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Answers to Questions from Sen. Domenici

Re: Testimony Before
Committee on Energy and Natural Resources Hearing - July 31, 2008

1. What is the effect of a National Interest Electric Corridor designation? Does it usurp state authority to site transmission lines? Does it adversely affect historic, cultural, scenic or natural resources?

Designation makes the designated area subject to "backstop" federal authority to site transmission, and confers on an applicant eminent domain authority. The scope of that authority is in dispute. Most agree that section 216 of the Federal Power Act (added by the Energy Policy Act of 2005) conferred on the Federal Energy Regulatory Commission (FERC) "backstop" siting and eminent domain authority in cases where the state or local entity does not have authority to site an interstate transmission line, or where that entity has not acted within one year of an application to site an interstate transmission line. For its part, FERC has interpreted section 216 more broadly to empower it to reverse state or local decisions that are timely made (i.e., within one year) to deny an application to site an interstate transmission line. Various state regulatory bodies and other interests have challenged this interpretation.

The National Interest Electric Transmission Corridor designations made by the DOE as a supplement to its 2006 Congestion Study do, in my opinion, usurp the authority of states in the siting of electric power transmission lines. Also, they could undercut the efforts of the Regional Reliability Councils to coordinate the plans of the various RTOs, ISOs, transmission owners, generating companies, and Electric Service Providers operating within their defined geoelectrical areas.

As I said in my July 31, 2008 Senate testimony: "I believe that decisions on whether particular transmission lines are needed for reliability are best addressed by the states and by the eight existing regional reliability councils. They have consistently done a good job on this in the past. I do not believe that either DOE or FERC has the experienced staff or other resources to do this as well as the regional reliability councils and the states."

The designation of "corridors" which encompass some entire states and major portions of others seems to violate Webster's definition. In such huge areas, there

are undoubtedly more "historic, cultural, scenic or natural resources" than could possibly be listed here.

2. What are the implications for the grid if the U.S. changes climate change policy and commits to carbon reductions?

I do not have expertise in the areas of "climate change policy" and "carbon reductions;" hence I do not feel qualified to comment.

3. Does the Piedmont group support the development of renewable energy resources?

As I stated in both my written and oral testimony, the opinions I expressed at the hearings were entirely my own. Although I was listed as representing Piedmont Environmental Council, I was not acting on their behalf. I assume that Piedmont was involved in obtaining my invitation to testify, but my written and oral comments do not necessarily represent their views. In fact, I have never been an employee of Piedmont or a consultant for them. I appeared at the Senate hearings on July 31, 2008 *pro bono*, and did not receive a fee from Piedmont or from anyone else. Therefore, I cannot speak for Piedmont on this issue.

4. Do you realize that in the east the most abundant renewable resource is wind power, located in West Virginia? How do you get that wind to load centers in DC, Philadelphia and New York without interstate transmission?

I cannot judge the accuracy of the statement, "in the east the most abundant renewable resource is wind power, located in West Virginia." But a casual glance at the Department of Energy's map of wind resources suggests, to my admittedly amateur eye, that it isn't. Rather, it appears that the East Coast from Maine to the Carolinas, Cape Cod and nearby islands, and the upper Great Lakes all have wind potential superior to West Virginia's.

Wind generation has a low capacity factor (approximately 30%), and an even lower effective capacity, or probability of being available at the time of system peak (in the range of 8-11%). Hence the viability and cost-effectiveness of building long distance transmission to deliver wind energy to distant load centers – e.g., from West Virginia to DC, Philadelphia and New York – is highly problematic. There's also the question of Transmission I^2R losses over such long distances, and the likely need for voltage/reactive support (VARs).

In any case, this question appears to be based on the mistaken assumption that I am opposed to interstate transmission lines, or to bulk power transmission in general. This assumption is totally false. I do not automatically oppose transmission construction for *any* generating resources – wind, solar, geothermal, hydro, nuclear, oil, gas, or coal. Or solely for reliability. I believe that each case should be presented honestly, and judged on its own merits.

