

**REBUTTAL TESTIMONY
OF
P. JEFFREY PALERMO
ON BEHALF OF
VIRGINIA ELECTRIC POWER COMPANY
BEFORE THE
STATE CORPORATION COMMISSION OF VIRGINIA
CASE NO. PUE-2007-00031**

1 **Q. Please state your name and position.**

2 A. My name is P. Jeffrey Palermo, and I am employed as an Executive Consultant with
3 KEMA, a power system engineering consulting firm.

4 **Q. Have you prefiled direct testimony in this proceeding?**

5 A. Yes. My direct testimony sponsoring the April 2007 KEMA Report ("KEMA Report")
6 was filed with Dominion Virginia Power's Application on April 19, 2007.

7 **Q. What is the purpose of your rebuttal testimony?**

8 A. My rebuttal testimony is in response to testimony by witnesses of other parties to this
9 case in regard to transmission system planning and the KEMA Report.

10 **Q. Would you briefly describe what was included in the KEMA Report (Attachment**
11 **PJP-1)?**

12 A. The KEMA Report presented the results of studies performed under my direction that
13 evaluated the need for new transmission facilities in 2011 and 2016 and identified
14 solutions that would meet applicable reliability criteria. The studies found that
15 improvements were needed for both years and emphasized long-term solutions based on
16 2016 conditions.

1 **Q. In the KEMA Report, what was the most critical line overload that you identified?**

2 A. The most critical overload was the loading on the Mt. Storm–Doubs 500 kV line when
3 the Mt. Storm–Greenland Gap 500 kV line was out of service. Under those conditions,
4 the Mt. Storm–Doubs line loaded to about 2,670 MW in 2011 and 3,000 MW in 2016.
5 These amounts would be 226 to 558 MW above the limit for this line. The KEMA
6 Report also noted that “By 2016 the Dooms–Lexington, Bristers–Morrisville,
7 Cunningham–Elmont, and Bristers–Ox 500 kV lines also appear on the list. The
8 contingencies that overload the Mt. Storm–Doubs line now also include the loss of
9 Morrisville–Front Royal, Front Royal–Meadow Brook, Doubs–Bedington, or Dooms–
10 Cunningham. In addition, there are many more overloads on the 230 kV, 138 kV, and
11 115 kV transmission facilities than there were in 2011.”¹

12 **Q. Did the KEMA Report also identify how much of this Mt. Storm–Doubs loading was**
13 **due to northern Virginia customer load?**

14 A. Yes. About 570 MW of northern Virginia load (8% of the 7,125 MW northern Virginia
15 load) will flow on the Mt. Storm–Doubs line following the Mt. Storm–Meadow Brook
16 outage. This 570 MW loading is about 19% of the 3,000 MW loading on the Mt. Storm–
17 Doubs line following the contingency.

18 **Q. Was this information used to estimate the amount of DSM or new generation that**
19 **would be needed to correct the Mt. Storm–Doubs line overload?**

20 A. Yes. Since about 8% of northern Virginia load flows on the Mt. Storm–Doubs line
21 during the Mt. Storm–Meadow Brook contingency, the northern Virginia load would

1. See pages 29-30 of the KEMA Report, Attachment PJP-1.

1 have to be reduced by 6,975 MW (558 MW/8%) mitigate the contingency. This was
2 discussed in section 5.2 of the KEMA Report.

3 **Q. The KEMA Report has been criticized for not considering solutions that included**
4 **combinations of DSM and generation. In particular, PEC witness Merrill made**
5 **such claims at pages 61-64 of his direct testimony. Why didn't KEMA consider**
6 **such combinations?**

7 A. The KEMA Report did not specifically address combinations of DSM and distributed or
8 central station generation because the amounts required in northern Virginia would be
9 enormous. It would be unwise to consider such changes to be a realistic alternative in the
10 time required.

11 **Q. Have you made any further analysis of the impact load reduction on the overloading**
12 **of the Mt. Storm-Doubs line following the Mt. Storm-Meadow Brook contingency?**

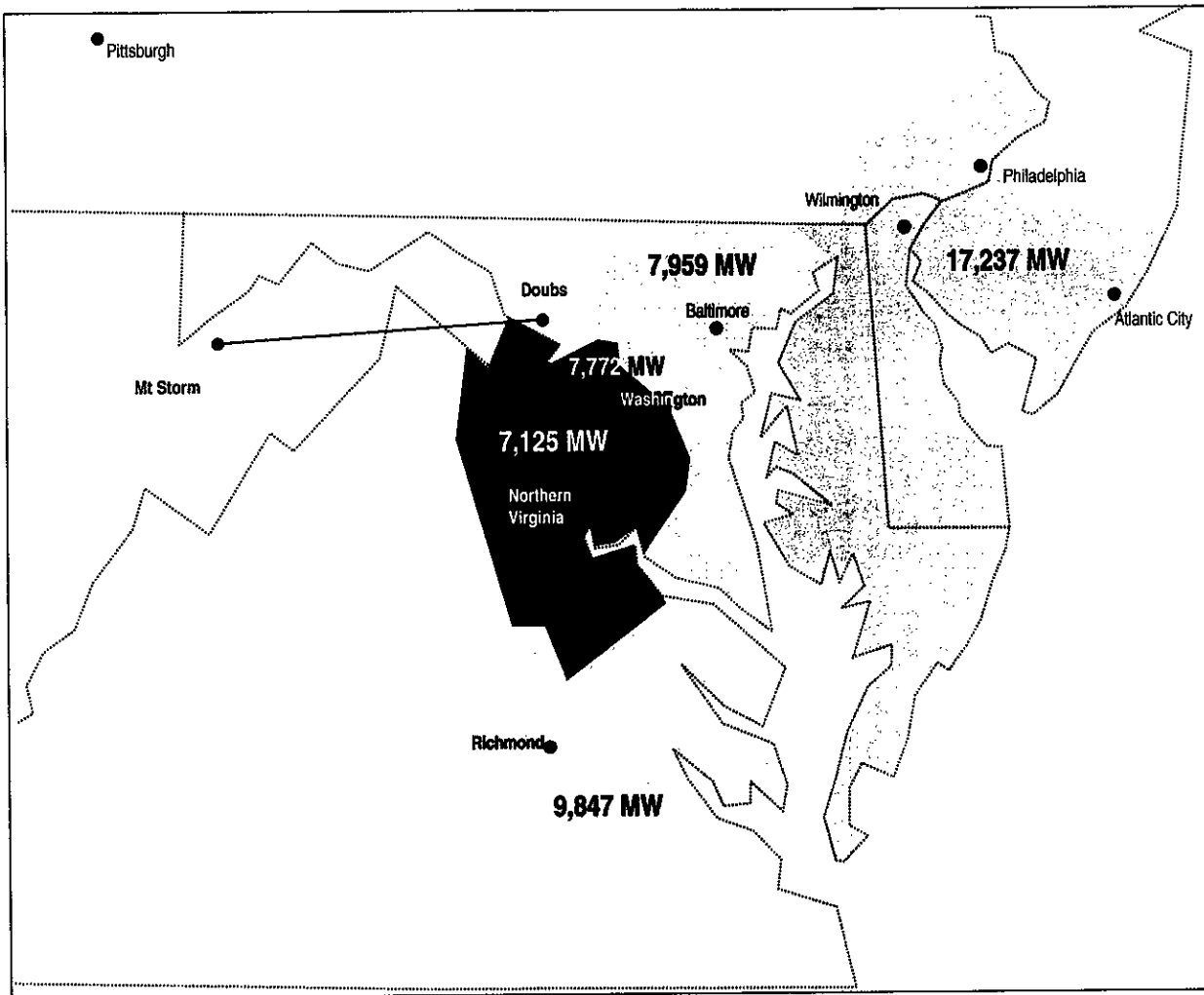
13 A. Yes. I reviewed the impact of northern Virginia load on the Mt. Storm-Doubs line
14 during the Mt. Storm-Meadow Brook contingency and verified the conclusions. In
15 addition, the impact of changes in load of a few other areas was also estimated.

16 **Q. What other areas did you analyze for the impact of load changes?**

17 A. In addition to northern Virginia, we evaluated the impact of the load in the Washington,
18 D.C., area, the Baltimore area, the Richmond/southeastern Virginia area, and the
19 Philadelphia/eastern Pennsylvania/southern New Jersey area. These areas are shown in
20 Figure 1:

- 21 • The northern Virginia area, which is the same as used in the KEMA
- 22 Report.
- 23 • The Richmond area that includes Richmond, Tidewater Virginia, Norfolk,
- 24 Virginia Beach, and the surrounding area.
- 25 • The Washington area served by Potomac Electric Power;
- 26 • The Baltimore area served by Baltimore Gas & Electric; and
- 27 • The Philadelphia region which includes areas served by Philadelphia
- 28 Electric, Delmarva Power & Light, and Atlantic City Electric.

Figure 1
Load areas evaluated for impact on Mt. Storm–Doubs loading



- 1 Q. What did this analysis show regarding the northern Virginia load impact?
- 2 A. The impact of the northern Virginia load impact was slightly higher at 8.5% rather than
- 3 the 8% found for the KEMA Report. The reason for the difference is that for this
- 4 analysis we used the MVA loading on the Mt. Storm–Doubs line instead of the MW
- 5 loading that was used for the KEMA Report. By using the MVA loading we include the
- 6 impact of both the MW and Mvar flow on the circuit loading.

