This letter was written to Devon Dotson, Director – Legislation, Policy and Special Projects, Maryland Energy Administration, in the fall of 2009 by Wendell Beitzel, Delegate, Maryland House of Delegates.

Subject: FW: Wind Energy questions

Dear Devon:

Thank you for your considered reply to my initial inquiry on this subject. However, it is not at all "clear" that industrial wind technology can, as you stated, "supplant fossil fuel sources of energy." I find it fascinating you believe that energy inimical to modern standards of power production (begun when steam replaced wind hundreds of years ago), which also provides no capacity value, can supplant generating units that do provide high power performance and certain capacity value. If wind were merely intermittent and unpredictable (which it is) but produced at a steady level, it might actually do some good. But, from discussion with my experts, its relentless variability caused by the random nature of its power source dooms it to be nothing more than supernumerary energy flutter. That independent system operators and some in the international energy industry push this capacity-less technology is yet another sign that industry profits have become more important than tax and rate payer's wallets. Moreover, it's easy to document that losses to the US Treasury from wind subsidy account for up to 67% of the capital cost of most wind projects around the country--and up to 80% if various other state and local "incentives" are included.

Wind volatility adds greatly to the instability of any grid, since it continuously disturbs the essential match between supply and demand; indeed, the only way to control it is to shut it down completely. Wind flux is in addition to the instability caused by demand flux--and is much more unpredictable, for demand is not completely random. Wind flux therefore introduces a larger, less predictable net demand than the normal demand fluctuations alone. In fact, wind is known as "negative demand," since, when it skitters into and around a grid, it's virtually indistinguishable from the effect caused by people and industries turning their appliances off and on. We pay a lot for regulating demand fluctuations, using controllable, highly reliable conventional generators, which produce their rated capacities, or a desired fraction, whenever asked, to surgically mesh supply with demand in ways that insure reliable, affordable, secure electricity. But this is a reasonable expense, since getting electricity on whim in a mobile society has helped create much wealth, enterprise, and well-being.

Regulating the additional flux of wind, where any energy derived is a function of the cube of a small range of wind velocities (small changes in wind speed create large changes in wind "power," moment to moment), has questionable, if any, benefits, not least in offsets of greenhouse gas emissions wind energy might induce on a grid. Without any evidence that storage of industrial levels of wind energy is practical, even feasible, in the coming decades, regulating its volatility requires highly flexible conventional generation (in the PJM, given the dearth of hydro, this usually means natural gas units, likely open cycle systems) operating more inefficiently than they would if there were no

wind energy. A hydro expert has called the notion of floodgates at large hydro stations as moderators for wind "the worst idea I have ever heard in this arena," since "floodgates spill water around the turbines." Such a mechanism would likely waste more energy than it would generate. Building a flotilla of wind projects based upon the "hope" of storage capacity seems incredibly problematic—and expensive, a clear case of putting the cart way ahead of the horse.

Frankly, linear "projections" that simulate carbon emissions reductions due to wind based upon a one-for-one replacement hypothesis wouldn't pass even casual scrutiny in any transparent scientific forum; they capture the same kind of "reality" as college football polls. There are many complex variables that must be accounted for in such a process. Although wind can replace a kilowatt of energy generated from other sources, those source have to burn fuel in order to compensate for wind volatility--even if the energy isn't used directly to supply electricity.

Your claim that "intermittency [volatility] has been reviewed in detail" is not supportable. The most notable paper on the subject, The Costs and Impacts of Intermittency, by Robert Gross, et al (2006), ambiguously discusses what German studies called "the shadow capacity need," and then states:

"Intermittent renewable energy plants can save fossil fuel, but may also increase the amount that conventional plants must vary their output, operating in response to market signals. This change in utilization of generation is a separate issue from the need to establish additional reserves. These effects can be quantified using time series data on intermittent outputs and demand, and the implications for the operation of conventional stations assessed." [emphasis added] "However improved forecasting does not eliminate these costs [system balancing and other system efficiency impacts], since the need to manage predicted fluctuations will still lead to the effects described above."