At the July 31 hearings, in answering a question (I believe from Sen. Murkowski) during the Q&A, I said that, to me, the issue isn't whether or not we should add transmission infrastructure *per se*. It's really about considering all options – including transmission, local and distributed generation, and DSM. But, more important, it's about HONESTY, both in presenting the *reasons* for proposed transmission additions, and in *applying standards and criteria*. If we want to build transmission for new remote coal-fired generation, let's *say* that, and let the case be decided on its merits. Likewise, if we want to build transmission for renewables, let's say that, and let *that* case be decided on its merits. Finally, if we want to build transmission because it's needed to make the existing system reliable, let's say that, and let the case be decided on its merits. But let's *not* disguise what we want to build for coal or renewables or whatever as "needed for the reliability" of the existing system, if it really isn't. Let's not use blackout scare tactics for transmission additions that are really wanted so that new generation can be sited hundreds of miles from load centers. And, in our planning studies, let's apply standards and criteria correctly, not misrepresent them to indicate a "reliability violation" when there really isn't one.

5. You appear to advocate building more generation close to load centers. What kind of generation do you realistically think can be built close to load centers today?

As I said in both my written and oral testimony, all alternatives should be fully explored and carefully considered on a non-discriminatory basis – including local and distributed generation close to the load. Siting generation closer to the load centers it's intended to serve has the benefit of providing inherently higher reliability, greater protection from terrorist attack, as well as insuring local area protection, voltage support, and close-in black start capability.

There's no inherent limitation on the types of generating facilities that could be built close to load centers, but the US already has gas, oil and nuclear plants so located. Certainly gas, and renewables such as solar, could be sited even within large metropolitan areas. Gas-fired combined-cycle units which have very low emissions, and efficiencies on the order of 60%, are now feasible. DSM, of course, is a "natural" as a resource located within load centers.

6. Can you provide specific examples of where a NERC Planning Standard was misapplied by not allowing time for system readjustments? Who, where, when?

In my opinion, NERC Reliability Standard TPL-003, Category 3 (C3), was misapplied by TrAILCo in proceedings before the Pennsylvania Public Utilities Commission in the application of Trans-Allegheny Interstate Line Company (TrAILCo) regarding the proposed 500kV TrAIL project and associated facilities. I came to this conclusion, and testified to that opinion, as an expert witness for the

Energy Conservation Council, an intervener in the proceeding. This conclusion was based on my more than 45 years experience in bulk power system planning and reliability. (My bio is included with my written testimony.)

The C3 standard, sometimes referred to as "N-1-1," provides for imposition of a first contingency, followed by manual system adjustments, then imposition of a second contingency. The phrase "manual system adjustments" allows for a wide variety of possible adjustments between the occurrences of the two contingencies; e.g., changing the outputs of generating units, modifying schedules, switching transmission lines, changing transformer and phase angle regulator taps, activating generating reserves, and any other actions feasible within a specified time frame (usually at least 10 minutes).

A number of contingencies were cited by TrAILCo as violations of N-1-1 testing under this standard, but "manual system adjustments" were not attempted between the first and second contingencies. In my view, this is an egregious error or misapplication; it applies a test to the system which is much more stringent than NERC Standards require, indicates a reliability violation where none exists, and implies the need for reinforcements which are not required to maintain reliability in accordance with national standards.

7. Can you provide specific examples of where a NERC Planning Standard was misapplied by manipulating generation through the exclusion of committed units? Who, where, when?

I did not say in my testimony that "a NERC Planning Standard was misapplied by manipulating generation through the exclusion of committed units." I *did* say the following: "In some cases, units well along in the process have been deliberately excluded from studies because they would solve a reliability problem, while others *at the same place in the queue* were included, precisely because they exacerbate a reliability problem. In my opinion, this makes absolutely no sense." This approach was used by TrAILCo in the same Pennsylvania proceedings cited above. In my opinion, it violates the spirit of the NERC Standards process, and of the principle laid down by FERC, NERC, DOE and EPAct that all standards and criteria must be applied on a non–discriminatory basis.

Interveners in the Virginia TrAILCo case have alleged that compliance with the NERC Planning Standards was tested using load flow simulations that excluded significant existing and planned generating stations (including the existing Mirant Potomac station, and Dominion's proposed Possum Point #7 and Warren stations); also, the studies assumed that no new plants, beyond those already possessing PJM interconnection service agreements, would ever be built in eastern PJM.