1 Q. What did this analysis evaluate?

2 A. The analysis evaluated the impacts of these load areas on the Mt. Storm–Doubs line
3 loading following the Mt. Storm–Greenland Gap outage, which is a segment of the
4 existing Mt. Storm–Meadow Brook line.

5 The Mt. Storm–Doubs and Mt. Storm–Meadow Brook 500 kV lines are part of a network
6 of 500 kV lines serving Virginia and the mid-Atlantic region. Power is flowing on this
7 network—including these two lines—delivering power to each of the areas shown in
8 Figure 1. Each area will have a different impact on the loadings on these lines. The ratio
9 of the impact on a line’s loading to each area’s load for the purpose of this analysis will
10 be called the “impact factor.” If an area has a high impact factor, a load reduction will be
11 more effective in reducing a line overload. On the other hand, if an area has a lower
12 impact factor, it will take a greater load reduction to have the same reduction on a line’s
13 loading.

14 The results are shown in Table 1.

Table 1
Impact of selected load areas on the Mt. Storm–Doubs line loading
following the Mt. Storm–Meadow Brook outage

Load area	Percent of area peak load flowing on Mt. Storm–Doubs following Mt. Storm–Meadow Brook outage (“impact factor”)	Load reduction* required to relieve the 558 MVA overload	2016 peak load of the area
Northern Virginia	8.5%	6,563	7,125
Washington, D.C. (Pepco area)	9.8%	5,703	7,772
Baltimore (BG&E area)	9.4%	5,952	7,959
Combined NVA, D.C., Balt area	9.2%	6,052	22,856
Philadelphia area	5.4%	10,338	17,237
Richmond/southeastern Virginia area	1.8%	31,795	9,847

Note: * A load reduction may also include new generation.

1 For each of the areas evaluated, the table shows the percentage of the area load that
2 would flow on the Mt. Storm–Doubs line following the outage of the Mt. Storm–Meadow
3 Brook line (“impact factor”). As can be seen in the table, the northern Virginia, D.C.,
4 and Baltimore areas each have about the same percentage impact factors. And, if
5 evaluated individually, they each would require about a 6,000 MW load reduction to
6 relieve the Mt. Storm–Doubs overload.

7 The impact factors of the Philadelphia and the Richmond/southeastern-Virginia areas are
8 much lower. The lower impact factors mean that much larger amounts of load would
9 need to be reduced to relieve the Mt. Storm–Doubs overload. The impact factor is so low
10 that removing the entire load in the area would not be nearly enough to relieve the Mt.
11 Storm-Doubs overload.

12 The load reductions are less effective (the impact factors are smaller) as the load
13 reductions occur farther east of Doubs. This means that load reductions farther east of
14 Doubs are less effective in reducing the Mt. Storm–Doubs line overload.

15 **Q. How do these results affect what was included in the 2007 KEMA Report?**

16 A. They confirm and expand the results we reported previously regarding the impact of
17 various load areas on the overloaded Mt. Storm–Doubs line. As is implied in Table 1,
18 they are also useful in determining the amounts of DSM or new generation that would be
19 required to relieve the 2016 Mt. Storm–Doubs overload.

1 Keeping in mind that the 2016 Mt. Storm–Doubs n-1 overload would be 558 MVA, the
2 third column of Table 1 shows how much load reduction or new generation (or
3 combinations of these two) would be required to relieve this overload.

4 The table shows how much more effective it is to reduce load near to and east of Doubs.

5 **Q. Has the further analysis you described above led you to change your conclusions in**
6 **the KEMA Report?**

7 A. No. The additional information presented in Table 1 can be used to confirm and clarify
8 our earlier conclusions. This can be seen by considering the potential effect of some
9 possible combinations of the five areas shown in Figure 1, above.

10 For example, the effects described below are based on a few optimistic assumptions
11 regarding DSM, and distributed and central generation. Specifically let us assume::

- 12 • That the maximum reasonable demand reduction from voluntary
- 13 measures would result in a 3% reduction in total system peak load;
- 14 • That this 3% reduction could be achieved in addition to the DSM and
- 15 energy efficiency benefits already achieved in the areas shown in Table 1;
- 16 • That one 600 MW central generating unit could be sited and built by 2016
- 17 in northern Virginia;
- 18 • That two other 600 MW central generating units could be sited and built
- 19 by 2016—one in the Pepco area and one in the BG&E area;
- 20 • That the peak load could be reduced by 3% due to the installation and
- 21 operation of distributed generation; and
- 22 • That the peak loads of the various areas are coincident with each other.

23 **Q. What would be the result if we applied these assumptions to northern Virginia?**

24 A. Northern Virginia would clearly fall far short of the necessary reduction. DSM would
25 reduce the load by 214 MW (3%). A new central station generator would be 600 MW.
26 And distributed generation would be another 214 MW (3%). This totals only 1,028 MW,
27 far below the 6,563 MW required reduction.

1 Q. Is there a reasonable wider area solution—a Virginia-only solution?

2 A. No. Consider the effect of the combined northern Virginia and southeastern Virginia
3 area—an area that includes approximately all the Dominion Virginia Power loads east of
4 Doubs. Because the effectiveness of northern Virginia is so different from southeastern
5 Virginia we need to evaluate this combination in two steps.

6 If we apply the same assumptions to the combined area, northern Virginia will have the
7 same reductions as before—214 MW from DSM, 600 MW from a new central station
8 generator, and 214 MW from distributed generation—totaling 1,028 MW. Since northern
9 Virginia load reductions are 8.5% effective in reducing the Mt. Storm–Doubs overload,
10 the 1,028 MW load reduction will reduce Mt. Storm–Doubs loading by 87 MVA.

11 Using the optimistic assumption, southeastern Virginia will have a 295 MW reduction
12 from DSM (3%) and 295 MW from distributed generation. If we also assume a new
13 600 MW central generator is added in southeastern Virginia the load reduction in this
14 area would total 1,190 MW. Since southeastern Virginia load reductions are 1.8%
15 effective in reducing the Mt. Storm–Doubs overload, the 1,190 MW load reduction will
16 reduce Mt. Storm–Doubs loading by 21 MVA.

17 So accepting the optimistic assumptions from above, the combined northern and
18 southeastern Virginia load area would reduce the Mt. Storm–Doubs loading by 108 MVA
19 (87 + 21). The Mt. Storm–Doubs line would still be overloaded by 450 MVA (558 –
20 108). So even with optimistic assumptions for load reduction and new generation there is
21 no reasonable Virginia-only solution.

1 **Q. How do your assumed DSM reductions compare with those proffered by Piedmont**
2 **Environmental Council witness Violette?**

3 A. Dr. Violette is rather optimistic about the potential for DSM in his assumptions. He
4 “concluded that a well designed portfolio of DSM programs could reduce the peak
5 demand for the Commonwealth of Virginia by approximately 5,000 MW by 2017.”²
6 Since northern Virginia is about a quarter of the Commonwealth’s peak load, this would
7 translate to about a 1,200 MW reduction by 2017.³

8 Using his very optimistic estimate would still not be enough to come close to the amount
9 of reduction needed to mitigate the overload. In the calculation above I assumed that
10 there would be a 295 MW reduction from DSM. Using Dr. Violette’s very optimistic
11 scenario would reduce the peak by another 905 MW (1,200 – 295). Using the 8.5%
12 impact factor would mean an additional 77 MW reduction in the Mt. Storm–Doubs line
13 loading.

14 So if we use Dr. Violette’s estimate instead of mine, the Mt. Storm–Doubs overload is
15 reduced from 450 MVA to 373 MVA. This is still a very high overload.

16 **Q. So if there are no Virginia-only solutions, aren’t there reasonable regional**
17 **combinations of DSM and new generation that could be used to relieve the Mt.**
18 **Storm–Doubs overload?**

19 A. No. For example, consider the impact of applying my assumptions to the combined
20 northern Virginia, Washington, and Baltimore areas. DSM would reduce the load by
21 686 MW (3% of 22,856). Three new central station generators would be 1,800 MW.

