM's recent auctions evidence the significant contribution that demand management can make. A 10% reduction is

²⁰ Joseph T. Kelliher, Chairman, Fed. Energy Regulatory Comm'n, Statement on PJM Interconnection, LLC Reliability Pricing Model (Apr. 20, 2006).

²¹ Press Release, ISO New England Inc., Competitive wholesale Markets Prove an Effective Tool for fulfilling Regional Electricity Needs (Mar. 16, 2007) (http://www.iso-ne.com/nwsiss/pr/2007/fcm_soi_results_03-16-2007.pdf) (In comparison, New England's recent initiative called forth more than 17,000 MW of new power plants and demand-side resources.)

²² See <http://www.cpv.com/pdf/presrelease7.25.07.pdf>

feasible. This would amount to more than 3,500 MW and by Dominion's numbers would eliminate the need for the Loudoun line. Perhaps 3,500 MW are not feasible by 2011, but in combination with generation options or less-obtrusive transmission options demand management could still eliminate completely any need for the Loudoun line.

3. *A 525-MVAR static VAR compensator (SVC) at Meadow Brook.* Four such devices would solve voltage problems in Pennsylvania (two places), Maryland, and Meadow Brook.²³ The first three are in PJM's plan. The one at Meadow Brook was never mentioned publicly. Installing it would solve the only real problem used by Dominion to justify the Loudoun line. It would cost about \$35 million, while the Loudoun line would cost more than \$850 million. The device would have a footprint measured in square feet – its only environmental impact. The impact of the Loudoun line, in contrast, would be enormous.

The proposed CPV Warren plant to be built near Meadow Brook by 2010 will provide nearly half of the MVARs needed at zero cost if it is connected to the grid properly, reducing the size and cost of the Meadow Brook SVC.

4. *A phase-angle regulator (PAR) on the Pruntytown-Mt. Storm line.* A PAR is a special transformer. PARs increase the impedance of a line, thereby reducing its flows and increasing flows along other paths. It would direct some flows away from the Pruntytown-Mt. Storm-Doubs lines onto lines that are less heavily loaded. It would increase the west-to-east transfer capability by more than half what the Loudoun line would give. It would cost about \$150 million. Its environmental impact would be limited to its footprint. PJM has had several in service for many years. They are more reliable than any thermal power plant.

A PAR could be a useful hedging option. It could provide some increase in transfer capability while other options (new plants, demand management, etc.) were being built.

Alternatively, it could be a permanent element of the system, in combination with other options.

5. *The proposed Amos-Bedington-Kempton 765-kV line.* This line would be much larger than the Loudoun line, which it in essence would parallel. In July 2006, PJM said that building the Loudoun line in 2011 would solve all problems in the local region through 2021. By early 2007, PJM said that, even with the Loudoun line, the 765-kV line is needed to solve serious problems in the region beginning in 2012. Neither Dominion/Allegheny nor PJM admits addressing whether the Loudoun line would still be needed if the 765-kV line were built. We have studied this, using PJM's data and the same software PJM and Dominion use. The answer is, "no."

²³ PJM and Dominion e-mails show that they knew this at least as early as May 1, 2006. Dominion Discovery Response, (Bates No. DOM000218.)

Appendix B: Dominion's Analysis of Generation and Demand Management Alternatives

KEMA Incorporated evaluated demand-side management (DSM) and generation options in connection with Dominion's SCC filing.²⁴ This evaluation was not part of the planning process, but rather was performed after the fact to justify Dominion's decision to build the Loudoun line.

KEMA's "analysis" of DSM or new generation as alternatives to the Loudoun line is biased and shallow. KEMA considered only "new northern Virginia generation"²⁵ and DSM. The power system is regional as are the markets to be serviced by the proposed Loudoun line. There is no justification for restricting the alternatives to northern Virginia. The *supposed* reliability need for the line is regional.

KEMA admits that DSM could displace the Loudoun line, but goes on to argue that to do so DSM would require "about a 3,000 MW load reduction" in Northern Virginia by 2011.²⁶ The Northern Virginia load growth that supposedly requires the line is only 465 MW. KEMA offers no reconciliation of these wildly inconsistent numbers.

KEMA "analyzed" only two generation alternatives — both destined to fail.

- *Distributed generation.* "Our analyses show that nearly 30,000 small new distributed generators would be needed by 2011 and nearly 80,000 by 2016. . . . The number of new distributed generating units that would be required . . . is beyond reasonable expectation."²⁷ KEMA is right — a new technology will not achieve such market penetration so fast. The 80,000 number is especially disingenuous; it refers to what would be needed to displace other major transmission additions — such as the Amos-Bedington-Kempton 765 kV transmission line — needed even if the Loudoun line is built.
- *New Loudoun substation power plant.* According to KEMA: "[T]his would require a 3,000 MW plant by 2011 — by far the largest plant in Virginia, and one of the largest in North America Such a large new plant would be nearly impossible to license and build by 2011."²⁸ KEMA ignores that it is distinctly possible to site reasonably sized plants

²⁴KEMA Report pp. 69-70

²⁵ *Id.* at p. 4

²⁶ *Id.* at p. 69 (emphasis added).

²⁷ *Id.* at pp. 69-70

²⁸ *Id.* At p. 70

summing much more than 3,000 MW in the region to be supplied by the Loudoun line; such plants have been proposed and are awaiting approvals by PJM and the local utilities.

Both KEMA generation "options" are obvious non-starters. KEMA says as much; consequently, they didn't do any analysis. In particular, KEMA did not consider the thousands of MW of generating plants that are now in the eastern-PJM interconnection study queues, all of which are real options. KEMA did not look at other projects that are or were temporarily on hold, such as CPV Warren. They did not consider other potential generation, conservation, and efficiency options that will be called forth by PJM's recently reformed capacity market. Neither did Dominion. Neither did Allegheny. Neither did PJM.