8. Generation re-dispatch is allowed under NERC Operating Standards. Are you claiming that generation re-dispatch should also be allowed under

NERC Planning Standards? If so, doesn't this place the grid at greater reliability risk? If so, doesn't this take away one of the primary tools that transmission system operators now use when real-time conditions may have 15 to 20 transmission lines and generators out of service?

Generation re-dispatch *is* allowed under NERC Planning Standards. It is inconsistent and illogical for the initial dispatch, prior to the imposition of any contingencies, not to recognize the possibility that contingencies will occur. Sometimes system planners select initial dispatches which appear neutral but in fact bias the apparent vulnerability of the system.

Many systems utilize re-dispatch in their planning studies. Not to do so, in my opinion, ignores one of the methods available to solve reliability problems. It also ignores the reality of how systems are actually operated – something for which system operators have castigated planners since I began my career in 1962! I personally believe that planning procedures, in general, should try to replicate how the system is actually operated in the real world.

The underlying problem is how to determine the amount of transmission transfer capability needed in a system. In my opinion, a comprehensive planning procedure would use multi-area Loss of Load Expectation (LOLE) studies to determine required transfer capabilities for given installed generation assumptions. The result would not require that economic dispatch always be followed; rather, it would use probabilistic techniques to optimize the system and determine the minimum interface transfer capabilities necessary to meet an overall LOLE requirement of 1 day in 10 years. This would in turn suggest where reinforcements might be necessary.

Adding transmission that really isn't needed for reliability acts as a magnet for remote generation. It's comparable to the way interstate highways radiating from an urban area attract new housing developments as each new section is opened. With interstates, housing developers are incented to build new subdivisions, and the ensuing growth often overwhelms the increased highway capacity. In power systems, generation developers are incented to locate generation more remote from load centers, making the system inherently less reliable. Adding transmission increases the transfer capability of the system, but does not in-and-of-itself enhance reliability. Reliability can only be improved by making the reliability standards themselves more stringent. As I said in my Senate testimony, *Reliability is a function of the standards used, not the amount of wire in the air*.

More important, increasing the amount of remote generation creates a reliability problem and a potentially devastating national security risk. With more generation sited at locations far from urban centers, those metropolitan areas become increasingly dependent on remote generation, and hence on long transmission lines. This in turn makes them more susceptible to transmission

contingencies which go beyond normal planning and operating standards, and increasingly vulnerable to terrorist attack.

9. If there is a risk of having rolling blackouts unless more electrical transmission is added, do you believe someone has a responsibility to communicate that risk to the public?

This question presumes that "rolling blackouts" are the *ipso facto* consequence of not adding transmission. That simply is not the case. "Reliability" is of two types: "adequacy" (or "resource adequacy"), which means the sufficiency of resources to serve load; and "operating reliability" (a.k.a. "transmission reliability") which means the ability of the synchronous interconnection or "grid" to survive sudden contingencies without dire consequences – overloads, low voltages, cascading outages, instability, system separation, or loss of firm customer load. So-called "rolling blackouts" refer to the former, not the latter.

"Rolling blackouts" are not blackouts in the sense of November 9, 1965, or August 14, 2003. They involve rotating feeder outages, voltage reductions ("brownouts"), and public appeals; they do *not* involve instability, system separations, and total loss of power supply over large geoelectrical areas. Also, "rolling blackouts" are caused by inadequate generating and related resources (DSM etc.), not by a lack of transmission. Of course, insufficient transmission *can* sometimes contribute to a resource availability problem, but in recent years I have seen very few examples. Multi-area LOLE studies which include transmission constraints between the specified areas, as described in my answer to Question #8 above, are the most effective way to determine if this is the case. Unfortunately, these are not frequently performed nowadays. The TrAILCo application before the Pennsylvania PUC, for example, never mentioned them.

On a related subject, NERC Standards permit controlled load shedding for unlikely combinations of contingencies and operating conditions. Some refer to these as "rolling blackouts," a scare technique. The significant difference between controlled load shedding and a cascading failure (blackout) is that controlled load shedding is normally done for only short periods, after which service is restored. Restoration of service after a blackout, on the other hand, may take days.