2. See direct testimony of Dr. Violette, page 5, lines 6-8.

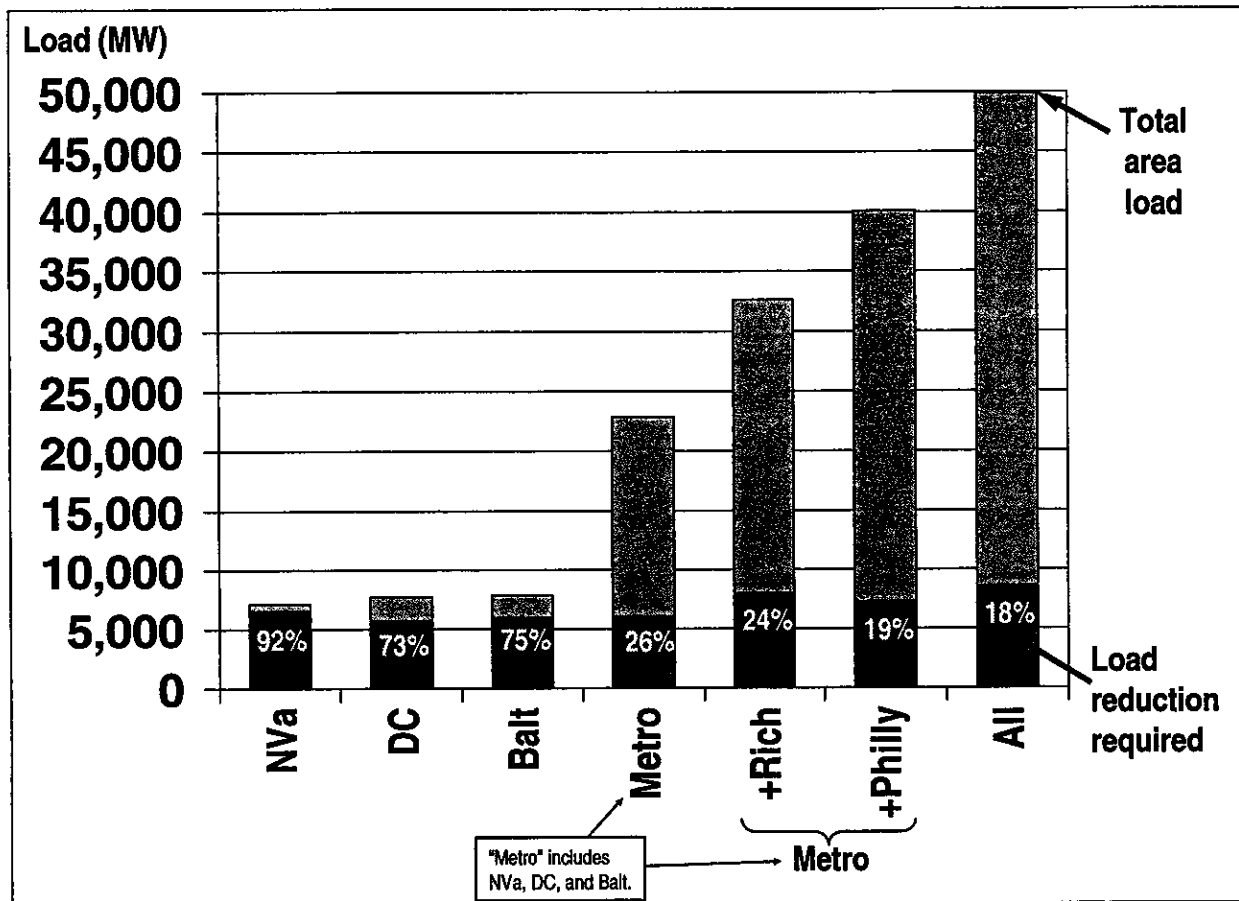
3. This assumes that assuming the DSM reductions are effective evenly across the Commonwealth.

1 And distributed generation would add another 686 MW (3%). This totals 3,172 MW,
2 only about half of the 6,052 MW required reduction.

3 **Q. Can you give examples considering even wider areas of reduced load?**

4 **A.** Yes, but the problem is that as you widen the geographic area you get farther from Doubs
5 and load reductions become less effective. The information from Table 1 can be used to
6 make estimates of the amounts of relief provided from different areas. The results are
7 shown in Figure 2, below.

Figure 2
Load reduction as percent of total area load to relieve Mt. Storm–Doubs overloading



8 The figure shows the amount of load reduction needed to relieve the 2016 Mt. Storm–
9 Doubs overloading for different groupings of the areas shown in Figure 1, above. The

1 height of each bar shows the total megawatt load in each area. The darker portion of each
2 bar is the megawatt amount of load reduction required to relieve the Mt. Storm-Doubs
3 overload. The percent of each area's total load that must be reduced is also shown.

4 Figure 2 shows that as the size of the area gets larger the percentage of load necessary to
5 relieve the overload gets smaller. However, in all cases the required reduction is at least
6 6,000 MW, much larger than could reasonably be achieved with DSM or new generation
7 by 2016.

8 **Q. How did you calculate the results shown in Figure 2?**

9 A. The impact factors from Table 1 were used for northern Virginia (8.5%), Washington
10 (9.8%), and Baltimore (9.4%). These are the amounts of each area's load that contributes
11 to the Mt. Storm-Doubs line loading under the n-1 condition. Each of these areas would
12 have to shed about 6,000 MW of to relieve the Mt. Storm-Doubs overload. Since each of
13 these areas has a peak load of about 7,500 MW, a 6,000 MW reduction would be at least
14 73% of the load in each area—clearly an unreasonable and unacceptable amount that
15 would mean blackouts for most of the load in the metro Washington area.

16 For the combined northern Virginia-Washington-Baltimore area Table 1 shows the
17 impact factor (9.2%) and that a 6,052 MW reduction in the combined area would relieve
18 the Mt. Storm-Doubs overload. The peak load of the combined area is 22,856 MW, so a
19 26% reduction ($6,052/22,856$) in load of the combined area would relieve the overload.

20 While this 26% load reduction is much less than the 73% load reduction required of each
21 area alone, it is still clearly unreasonably and unacceptably high and would also require
22 major rolling blackouts.

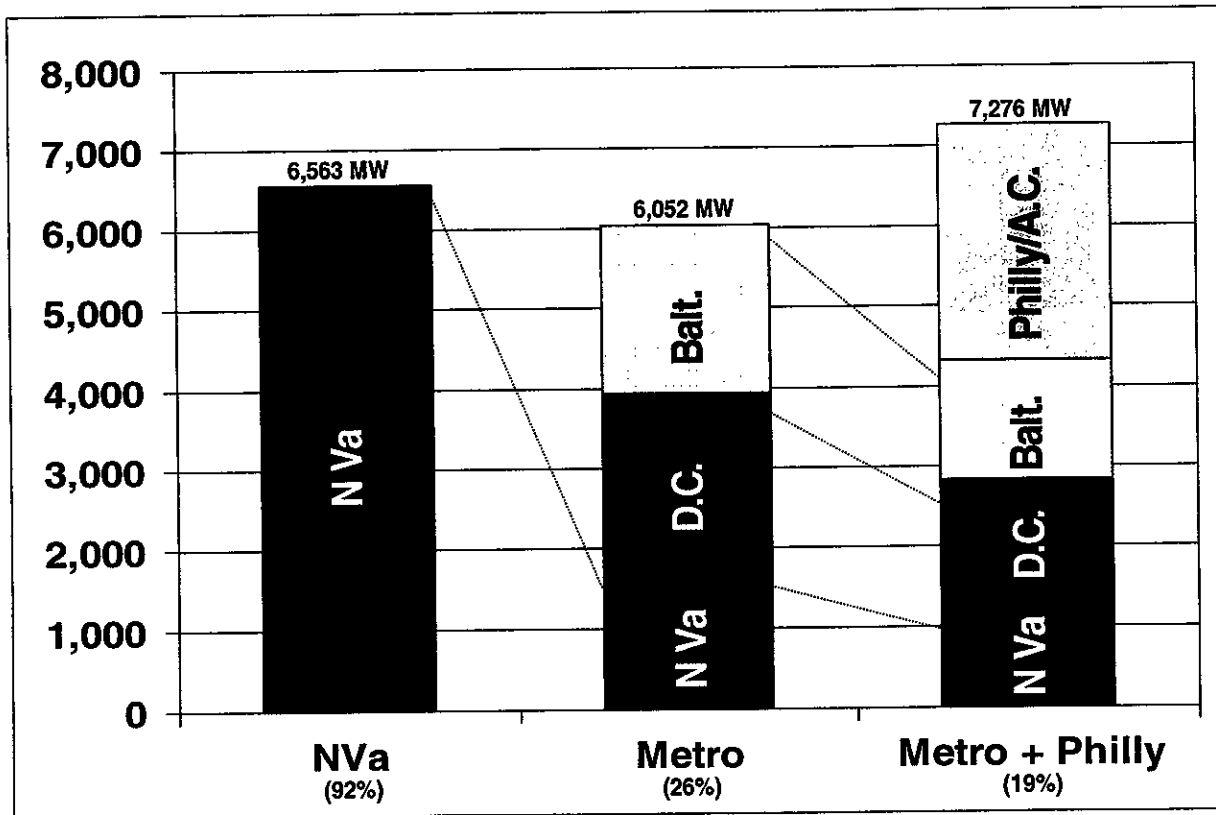
1 Figure 2 shows the results of similar calculations for other combinations of areas. It also
2 shows that as the size of the area gets larger, the total MW of load that must be reduced
3 generally trends upward.

4 **Q. That the total load that must be reduced increases is a somewhat surprising result.
5 Would you explain it?**

6 **A.** This reflects the declining impact of load reductions that occur farther east of Doubs.

7 Consider the three combinations shown in Figure 3, below—northern Virginia, the
8 Washington metropolitan area, and combination of the metropolitan area with the
9 Philadelphia area. The figure shows the amount of load reduction required from each
10 area in the different combinations. The figure also shows the percentage of load
11 reduction required (the same as shown in Figure 2, above).

Figure 3
Details of required load reductions to relieve Mt. Storm–Doubs overloading in 2016



1 The first bar in the figure show the load reduction required if the affected area were
2 limited to northern Virginia. The reduction would have to be 6,563 MW, about 92% of
3 the peak load.