Simplistic linear projections are half-truths, not based on reality; they also ignore interrelated system wide dynamics. Any claim about wind-caused carbon reductions not based on system wide generation behavior at sufficiently fine-grained time increments cannot be substantiated—and therefore should not be made. Or believed.

To settle this issue, please produce--from any modern grid system but preferably the PJM--annual chronological load dispatch analyses at sub-hourly, preferably 15 minute, intervals showing the thermal behavior of all units that interact with wind as it enters and exits the system. Specifically, such analysis must show:

(a) what power sources wind energy is (sporadically) displacing,
(b) what power sources are used to regulate wind's volatility,
(c) all the individual heat rates and ramping penalties that occur because of ramping thermal units up and back to engage wind flux, since these will likely have an increased, non linear effect on carbon emissions, and
(d) any thermal effects caused in voltage regulation and transmission due to the increased stresses of wind volatility.

It should also show the vicissitudes of demand over this period, revealing the correlation between wind patterns and demand cycles.

Your comments about the papers written separately by Mr. Hewson, a principle at Energy Ventures in Washington, and Mr. Sharman (an engineer in Denmark) for CEPOS, were not very cogent--or persuasive. Because of the ubiquity of coal and natural gas, virtually every expert in the electricity field has done some work for the fossil fuel industry. But Hewson especially has a diversified portfolio; he is not a coal company employee. Although I agree there is a major problem inherent with punditry in the energy sector, with its penchant for supporting the views of particular clients in regulatory hearings (I especially note this problem with those employed by limited liability wind companies and the American Wind Energy Association), I see no evidence of this in Hewson's paper.

He prominently acknowledged the work of the Australian engineer, Peter Lang. I don't know what engineers you have consulted, but the people I've asked point out what happens to the regulating reserves and their resulting ramp up inefficiencies (some older units have ramping heat rate penalties of 40%) as they are affected by the desultory behavior of the wind. Hewson's methodology and his facts seem current and compelling to a consensus of experts, certainly enough to create more than a reasonable doubt about MEA claims of wind/carbon reductions. What other flexible wind following units do you have in mind, other than hydro, various kinds of CHP (to include coal and natural gas) units, many of which aren't very flexible, and open or combined cycle natural gas generators? And, aside from hydro, what are their heat rates under normal conditions and under duress?

Let me ask you to provide information about each location here in the United States and in Europe that has backed down the coal industry specifically, and only because of wind energy. In those areas, please provide empirical evidence showing less coal burned per unit of electricity produced as a specific consequence of wind.

Ontario has long promised to retire (but has never been able to do so) all its coal plants. Officials tout that they will be replaced by "renewables." To hedge its renewable energy bet, the Ontario government is building natural-gas facilities as insurance against new wind projects. In other words, the province expects to replace coal with natural gas, not wind. The latter could not exist without either hydro, which presently provides the province about 25% of total generation [wind is about one percent], or flexible natural gas generators. Projections by the Ontario Power Authority depend upon planned conservation savings and natural gas, not wind, as a means of displacing coal. Similarly, boasts by the governor of Kansas that her state will not approve a new coal plant because of its increasingly expansive wind projects conveniently forget to mention how the state plans to increase its importation of, you guessed it, natural gas--at higher cost.

The CEPOS wind study states that wind reduced carbon emissions in Denmark, somewhat. But let's examine this further. In fact, the study showed all that installed carpet

of wind, which provides little energy within Denmark itself for grid security reasons, is effective only because the hydro imported from Scandinavia (which emits no carbon) regulates most of the wind flux. Over the last twenty years, the Danes have reduced their fossil fuel consumption vies a via electricity by about 6%. But this is mostly accounted for by increased importation of Scandinavian hydro, not wind alone--typically at spot market prices. The little that wind itself saves in Denmark is likely miniscule; and, regionally, Danish wind saves no carbon emissions, as the report revealed. If Denmark, as Sharman pointed out, did not have the Scandinavian "sink" in which it could dump its considerable excess wind, and if that sink did not have hydro as its principle source of power, the inference is clear. Denmark would be awash in both carbon dioxide emissions and wind turbines in the production of electricity. I would be happy to put you in touch with Sharman to verify this.

