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Alex Pavlak Comments to the Senate Finance Committee
SB 861

While Offshore Wind is three time more expensive than new natural gas and reduces emissions less than advertised, the real difficulty is that if we want a low carbon grid we can not have wind. Wind can contribute to a zero carbon grid only as a minor niche. Wind farms interfere with efficient base load technologies like nuclear power or coal gasification with carbon sequestration. To understand this we need to start with how wind systems work.

We cannot swap a wind farm for a coal plant. We need to keep existing capacity to provide power when there is insufficient wind. A more accurate system model is to plug in a wind farm and throttle down fossil-fuel generators whenever the wind blows. Wind reduces emissions by saving fuel. While this model works well with a few wind turbines, problems arise as we add more wind. Installing enough wind shuts down all fossil-fuel generators and the system is running 100% on wind.

Once all fossil-fuel plants have shut down, the wind system has reached its limit. The system cannot accept more wind capacity without curtailment (shutting down wind turbines). This begins to happen remarkably early, when wind provides only 5% of system power, generally in the middle of the night with low load and a high wind event. The limit can be increased by leveling the load (smart grid, demand response, storage) and long distance transmission. Computer simulations reported in the DOE's Eastern Interconnection Study suggests that the limit might be increased to 30%.

All of this is theoretical, no one has actually installed more than 5-6% wind. But assume that all this theory works, that we can really build a power system that is 30% wind and 70% fossil-fuel. What's next? How do we get to zero carbon? Wind promoters say we can replace coal plants with natural gas plants and reduce carbon emissions by more than 30%. But we can do that without wind. How does a wind system get from 70% fossil-fuel dependency to zero carbon? Can't add more wind because the system is already 100% wind for part of the time. Can't replace fossil fuel with something else because fossil fuel is the only known technology that can start and stop to backup wind. We're stuck.

One option is to add nuclear power. But since nuclear cannot cycle (it damages the fuel rods) we would have to decommission wind and reduce the size of the wind + fossil-fuel subsystem. But we cannot decommission if wind is locked into long term power purchase contracts. Wind interferes with deploying additional nuclear power. We are not only stuck, we are stuck for a long time.

The way to design a reliable power system that delivers energy on demand, is to think in terms of wind + (something else) as an integrated subsystem that can deliver energy on demand. 30% wind + 70% fossil-fuel is such a subsystem.

Wind + storage is an option. The barrier is cost. There is no power system in the world today that reliably levels daily load fluctuations. France comes close but even there they cannot handle larger fluctuations and they cannot do weekends. The cost of storing 100% of the load or leveling longer

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term fluctuations is prohibitively expensive.

Wind + hydro is a viable niche. The idea is to design and operate the hydro to backup wind. There are a number of studies underway. This is a niche because the amount of hydro is limited, 2.8% of production today. 2.8% hydro can support at most 1.2 % wind. There are competing interests for hydro power. Also Bonneville Power has found that during the spring they have too much wind and hydro and not enough of either during late summer peak loads.

The French electric power system is 90% carbon free today (80% nuclear, 10% hydro). In contrast, there is no evidence that wind can get close to zero carbon, except as a niche like wind + hydro. Wind interferes with efficient base load generators. My plea is to minimize risk with rational planning. Maryland needs a plan to develop an electrical power system that is clean, cheap and sustainable.

My name is Alex Pavlak, a PhD Professional Engineer who lives in Severna Park. I own two patents pending for wind turbines and I have published a number of papers on wind and how to develop clean energy systems. In the 1970's I was the president of a solar company for eight years. A main lesson from that experience is that intermittent generators like wind and solar are incompatible with systems that are required to deliver energy on demand. The resulting systems are inefficient, they simply do not work well.

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