4 The second bar in the figure shows the load reduction required if the affected area
5 includes the metro Washington area. Two things happen:

- 6 • First the required percentage of load reduction drops to 26%. This occurs
7 primarily because the total amount of load in the metro area is more than
8 triple that of northern Virginia alone.
- 9 • The second effect is that the total amount of load reduction is lower by
10 511 MW (6,563 MW - 6,052 MW). This occurs because the load in the
11 DC and Baltimore areas is slightly more effective than northern Virginia
12 at reducing the Mt. Storm–Doubs loading.

13 By increasing the size of the area, “only” 26% of northern Virginia’s load (1,881 MW)
14 would be at risk instead of 92% (6,563 MW). This reduction of risk for northern Virginia
15 comes at the added risk to 26% of the load in DC (2,052 MW) and Baltimore
16 (2,101 MW).

17 The third bar in the figure shows the load reduction required if the Philadelphia area is
18 combined with the metro area. In this case the results are different.

- 19 • First the required percentage of load reduction drops to 19%, as before,
20 because the total amount of load has increased by 75%.⁴
- 21 • The second effect is different than before—the total amount of load
22 reduction required is *higher* by 1,224 MW (7,276 MW - 6,052 MW).
23 This occurs because the load in the Philadelphia area has much less
24 impact on the Mt. Storm–Doubs loading than does the metro Washington
25 area load.

26 By increasing the size of the area, the load reduction required in the metro Washington
27 area drops from 26% to 19%—a 1,714 MW decrease for the metro Washington area. To

4. The area load increases from 22,856 MW to 40,093 MW—a 75% increase.

1 get this reduction, though, there must be an increase of 2,790 MW of affected load in the
2 Philadelphia area.

3 So while combining the northern Virginia, Washington and Baltimore areas reduces the
4 total MW impact, adding the Philadelphia area *increases* the total MW impact.

5 In all these cases the amounts of load that would have to be reduced are far greater than
6 any reasonable expectation. The necessary load reductions would be severe and have
7 serious impacts on the public. If the loads in all five areas were included, it would still
8 require an 18% reduction in load. Even if combined with various new generator options,
9 it is not reasonable. The most effective area would be the metro area—combining
10 northern Virginia, Washington D.C., and Baltimore—but this would require a 26%
11 reduction in load.

12 **Q. So there are no reasonable combinations of DSM and generation that could be**
13 **sufficient to relieve the Mt. Storm–Doubs overload?**

14 A. No. The customer load in northern Virginia, Washington, D.C, and Baltimore, even
15 when combined, is not large enough to support reasonable DSM measures or new
16 generation sufficient to relieve the Mt. Storm–Doubs overloads. Loads in eastern
17 Virginia and eastern PJM, while much larger, are far too removed from the overloaded
18 Mt. Storm–Doubs line for reasonable load reductions or generation additions to be
19 effective.

20 **Q. How do your assumed DSM reductions compare with those proffered by Virginia’s**
21 **Commitment witness Orans?**

22 A. On page 6 of his testimony, Orans says that 250 MW would be a “reasonable estimate of
23 achievable demand response” in northern Virginia. This is only slightly more than the

1 214 MW I assumed in the calculation made above that were shown to be far short of the
2 necessary reduction.

3 **Q. Does witness Orans seem to understand the principles you have described in regard**
4 **to the declining effectiveness of load reductions as they are farther removed from**
5 **the overloaded Mt. Storm–Doubs line?**

6 A. No. Dr. Orans states (at page 4) that the KEMA Report “is incorrect because it is based
7 on the false premise that the overloading can only be resolved by reducing the load
8 growth in Northern Virginia alone. In fact, the overload is due to load growth across the
9 Mid-Atlantic region.” The KEMA Report only addressed the situation for northern
10 Virginia because this case is before the Virginia Commission and involves a Virginia
11 utility. The ineffectiveness of widening the load reduction area has been addressed
12 above.

13 **Q. Does witness Orans offer any solutions in his testimony?**

14 A. On the next page, Dr. Orans seems to show a significant misunderstanding of the nature
15 and operation of transmission systems. He states that his “testimony describes federal
16 and state initiatives that aim to reduce peak load growth in the Mid-Atlantic region by
17 nearly 1,800 MW, substantially more than the expected overload on the Doubs line (370
18 MW) in 2011.”

19 He seems to believe that the 1,800 MW load reduction in the Mid-Atlantic region would
20 remove the 370 MW line overload. As has been discussed above, load changes in the
21 Mid-Atlantic region would have less than an 8% impact on the Mt. Storm–Doubs

1 overload.⁵ So an 1,800 MW load reduction in the Mid-Atlantic region would reduce the
2 Mt. Storm–Doubs overloading by less than 140 MW, not nearly enough to remove the
3 370 MW he refers to.

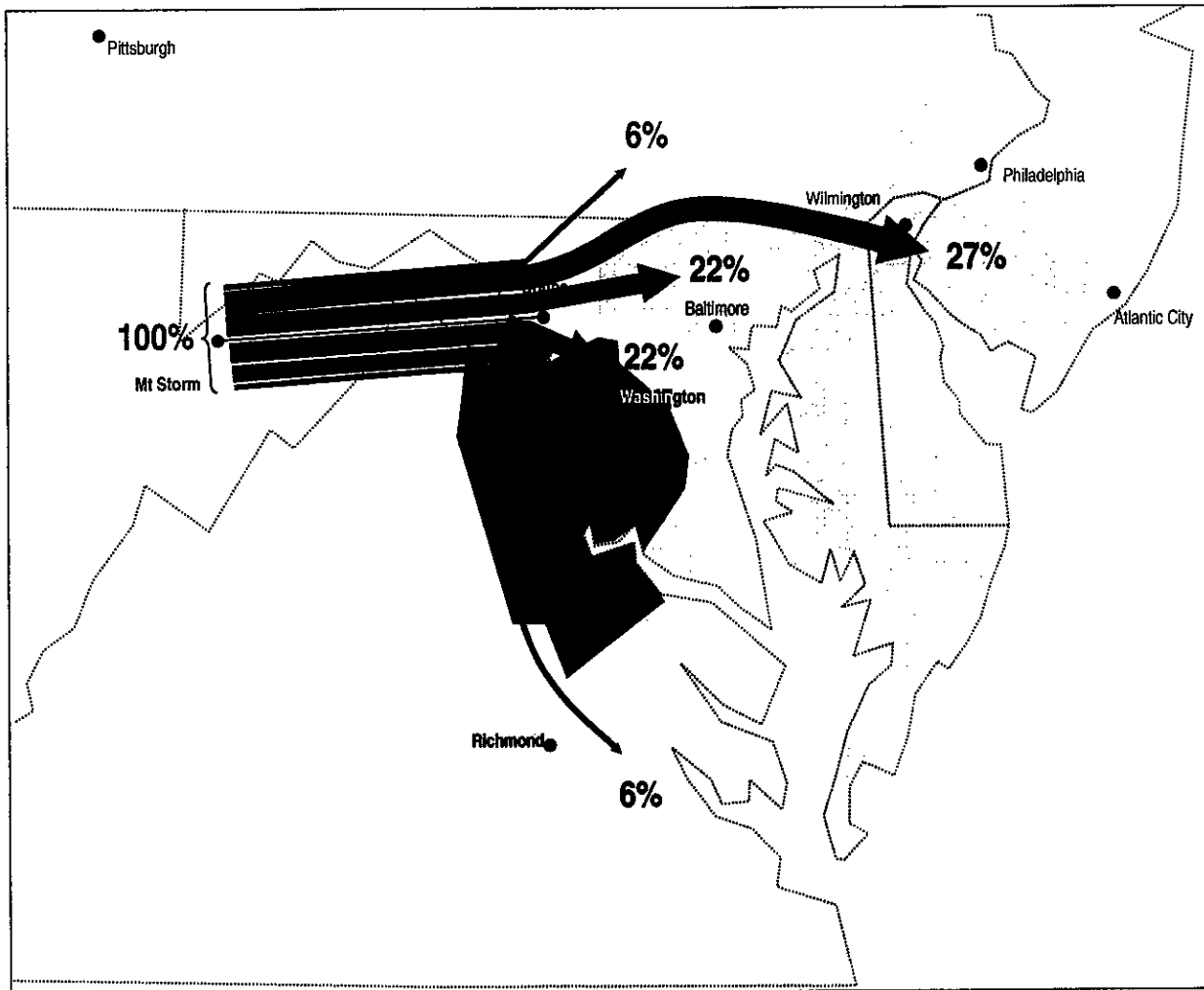
4 **Q. Various parties have commented that northern Virginia load only accounts for 19%**
5 **of the loading on the Mt. Storm–Doubs line following the Mt. Storm–Meadow Brook**
6 **outage. Has your further analysis allowed you to understand how much other**
7 **area’s loads account for the remainder of the loading on Mt. Storm–Doubs?**

8 **A. Yes. The same type of results used for Table 1, above, can be used to estimate the loading**
9 **impact of the different areas on the Mt. Storm–Doubs line loading. The results are shown**
10 **in Figure 4. There is more to be explained as to what these types of questions imply,**
11 **however.**

12 Figure 4 shows the impacts of different load areas on the Mt. Storm–Doubs n-1 loading.
13 The impact on the Mt. Storm–Doubs line is calculated by multiplying the peak load of
14 each area by the area’s impact factor.