I do believe that we *all* have an obligation to warn the public when there is a risk to power system reliability and national security for *any* reason – <u>that is precisely what I intended to accomplish in my testimony before the Senate Committee on Energy and Natural Resources</u>.

10. Do you oppose market-based generation dispatch (de-regulation)? Do you believe de-regulation financially benefits consumers or financially hurts consumers?

I have no objection to "market-based generation dispatch" in principle. However, in my view, the manner in which "de-regulation" was accomplished has greatly compromised the reliability of the bulk power systems in the US, as well as financially harming consumers. My views are well-represented in trade press articles I've written over the past ten years, as well as in the reports I've co-authored as a charter member of Power Engineers Supporting Truth (PEST). These may be viewed on the PEST web site at http://www.pest-03.org. Interestingly, our views were shared by the majority of the invited papers presented at the panel sessions in Washington and Toronto co-sponsored by the DOE and the National Energy Board of Canada during 2005.

One problem I've noted is that, under de-regulation, far fewer interregional studies have been performed. For example, a number of major 500kV transmission additions have been proposed within the PJM (Reliability*First*) area, but to my knowledge no comprehensive studies have been performed to assess their potential effect on the Ontario and New York (NPCC) systems, or vice versa. Such studies were routinely performed before "de-regulation." In fact, I was personally involved in many of them, serving on the MAAC-ECAR-NPCC (MEN) Study Committee and the Joint Interregional Review Committee.

History has shown that developments within one regional reliability council, RTO or ISO can have a profound effect on neighboring systems. For example, as early as the late 1960s, it was found that more than 40% of any transfer from the Ontario portion of NPCC to the southeast New York portion of NPCC would flow counterclockwise around Lake Erie, through Michigan, and then through PJM before entering New York from the south. It was a classic example of the laws of physics – Kirchhoff's Voltage Law, to be specific. Even a significant percentage of transfers from upstate New York to the New York City area were found to flow through PJM. This situation had become critical by the late 1970s, and the New York and PJM Power Pools finally agreed on a number of fixes.

In the 1980s, Hydro-Quebec and New England (both parts of NPCC) planned to build a 2,000 MW HVDC line between James Bay and the Boston area. A special MEN study was conducted; it determined that loss of the line could have a significant adverse impact on both PJM and New York. This led to an agreement whereby the capacity of the line was reduced, and its substation arrangements modified. More important, it was agreed that operation of the line (and the operation of all HVDC ties between Hydro-Quebec and its neighbors) would be coordinated with west-to-east power flows across both the PJM and New York systems.

These are just two examples of the importance of interregional studies – studies which have been conspicuous mostly by their absence in the post-deregulation industry.

11. Do you believe that more electrical transmission creates a less reliable grid?

There is no simple or generic answer to this question. But, all else being equal, a grid that increases reliance on remote sources of power generation is inherently less reliable than a grid that connects load to proximate local generation.

Sometimes a transmission addition will enhance the reliability of the grid, as when it is truly needed for reliability. Other times, a transmission addition will exacerbate an existing problem or lower reliability, as when the increased transfer capability it provides will be used to increase long-distance power transfers across the grid. As I said in my Senate testimony: "Addition of new transmission facilities will increase transfer capability, but reliability can only be improved by making the standards themselves more stringent. *Reliability is a function of the standards used, not the amount of wire in the air*. Further, transmission additions will not increase the reliability of the system if the increased transfer capability is used to accommodate increased power transfers. The same reliability standards would still be in place. The transmission transfer capabilities would be higher, but the higher transfer capability would simply be used to carry higher long-distance power flows."

Further, there's a national security risk. Quoting again from my testimony: "If more generation is built in remote areas, and less generation and other resources are built close to load centers, then the load centers will be increasingly dependent on distant generating capacity – located perhaps hundreds of miles away. It would be like running a long extension cord to a friend's house a block or two away to power your toaster, instead of plugging it into an electric outlet right in your own kitchen. The more major cities depend on long transmission lines, the more subject they will be to power outages and blackouts due to major contingencies on the transmission system. Indeed, this constitutes a national security problem, since these urban areas would be more at risk from terrorist attacks on transmission facilities."

George C. Loehr – August 2008