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Maryland Conservation Council

Protecting Maryland's Natural Heritage Since 1969

Comments on Contention 10C presented to the Atomic Safety and Licensing Board, Solomon's Maryland, January 25, 2012

My name is Karen Meadow, Treasurer of the MCC. I'll talk now about the intermittency of wind energy and its effect on the reliability of an electricity supply.

The interveners' assertion that wind and solar electricity are reliable enough to serve as base-load is incorrect. Figure 2 in your handout contains data taken from a study made by a group of offshore wind advocates at the Univ. of Delaware. It shows that the capacity factors of an enormous, 2,500 km long array of turbines off the Atlantic Coast would be 75% or GREATER on only about 13 days out of a year. However, the capacity factors of the current group of US nuclear reactors has been 75% or GREATER for 365 days a year, according to data from the Nuclear Regulatory Commission.

(Figure 2 also shows the two-fold larger ANNUAL AVERAGE capacity factor of nuclear compared to wind.)

The characteristics of this modeled offshore array are such that no better array can be hypothesized; an array that is spread world-wide would not perform notably better. Thus, the argument that building arrays in distant locations and connecting them will result in a stable supply is spurious, because statistical methods show that adding two frequency distributions similar to the one shown in Figure 2 will result in a new distribution which has essentially the same shape as the average of the two. That is, high capacity factors will still be uncommon.

It warrants explanation why a group of wind advocates would publish data that is harmful to their cause. The group was focused on their finding that the hypothetical array would almost never produce zero electricity, which is an often heard criticism of wind. They simply did not discuss the data which showed that the array would rarely function effectively, but they had to show these data to get the paper published.

Further, the technologies like smart grids, needed to make wind and solar power as stable as present base-load generators do not yet exist. Batteries will not come down in cost quickly, if they ever do; and compressed air storage is very much in a trial stage with no assurance that it can provide the required capacity. It also requires natural gas for its operation, thus generating Carbon dioxide.

Nuclear reactors are a proven technology and the designs from 40 years ago could be built today

with the assurance that they WILL work. Reactors like that being proposed for Calvert Cliffs will most assuredly work even better.

There are two synonymous terms used by the electricity industry to describe the proportion of the output of a RENEWABLES INSTALLATION that is as reliable as the output of conventional generators. They are: "firm" capacity and "guaranteed" capacity.

The large German electricity company E.ON has stated that only 8% of Germany's extensive wind capacity is "guaranteed" capacity. Furthermore, they expect that this percentage will fall to 4% as Germany adds more wind capacity, because the advantageous sites have already been exploited.

It is very informative to note that France, which uses nuclear power dominantly, produces 88 tons of Carbon dioxide per GWh of electricity generated, while Denmark produces 600 tons per GWh, almost 7-times more than France, despite its touted preponderance of wind and NO nuclear. These data are from the International Energy Agency.

Again, we conclude that wind does not offset Carbon dioxide production nearly as effectively as nuclear power, and respectfully request that the Contention be dismissed.

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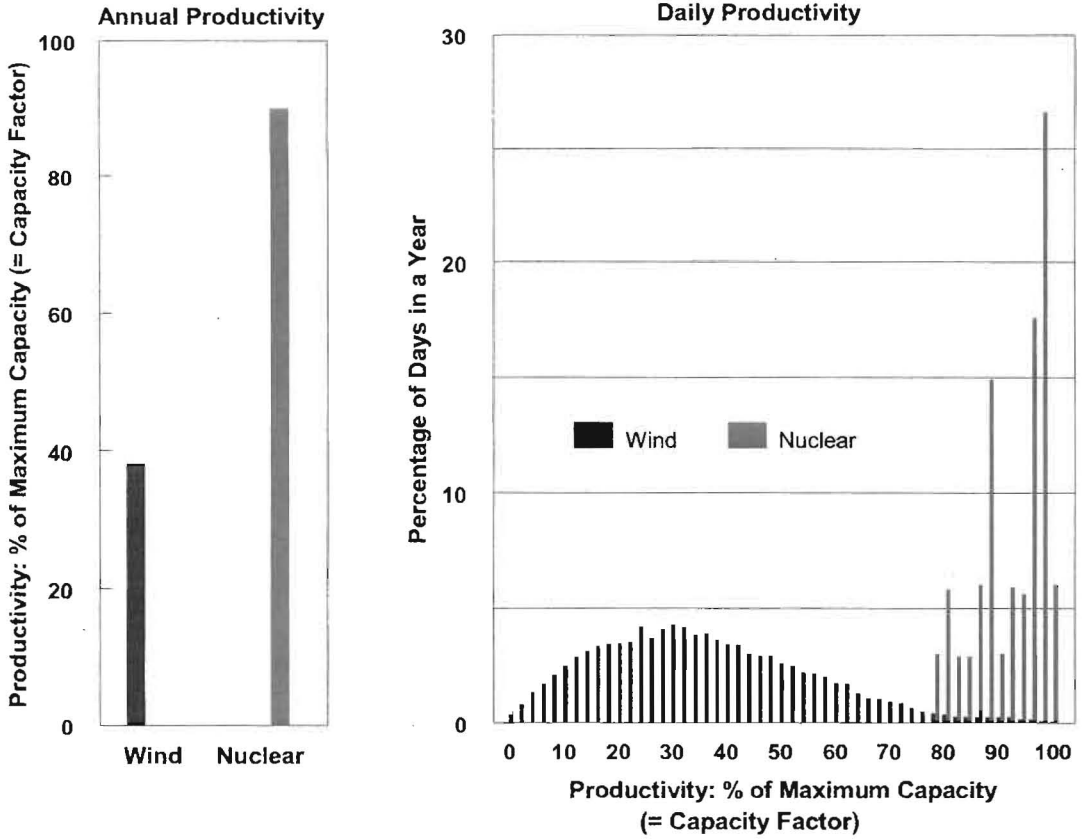
Comparing the productivity of a very large array of offshore wind turbines with that of nuclear reactors with the same total capacity

(Showing that the high cost of building a reactor doesn't lead to more costly electricity)



Sources of data: WIND TURBINES - from Kempton, et al., 2010, *Proc. Natl. Acad. Sci.*, 107:7240-7245. Data from 5 years of actual wind measurements made from weather buoys located off the Atlantic Coast from the Florida Keys to Maine.
NUCLEAR REACTORS: Energy Information Administration, USDOE, Monthly Energy Review Jan, 2011 (http://www.eia.doe.gov/emeu/mer/pdf/pages/sec8_3.pdf). Monthly data from Jan. 2008 through Oct, 2010 on the production of the 104 reactors in the US.

LEFT GRAPH: The quantity of electricity expected annually from either 20,000 five MW turbines built offshore from the Florida Keys to Maine or from the 104 current U.S. nuclear reactors. These data show that the higher cost of building the reactors is completely offset by the lower annual productivity (lower annual Capacity Factor) of the wind turbines, which necessitates building 2.5 times more turbines to get a given amount of electricity. The expected working life of the reactors (60 years) is longer than that of the turbines (25 years) which further reduces the construction cost of the reactors to 3-fold less than that of the turbines.

RIGHT GRAPH: A more detailed time analysis of the same data in the Left Graph. These data show that **turbines**, even in large numbers and built spanning long distances, perform very erratically. For only a few days a year will they produce at close to their maximum (this is called Intermittency). The **reactors**, on the other hand, never performed at less than 75% of their maximum capacity and they were at almost 100% for a significant proportion of the time.

The erratic productivity of this geographically extensive array of turbines creates the need for fossil fuel, carbon dioxide producing, back-up plants which add further to the relative cost of the wind turbines.