5. Figure 3 shows that the combined Metro Washington and Philadelphia areas would need to reduce 7,276 MW of load to relieve a 558 MW overload on Mt. Storm–Doubs. This is an impact ratio of only 7.6% ($558/7276 = 7.67\%$).

Figure 4
Impact of different load areas on the Mt. Storm–Doubs n-1 loading



1 As Figure 4 shows, 62% of the Mt. Storm–Doubs n-1 loading is due to loads in the
 2 combined northern Virginia/Washington-Baltimore area. Adding Richmond/southeastern
 3 Virginia to this accounts for 68%. Keeping in mind that it has the largest MW of
 4 customer load of the areas shown, the lower part of eastern PJM accounts for 27%. The
 5 net impact of the rest of eastern PJM and surrounding areas is only 6%.

6 So, as before, it is the combined northern Virginia/Washington-Baltimore area that
 7 accounts for the lion's share of the loading on the Mt. Storm–Doubs line.

1 **Q. You said earlier that there is more to be explained as to what these questions imply.**
2 **What did you mean by this?**

3 A. Implied in the questions about who is causing the Mt. Storm–Doubs loading are questions
4 about who is responsible and who should provide the solution.

5 Which area's loads are causing the need will not affect the need for the line—this depends
6 on the topology of the integrated transmission network and the laws of physics. The need
7 is based on the ability of the system to meet the appropriate reliability criteria.

8 Who should provide the solution—i.e. where it should be located—for a transmission
9 problem depends on where the problem occurs, not who is causing it. Transmission
10 problems are usually very location-specific—a particular line overloads when another
11 particular line is out of service. In general the solution involves upgrading the
12 transmission system to either eliminate the location-specific overload or mitigate the
13 location-specific contingency.

14 The solutions are based on technical studies as have been described in Dominion Virginia
15 Power's and KEMA's various studies.

16 **Q. What does Figure 4 show that is important for northern Virginia?**

17 A. It should be clear from Table 1 and Figure 2, the combined load in the northern
18 Virginia/Washington-Baltimore area has the largest impact on the Mt. Storm–Doubs
19 loading. If we add the Philadelphia/Atlantic City/Eastern PA area, the metro Washington
20 area's load impacted is reduced by about 1,700 MW. But, at the same time, the
21 Philadelphia area's load impacted (subject to blackout) is increased by 2,790 MW. So for
22 every MW we reduce the impact on the metro Washington area customer load we must

1 increase the impact on the Philadelphia area customer load by about 1.64 MW
2 (2,790/1,700 = 1.64).

3 **Q. Why is this 1.64 ratio important?**

4 A. The ratio is important because it explains why the northern Virginia-Metro DC area will
5 be most at risk if the line is not built.

6 If the proposed line were not built then there is an unacceptable likelihood that there will
7 be rotating blackouts in northern Virginia and the metropolitan Washington area.⁶

8 Whenever rotating blackouts are necessary, system operators consider the impact factors
9 in deciding where and what amounts of load should suffer rotating blackouts. In this case
10 the loads in the combined northern Virginia/Washington-Baltimore area would be at risk.
11 The other areas have too little impact on the overloading of the Mt. Storm–Doubs line
12 and so would not likely be included in any necessary rotating blackouts. As before, the
13 load closest to the problem has the largest impact on the overloaded line. This load is,
14 thus, bound to be affected because reducing this load is most effective in mitigating the
15 overload.

16 **Q. How is this important in regard to the proposed 502 Junction-Loudoun 500 kV line?**

17 A. Regardless as to who is ‘causing’ the overload, it is the northern Virginia/Washington-
18 Baltimore area that would be at risk. The loads in these areas have a much higher impact
19 on the Mt. Storm–Doubs overloading than the other areas. This means that it would be
20 these load areas that would suffer rotating blackouts in order to prevent overloading the
21 Mt. Storm–Doubs line.

6. This is the meaning of the planned system not meeting planning reliability criteria.

1 **Q. The calculations you have made in Table 1 and Figure 2 depend on the impact**
2 **factors. Would you explain how you determined these factors?**

3 A. The impact factors were developed from the 2016 powerflow case used for the KEMA
4 Report. The studies were made after having removing the proposed 502 Junction-
5 Loudoun 500 kV line from the model. The load in each area was reduced by 500 MW
6 one by one and the generation in PJM was reduced by 500 MW in proportion to each
7 unit's maximum capacity. Each of these cases was compared with the base case to find
8 the change in power flow on the relevant 500 kV lines.

9 Cases were also run with the Mt. Storm–Greenland Gap (that continues on to Meadow
10 Brook) and the Morrisville-Loudoun lines out of service. These cases were used to
11 determine the transmission outage distribution factors. These outage distribution factors
12 tell how much of the power flowing on a line that goes out of service will flow on other
13 lines.

14 The cases showed that 36% of the power flowing on the Mt. Storm–Greenland Gap line
15 would “transfer” to the Mt. Storm–Doubs line, and that 69% of the power flowing on the
16 Morrisville-Loudoun line will “transfer” to the Morrisville-Bristers line.

17 **Q. Have you reviewed the direct testimony of PEC witness Hyde Merrill in this case?**

18 A. Yes, I have. Of the six questions Dr. Merrill addresses I take exception to answers for
19 questions 2, 3, 4, and 5.

20 **Q. Do you agree with Dr. Merrill's answer to his question 2, that the line is not “needed**
21 **to ensure reliable electric service in Northern Virginia”?**

22 A. No. The line is clearly needed to reliably serve the customers of northern Virginia and
23 the metropolitan Washington, D.C. area as discussed above. It will be northern Virginia

1 customers who will be at greatest risk of interruption without the 502 Junction-Loudoun
2 Line and therefore will get the greatest reliability benefit from it. As is presented in the
3 direct testimony of witnesses Ronnie Bailey, Steve Herling and Scott Gass, the proposed
4 line is needed to meet regional, PJM, and Dominion Virginia Power reliability criteria.

5 **Q. Is the KEMA Report illogical in comparing the northern Virginia load growth with**
6 **the capability of the proposed new transmission line as stated by Dr. Merrill on page**
7 **12 of his direct testimony?**

8 **A.** No. Dr. Merrill wants to link the northern Virginia 2006-2011 load growth directly to the
9 need for the proposed line.

10 The KEMA Report does not attribute the need for the proposed line solely with the load
11 growth in northern Virginia. There are other changes occurring in the region that will
12 also impact the need for the line. There is little doubt that the northern Virginia region is
13 economically strong and growing. I live in Fairfax County—the largest part of northern
14 Virginia—and have seen the growth that is occurring there.

15 Dr. Merrill attempts to recast two statements so as to make them appear contradictory:

- 16 1. He tries to make the case that Dominion Virginia Power proposed the
17 line to meet northern Virginia load growth only for the 2006-2011
18 period. (The growth in this period is 465 MW.)
- 19 2. He seeks to contrast this with KEMA's finding that nearly 3,000 MW
20 of northern Virginia load would be at risk if the proposed line is not
21 built.

22 Dr. Merrill quotes, in part, pages 2 and 3 of Mr. Smatlak's direct testimony. In the
23 section quoted, Mr. Smatlak states that northern Virginia load is growing 'rapidly,' that it

1 is a 'vital' region that includes "hundreds of thousands of customers" and that the new
2 line must be in operation by the summer of 2011.

3 No doubt Mr. Smatlak knows that more than northern Virginia load growth is
4 contributing to the need—the quotations cited only discuss that this load is growing
5 rapidly and that it is important. Dr. Merrill does not question these points.

6 **Q. Is Merrill right in portraying that 465 MW of northern Virginia load growth**
7 **contributed to the need for the proposed 502 Junction–Loudoun line?**

8 A. Northern Virginia load has been growing for years and no new 500 kV transmission lines
9 have been built in this area to accommodate this growth. The last significant 500 kV
10 addition was the Ladysmith–Possum line. It was completed in 1993. So it will be
11 eighteen years by 2011 when the 502 Junction–Loudoun will be needed. During those
12 years northern Virginia load will have grown by more than 2,000 MW.⁷ So Merrill's
13 comparison of 3,000 MW of load at risk with 465 MW of load growth is just wrong.

14 During these years northern Virginia load has been served from a transmission network
15 that spans the region from northern Pennsylvania to North Carolina. The Bates White
16 report describes how northern Virginia is dependent on five critical 500 kV lines.⁸ Of
17 those five lines, only two are owned and operated by Dominion Virginia Power. Virginia
18 is part of this large regional transmission system. While Merrill's comparison may make
19 a good sound bite, it is actually very misleading. Virginia's public interest is best served
20 by strengthening the regional system with the proposed 502 Junction–Loudoun line.

7. This assumes a 2% average annual growth rate over the 18-year period.

8. See the Bates White Report, paragraph 57, and Exhibit 2.

1 In addition, very little new generation has been added in northern Virginia, so the load
2 growth has been served by power imported from outside the area. Ronnie Bailey's
3 rebuttal testimony shows that Virginia—and especially northern Virginia—are major
4 importers of power. This increases the region's dependence on the transmission system
5 to deliver the necessary power to supply its load.