In fact, aside from the higher costs that Sharman and his colleague mentioned, this was a principal reason for their visit to the United States, since they understood that most areas of this county don't have access to substantial hydro systems, which can provide a clean, highly flexible regulating source for wind. As you surely know, most areas of the continent do not have outlets in which to dump excess wind energy, a particularly vexatious problem since, typically, the most wind energy is produced at times of least demand.

Yes, today's grids can incorporate a small penetration of wind flux into their schema using the ballast from existing conventional generators, mostly fossil-fired, to make it appear whole. But this seems much ado about very little. As Lang shows, natural gas units by themselves can accomplish almost as much carbon emissions savings without wind as they can with it. Ditto the situation in Denmark with hydro. Larger wind penetrations threaten any grid's marginal security reserves. To maintain those margins--that is, to retain high capacity to engage emergency situations--more wind will mean, of necessity, more high capacity conventional generation, as a number of wind studies in Germany have concluded.

Just like you I have called on people with far more expertise that I have on wind energy to help prepare this response to your email message. Should you or any of the people that helped you prepare your reply dispute what we have represented in this reply, I would very much appreciate a meeting with Mr. Gohn, the MEA's expert on wind energy, to discuss these issues more fully. Perhaps he'll bring with him some of the information I've requested. Given that there are now around 35,000 industrial wind turbines extant on this continent, I'd love to see data that supports your contention that less fossil fuels are now used in the production of electricity solely because of the use of wind energy--and not some other factor (such as recent demand reductions caused by the recession).

Adding, say, 2000MW (1000-2.0MW each) of Maryland-based rated wind capacity, spread over many hundreds of miles, would provide the PJM with about, perhaps, an annual average of 600MW, assuming a combined capacity factor of 30%, higher than the nation's average for wind. Based on the behavior of wind projects around the world, about 60% of the time they would produce less than 600MW. At peak demand times,

they would likely produce less than 200MW--and often produce virtually nothing. They rarely would produce their rated capacity. Whatever they do produce would be continuously skittering.

To realize the entire 2000MW of nameplate wind capacity--and to balance the routine flux as well as engage the widest swings possible from this capacity (that is, from zero to 2000MW) in what could be an hour's time--the PJM must infill any shortfall in wind production with conventional generation up to 70% of that nameplate capacity, much of it deployed highly inefficiently. Use of the spot market and its higher prices will, of necessity, increase, as it has everywhere wind is a player. Even if all this skitter was regulated with pumped hydro (which is extremely unlikely), there would be only negligible carbon savings from the wind/hydro combination over and above any savings that could be achieved through hydro alone, without any wind.

In my considered view, and the views of those persons that worked with me to prepare this message, there is ultimately no substituting for capacity value if we are to maintain reliable, secure, affordable supplies of electricity. I believe there is mounting evidence that industrial wind technology resembles nothing so much as the energy sector's equivalent of the subprime mortgage schemes that wreaked havoc with the economy. Both are enabled by wishful thinking, bogus projections, no accounting restraints or accountability, and no meaningful securitization, allowing a few to make a great deal of money at everyone else's expense. The politicalization of our electricity system is not wise public policy.

Science that is supported by information from real world behavior while accounting for ll sufficient variables--and not some cherry-picked simulation deployed by those who would profit by a particular point of view, financially and ideologically--is always welcome.

I look forward to hearing from you if you desire further debate on this matter and a meeting with Mr. Gohn with my experts to refute his representations. I really believe that MEA is on the wrong track and when the train arrives at the station, the passengers, every electric consumer in Maryland, will be stuck with paying the freight, higher electric bills.

Delegate Wendell Beitzel