6 **Q. So is there an illogical contradiction as Merrill claims?**

7 **A.** There is no contradiction here. Years of growth in northern Virginia, together with many
8 other factors have caused the need for the proposed line. By 2011 the situation will be so
9 serious that there are no other reasonable DSM or generation solutions—the need is too
10 great.

11 The discussion associated with Figure 4, above, shows that it will be the metropolitan
12 northern Virginia/Washington, D.C./Baltimore area that will be most at risk if the
13 proposed line is not built. Which area is causing the need is not relevant in regard to the
14 need. Nor does it change the fact that it will be the northern Virginia area that will be at
15 risk. There is no evidence here that the proposed line is not needed. The point raised by
16 Dr. Merrill is irrelevant to whether the proposed line is needed.

17 The fact remains that the Mt. Storm to Doubs 500 kV line is a Dominion Virginia Power
18 owned line built to serve Dominion Virginia Power load including northern Virginia. It
19 was originally constructed in the 1960s as part of the first 500 kV system in operation in
20 the western world. Mt. Storm generation was built to serve Dominion Virginia Power
21 loads. So Mt. Storm–Doubs has always been an integral component of the transmission

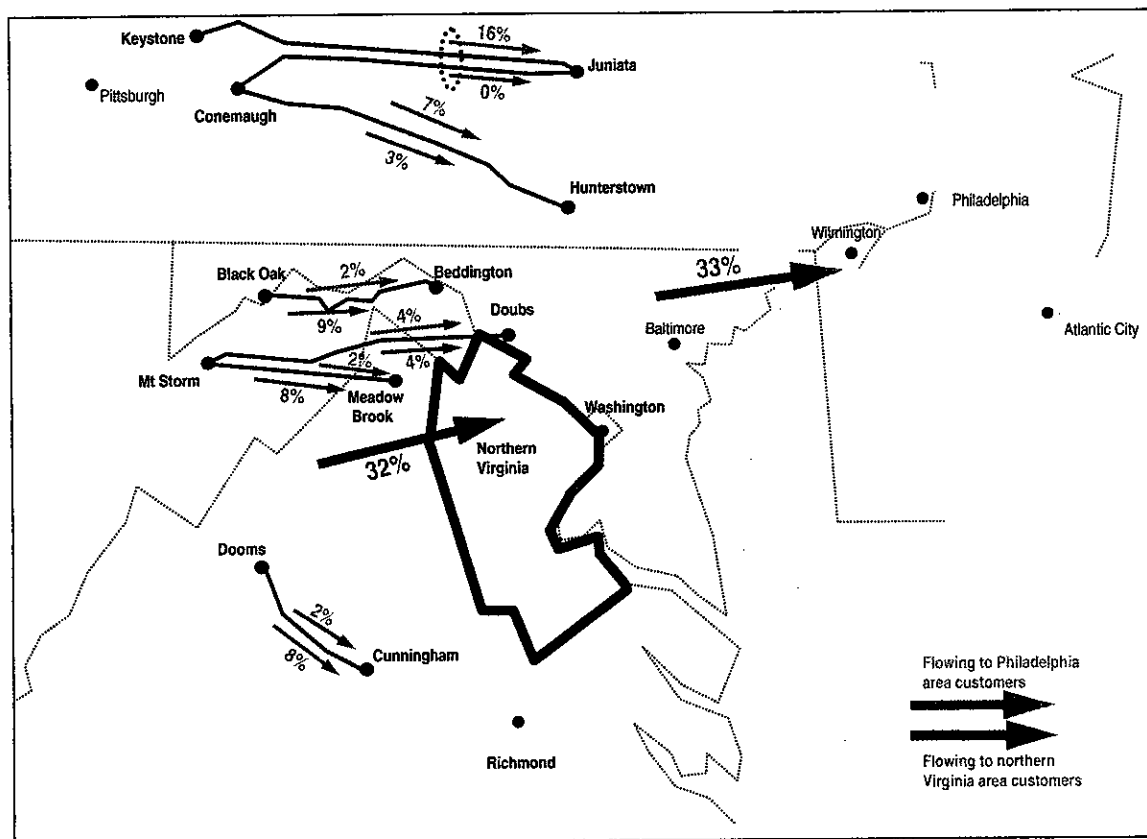
1 system designed to serve Virginia loads. The line has now been in service for over 40
2 years, but protecting its operational integrity remains critical to Virginia.

3 **Q. Can the results from the studies you made of the impact of the five areas shown in**
4 **Figure 1 be used to show how northern Virginia and the other load areas you**
5 **evaluated use the regional transmission network?**

6 **A. Yes. The results can be used, for instance, to compare the share of load that flows on**
7 **these lines to the northern Virginia and Philadelphia areas.**

8 The percentage of customer loads in northern Virginia (green arrows) and Philadelphia
9 (grey arrows) flowing on the west-to-east 500 kV network are shown on Figure 5. The
10 figure shows the share of each area's load flowing on the 500 kV network.

Figure 5
Percent of customer load in northern Virginia and Philadelphia
area flowing on the west-to-east 500 kV network



1 In total, northern Virginia and the Philadelphia area are comparable—about 32% of the
2 northern Virginia area load flows on these 500 kV lines and about 33% of the
3 Philadelphia area load flows on these 500 kV lines.

4 It is interesting to see that 16% of northern Virginia's load will flow on the four northern
5 lines in Pennsylvania and Maryland while 10% of the Philadelphia area's load will flow
6 on the four southern lines in Virginia and Maryland. This type of 'reciprocity' occurs
7 often in the power flowing on transmission networks.

8 **Q. In answering his question 3, Dr. Merrill states that the line is not "needed to ensure**
9 **reliable electric service regionally." Do you agree with this answer?**

10 **A.** No. The KEMA analysis showed that the line is clearly needed for regional reliability.
11 The regional nature of the problem and the use of the regional network have been shown
12 above in Figure 5 and Table 1. The specific issues raised by Dr. Merrill in regard to this
13 question are addressed by other witnesses.

14 Without the proposed line, the system can not meet Dominion Virginia Power or PJM
15 planning reliability criteria and it can not pass the PJM load-deliverability test. Without
16 the proposed line, overloads will occur on major 500 kV lines in Pennsylvania, Maryland,
17 and Virginia. Without the proposed line, some of these overload conditions will place
18 electricity customers in northern Virginia and the metro Washington area at clear risk for
19 rotating blackouts.

1 **Q. In answering his question 4, Dr. Merrill states that the need for the line is not based**
2 **on “industry-standard methods” or “on reliable data and assumptions.” Do you**
3 **agree with this answer?**

4 **A. No. Dr. Merrill seems to adopt a slightly corrupted version of “good utility practices”**
5 **presented in the KEMA Report. The report discusses good utility practices that require:**

- 6 • “Using reliable data and assumptions;
- 7 • Using industry standard methods and computer tools; and
- 8 • Using accepted national and local criteria.”⁹

9 Dr. Merrill finds five “deviations” from industry standard methods and criteria. His
10 deviations all address the criteria used by PJM and Dominion Virginia Power.

11 It has been 40 years since the National Electric Reliability Council (“NERC”) first
12 established minimum national reliability criteria.¹⁰ The original organization included
13 nine regional reliability councils for different areas of the country. Each of these regional
14 councils had additional criteria that applied to their regions. In addition, individual
15 utilities had their own criteria used in planning and operating their systems. Together the
16 national and regional councils and the individual utilities formed a hierarchy of criteria.

17 The national criteria were (and still are) minimum criteria. The regional criteria are more
18 stringent and specific than the national criteria and are accepted as the minimum criteria
19 for the region they cover. Finally, most all individual utilities have more stringent,
20 specific or additional criteria than the national or regional criteria.

9. See page 11 of the KEMA Report (Attachment PJP-1).

10 The original organization has evolved since 1968 into the present North American Electric Reliability Corporation.

1 This hierarchy of criteria – national, regional, and local – as a whole, provides the
2 standard for planning and operating the electric power system. This hierarchy of criteria
3 is the industry standard in regard to planning and operating criteria. Dr. Merrill seems to
4 believe that only the national NERC standard criteria should apply. He ignores the
5 long-standing industry practice of applying more stringent regional and local criteria,
6 where applicable.

7 **Q. Are there other examples of Merrill’s misunderstanding of planning criteria?**

8 **A.** Some examples of what I consider good regional criteria are ones that Dr. Merrill seems
9 to reject. The PJM Load Deliverability Test and The Generation Deliverability Test
10 evolved from reliability practices PJM has used since the 1960’s. They have been
11 updated to reflect the changes in the industry’s structure and ownership and PJM’s role as
12 the independent system operator for the region. These tests are not part of the NERC
13 standards, they are more stringent, and they reflect the long-standing practices of the
14 utilities in PJM.

15 Witness Merrill, CPV Warren witness George Loehr, Board of Supervisors of Fauquier
16 County witness Dr. Mili and others seem to be confused about the single contingency or
17 “n-1” criteria used in evaluating utility plans. The “n” refers to the initial system
18 conditions. It does not mean that all facilities are in service and available to their
19 maximum capability. Nor does it mean that the system has been optimized before
20 evaluating any contingencies.

21 The NERC planning standard for normal conditions (TPL-001, Category A) requires that
22 the interconnected transmission system is planned, “with all transmission facilities in

1 service and with normal (pre-contingency) operating procedures in effect”. In this case
2 the ‘n’ refers to normal operating conditions. Normal operating conditions often include
3 certain breakers being ‘open’ and generators or other devices limited in their operation.

4 Consistent with this understanding and historical precedent, the Dominion Virginia
5 Power planning criteria are based on stressed system conditions. For the northern
6 Virginia area the stressed condition is represented by assuming that the largest generating
7 unit (Possum Point 5) is out of service—a long-standing practice of Dominion Virginia
8 Power in evaluating system plans. For Dominion Virginia Power, this is the initial
9 condition for their studies, and an inherent component of the “n.” Merrill and Loehr both
10 incorrectly interpret the Dominion Virginia Power criteria that begin with the Possum
11 Point 5 unit out of service as a single contingency, n-1 event. They then both incorrectly
12 conclude that additional contingencies will represent multiple contingencies—either
13 “n-1-1” or “n-2” events.

14 **Q. Is your understanding consistent with the NERC Standards?**

15 A. Yes it is. Consider the NERC Standard TPL-002—the standard that applies to single
16 contingencies.

17 The purpose of this standard is stated as “System simulations and associated assessments
18 are needed periodically to ensure that reliable systems are developed that meet specified

1 performance requirements with sufficient lead time, and continue to be modified or
2 upgraded as necessary to meet present and future system needs.”¹¹

3 The first requirement (R1) of the standard continues: “The Planning Authority and
4 Transmission Planner shall each demonstrate through a valid assessment that its portion
5 of the interconnected transmission system is planned such that the Network can be
6 operated to supply projected customer demands and projected Firm (nonrecallable
7 reserved) Transmission Services, at all demand levels over the range of forecast system
8 demands, under the contingency conditions as defined in Category B of Table I.”¹²

9 Category “B” of Table 1 lists events “resulting in the loss of a single element,” or n-1
10 events.¹³

11 So far, this is consistent with the Merrill, Loehr, and Mili understanding.

12 However, they have overlooked Requirement R1.3.2 of TPL-002, that requires that the
13 studies must “cover critical system conditions and study years as deemed appropriate by
14 the responsible entity.”¹⁴ The responsible entities in this case are PJM and Dominion
15 Virginia Power, and each has their own way of addressing critical system conditions. For
16 PJM this is found in their generation and load deliverability tests. For Dominion Virginia
17 Power, it is found in their historical approach to stressed system conditions that assumes
18 the largest unit in the area (Possum Point 5) is unavailable.

11. *Reliability Standards for the Bulk Electric Systems of North America*, January 1, 2007; Standard TPL-002-0 — System Performance Following Loss of a Single BES Element, Adopted by NERC Board of Trustees: February 8, 2005, page 1 of 5.

12. *Ibid*, page 1 of 5.

13. *Ibid*, page 4 of 5.

14. *Ibid*, page 1 of 5.

1 The criteria used by PJM and Dominion Virginia Power, the ones that these witnesses
2 complain about, are consistent with the NERC Standards. Their argument is, in effect,
3 that the lower, minimum, standards should be used, standards that will result in a less
4 reliable system. This is not the intent of the NERC Standards.

5 **Q. Does witness Mili make a similar error in critiquing the Dominion Virginia Power**
6 **and KEMA studies?**

7 A. Yes. On pages 4-5 of his testimony he bases much of his review on his interpretation that
8 the Dominion Virginia Power and KEMA studies were based on “n-1-1” criteria. As
9 discussed above, these studies are based on NERC Standard TPL-002 which describes
10 the “n-1” criteria.

11 **Q. Do you agree with witness Loehr’s critical comments about the application planning**
12 **criteria?**

13 A. No. His misunderstanding is similar to that described above. He believes that the NERC
14 Standards were not properly applied in regard to the handling of Possum Point 5 (page 8
15 at lines 12-14). He believes that there should be a wider range of adjustments allowed to
16 remove the Mt. Storm–Doubs overload. The NERC Standards allow for such
17 adjustments for Category C – multiple contingency events – covered by Standard
18 TPL-003. As was discussed above, the Dominion Virginia Power, PJM, and KEMA
19 studies he refers to are of NERC Category B – single contingency events – covered by
20 Standard TPL-002. Category B events do not allow such adjustments. He raises this
21 issue again on pages 11-12 of his testimony. As with Dr. Merrill, he seems to be
22 advocating that Dominion Virginia Power and PJM use the lower, minimum, standards
23 that would result in a less reliable system.

1 **Q. Do you agree with the testimony of Mr. Loehr (at page 7) where he concludes that**
2 **the “claim of need is flawed in two ways”?**

3 A. No. He claims that the studies “have not properly applied the established security
4 (operating or transmission reliability) standards to determine the amount of permissible
5 power flows on the system.” This comment seems to be out of date.

6 There was a time when PJM and its member utilities made various studies of transfer
7 capabilities and integrated generation/transmission plans and options. This is no longer
8 true. PJM now makes generation and load deliverability studies for reliability analyses,
9 uses transmission rights to allocate scarce economic transmission resources, and no
10 longer has integrated planning of generation and transmission.

11 **Q. Do you agree with Mr. Loehr about the risk of blackouts on pages 14-16?**

12 A. No. I disagree with his description as to what counts as a blackout and what violating
13 planning criteria means. He seems to feel that rotating blackouts are not blackouts.¹⁵
14 Perhaps what Mr. Loehr really means is that there is a difference between controlled
15 blackouts and uncontrolled blackouts. I would agree that there are differences between
16 controlled and uncontrolled blackouts. But to utility customers rotating blackouts are
17 ‘blackouts.’ Just remember the furor over the few days of rotating blackouts that
18 occurred during the 2000-2001 California electricity crisis.

19 He also seems to mix power system ‘planning’ and ‘operating’ criteria. Planning criteria
20 must address a much more uncertain future than operating criteria. He seems to feel that
21 if the system fails the planning criteria, the planner can fall back on the flexibility that

15. Loehr’s testimony, page 15, lines 3-7.

1 system operators have to solve problems. He also seems to feel that planning studies
2 should include the many options that would be available to the system operators. But this
3 ignores the much higher uncertainty in making planning studies for conditions five and
4 ten years in the future.

5 The planning criteria are set to allow for this difference in uncertainty. It is just wrong to
6 mix planning and operating criteria and studies. Failing planning criteria means that the
7 system has reached an unacceptable risk of having a blackout. The failure means that
8 plans must be developed to remove the criteria violations.

9 As an analogy, consider someone getting a blood cholesterol test. If the cholesterol level
10 is above 200 then that person is considered to be at risk. It does not mean that person will
11 have a heart attack that day, or that year, or the next year. They may never have a heart
12 attack. But they have reached a level where they are at an unacceptable risk for heart
13 attack. A prudent person would not wait until they experienced chest pains but would
14 take actions to reduce their cholesterol level so that the risk of failure (heart attack) is
15 reduced to acceptable levels.

16 In a similar way, the system planner must make plans to modify the system so that the
17 unacceptable risk of failure (blackout) is reduced to acceptable levels based on planning
18 criteria.

19 **Q. Is Dr. Orans correct in his three components of the contingency analyses made by**
20 **KEMA, Dominion Virginia Power, and PJM (see pages 23-24 of his testimony)?**

21 **A. The first and third of his three components are incorrect.**

1 As discussed above, he misunderstands the purpose of using the unavailability of Possum
2 Point 5 to represent stressed system conditions. This is the first of his three factors and
3 his criticism is wrong.

4 In his third factor he cites the “especially high load” used for the studies. This criticism
5 is also wrong. As was discussed in the KEMA Report (at page 16), “the deterministic
6 power system planning criteria ... test the system to see that it is robust enough that it can
7 survive the many other events that are not actually being studied.” This applies to the use
8 of peak load conditions in system studies. Dr Orans objects that the peak load is a rare
9 event, and yet he ignores the fact that this is the universally accepted standard for making
10 such planning studies.

11 **Q. Dr. Merrill, at page 31, states that PJM and the Applicants “have chosen a base-case**
12 **dispatch for economic reasons rather than reliability reasons.” Similarly, Mr.**
13 **Loehr (at pages 25-26 of his testimony) and Mr. Bouford (at page 9 of his testimony)**
14 **question the dispatch and redispatch KEMA used. Do you agree with these**
15 **criticisms?**

16 **A. No. The dispatch has specifically been made in the most unbiased way.**

17 The base dispatch used by KEMA (and PJM and Dominion Virginia Power) adjusts all
18 PJM generation in proportion to each generating unit’s maximum capability to balance
19 the system load. This is the most unbiased approach. If an ‘economic’ dispatch were
20 used, the lowest-cost generation (mostly coal) would be dispatched first, followed by
21 gas-fired combined-cycle and steam units, and finally, the simple-cycle gas-fired units
22 and other expensive units. Such an economic dispatch would likely increase generation
23 in western PJM and correspondingly reduce generation in eastern PJM. This shift in the

1 generation pattern to the west would increase the loading on the Mt. Storm–Doubs and
2 Black Oak-Bedington lines.

3 In contrast, it would appear that the dispatch sought by witness Merrill would be
4 “uneconomic” and biased dispatch that would lower western generation in favor of
5 eastern generation. As I understand it, PJM seeks to tread the “middle path” in this
6 regard—to use an unbiased proportional dispatch, one that favors neither eastern nor
7 western generation.

8 **Q. On this same page (page 31) Dr. Merrill states that “changing the dispatch to**
9 **increase the generation in PJM’s Mid-Atlantic area by 61.9 MW, with a similar**
10 **decrease in western PJM, would resolve the asserted NERC criteria violation in**
11 **2011.” Is this correct?**

12 **A. No. It is wildly misleading. The same error is echoed by Dr. Orans on page 6, lines 18-**
13 **20 of his testimony. They both seem to believe that a 61.9 MW overload on the Mt.**
14 **Storm–Doubs line could be removed by adjusting load or generation by about 62 MW.**

15 Dr. Merrill states that you could change the generation dispatch east and west of Doubs
16 enough to remove the overload. This may be true, but the change in dispatch would have
17 to be at least about 500 MW to relieve the 62 MW overload. What they seem to have
18 forgotten are the many parallel transmission paths between Mt. Storm and Doubs that the
19 power would flow on.

20 For example, assume the optimistic hypothetical case where new generation would be
21 added at Doubs. There are at least five obvious 500 kV and multiple 230 kV
22 transmission paths between Mt. Storm and Doubs. Only a part of the change in flow
23 resulting from the change in generation would flow on the Mt. Storm–Doubs line. In this

1 case only about 11% of the new generation would reduce the flow on the Mt. Storm–
2 Doubs line under n-1 conditions. So in order to reduce the loading on the Mt. Storm–
3 Doubs line by only 62 MW there would have to be about 600 MW of new generation at
4 Doubs.

5 Studies presented in the KEMA Report showed that increasing northern Virginia
6 generation would reduce about 8% of the contingency loading on the Mt. Storm–Doubs
7 line. This would mean that northern Virginia generation would need to be increased by
8 almost 800 MW (62 MW/0.08).

9 So the statements that adding new generation or adjusting load by small amounts are very
10 misleading in that it would take a much larger change to reduce the line loading by
11 62 MW.

12 **Q. Is the CPV Warren plant equivalent to Possum Point 5 in terms of its impact on the**
13 **Mt. Storm–Doubs line loading as claimed by Dr. Orans on page 26 of his testimony?**

14 **A. No. The impacts are quite different. The Possum Point 5 plant has a 7.5% impact factor**
15 **on the Mt. Storm–Doubs loading because it is located east of Doubs. In contrast, the**
16 **impact factor for a hypothetical generator connected to the Meadow Brook 500 kV bus is**
17 **only about 1.5% because it would be located slightly west of Doubs. This means that the**
18 **Possum Point 5 unit is five times as effective as a new unit at Meadow Brook in reducing**
19 **the contingency loading of Mt. Storm–Doubs.**

20 Using these impact factors, a 600 MW unit at Meadow Brook (like CPV Warren) would
21 reduce the Mt. Storm–Doubs line loading only about 9 MW. The 770 MW Possum Point
22 5 unit would reduce the loading about 58 MW.

1 The impacts are not even close to being comparable.

2 **Q. Is Dr. Merrill correct (on page 33 of his testimony) in stating that Dominion**
3 **Virginia Power and KEMA did not use Dominion Virginia Power's published**
4 **criteria?**

5 **A.** He is partially correct. What he concludes is, regardless, incorrect.

6 He believes that neither Dominion Virginia Power nor KEMA redispatched the system
7 generation in their studies to properly compensate for the absence of Possum Point 5. As
8 I understand it, Dominion Virginia Power redispatched using only Dominion Virginia
9 Power generation. This is consistent with the Dominion Virginia Power criteria.

10 KEMA proportionally redispatched all PJM generation, which is different from the
11 Dominion Virginia Power criteria.

12 Based on this assumed error, he believes that if the redispatch used 'eastern' Dominion
13 Virginia Power generation the Mt. Storm-Doubs line (and the Black Oak-Bedington line)
14 would not be overloaded.

15 This is contradicted in two ways—first, the Dominion Virginia Power studies
16 redispatched Dominion Virginia Power generation to compensate for Possum Point 5 yet
17 the lines were still overloaded, and, second, there is not enough northern Virginia
18 generation 'east' of Doubs to fully offset the absence of Possum Point 5. The analyses
19 that KEMA has performed (described above associated with Table 1) show that as you
20 move east, and especially south from Doubs, generation changes become less effective.
21 There is just not enough Dominion Virginia Power generation east of Doubs without
22 Possum Point 5 that would make enough of a difference.

1 In addition, Bates White examined the differences between the KEMA and Dominion
2 Virginia Power redispatches.¹⁶ They found that the loading on the Pruntytown–Mt.
3 Storm line was the only line that showed any significant difference between the two
4 dispatch approaches. Bates White concluded that the “different redispatch assumptions
5 have minimal impact in determining the need for the proposed line.”

6 **Q. Are Mr. Loehr’s criticisms at page 25 of his testimony regarding interface limits and**
7 **transfer capabilities addressed in the KEMA Report, correct?**

8 A. He would like to see interface limits and transfer capabilities. KEMA did not make such
9 an analysis because it was unclear what interfaces we would evaluate other than the
10 interface into northern Virginia.

11 PJM makes analyses as part of their load deliverability test that are similar to what
12 Mr. Loehr seeks. The test involves determining an import capacity requirement for a
13 load area—in effect this is an interface import requirement. This is followed by an
14 analysis to see if the system has sufficient transfer capability to deliver the required
15 import. It was the multiple violations of PJM’s load deliverability test that triggered the
16 studies by PJM that led to the approval of the proposed line to meet PJM’s reliability
17 criteria.

18 **Q. Have you reviewed the testimony of Benjamin K. Sovacool on behalf of the**
19 **Piedmont Environmental Council in this case?**

20 A. Yes, I have.

16. See the Bates White Report, *Needs Analysis of the Proposed 502 Junction-Mt. Storm- Meadowbrook-Loudoun 500 kV Transmission Line*, January 4, 2008, at pages 32-34.

1 Q. Did you find any errors or misstatements in Mr. Sovacool's testimony in regard to
2 power system reliability studies?

3 A. Yes, there were at least three that should be corrected.

4 Q. What is Mr. Sovacool's first error that you wish to correct?

5 A. On pages 3-5 of his testimony he discusses the need for reactive power. At page 3, lines
6 7-9 he mentions that a lack of reactive power has been an important factor in most
7 blackouts in the US. He also cites some examples on pages 3 and 4. I agree, adequate
8 reactive power is one important factor in preventing blackouts.

9 On page 4, at lines 14-19, he states:

10 Long distance transmission is not reliable. Given the complexity of
11 the modern electrical system, and what we know about the role
12 reactive power has played in recent outages, relying on longer
13 transmission lines to wheel greater amounts of real power is
14 perhaps the *worst* strategy for ensuring system reliability. Large
15 and long transmission lines lose reactive power the larger and
16 longer they become, requiring the system to compensate in ways
17 that *increase* the likelihood of systems collapse.

18 The last part of this statement is not correct for the proposed 502 Junction-Mt. Storm-
19 Meadow Brook-Loudoun 500 kV line. This line has clear benefits in regard to reactive
20 power. When we examine either the 2012 conditions or the 2016 conditions we find that
21 the existing PJM 500 kV network will be heavily loaded and that the resulting Mvar
22 losses are high.

23 By adding the proposed line to the network the loading on the parallel 500 kV lines is
24 reduced. The reduced loading on the 500 kV system reduces system reactive losses and
25 this decreases the amount of reactive power that must be produced by PJM generation by
26 about 2,200 Mvar. This is the amount of reactive power that would typically be produced

1 by about 6,000 MW of generation. And even in the case where the proposed Amos-
2 Bedington-Kemptown 765/500 kV line is assumed in service, adding the 502 Junction-
3 Loudoun 500 kV line reduces PJM system reactive generation by about 1,100 Mvar.

4 In both cases about a third of the reduction is in Dominion Virginia Power generating
5 units. Adding the 502 Junction-Loudoun 500 kV line will free up 400 to 700 Mvar of
6 Dominion Virginia Power generating capacity.

7 These are all significant improvements in the reactive situation of PJM and Dominion
8 Virginia Power and are directly attributable to the proposed 502 Junction-Loudoun
9 500 kV line.

10 **Q. What is Mr. Sovacool's second error that you wish to correct?**

11 A. On page 5, at lines 2-3, he states "Reactive power losses increase exponentially with the
12 distance transmitted." While reactive losses increase with distance, they only increase
13 linearly with regard to line length. They increase exponentially with regard to loading.
14 So a line that is twice as long as another will have twice the losses, but if it were twice as
15 heavily loaded it would have four times the losses.

16 **Q. What is Mr. Sovacool's third error that you wish to correct?**

17 A. He seems to want to improve system reliability over the long term by having less long-
18 distance transmission and more local generation built. Accomplishing this philosophical
19 change to electric power system development faces many legislative, regulatory, cost,
20 and public opposition hurdles and would take many years to implement. On the other
21 hand, failure to build the proposed line will present an unacceptable reliability risk to
22 northern Virginia customers in just three years.

1 Q. Does this conclude your rebuttal testimony?

2 A. Yes.