

Testimony on Indiana's Wind Energy Resources

Prepared by Dennis Elliott, National Renewable Energy Laboratory

Hello. My name is Dennis Elliott, and I am a principal research scientist at the U.S. Department of Energy's (DOE's) National Renewable Energy Laboratory in Golden, Colorado. My primary expertise is wind energy resource assessment, and I have more than 20 years experience in studying and characterizing the wind resource. I led the development of the Wind Energy Resource Atlas of the United States, published in the 1980s. In support of DOE's Wind Powering America program, I recently led the development of updated high-resolution wind maps for more than 30 states, including Indiana. The new wind resource maps are based on state-of-the-art computer modeling techniques that map the wind resource at spatial resolutions of 1 square kilometer or finer at heights up to 100 m above the ground. The new maps are validated with available wind measurement data.

The new Indiana maps show considerably more wind resource potential (especially at heights of 70 m and 100 m above ground) than indicated by the previous 1980s map for 50-m height. The old Indiana wind map was based largely on airport wind measurements collected at heights of only 5 m to 20 m above ground and extrapolated up to the 50-m height. The old map indicated that the 50-m wind resource was only power class 1 to 2, considered too low for commercial development. The new wind maps for heights of 70 m and 100 m show considerably greater wind resource than is available at 50 m due to the strong wind shear, or change of wind speed with height, that is present in Indiana.

We estimate that Indiana has at least 40,000 megawatts (MW) of wind energy potential using current technology at 70 m to 80 m above ground. This is more than double the entire generating capacity of Indiana. In preparing this estimate, we excluded all environmentally sensitive land, urban areas, airports, wetlands, and water bodies. We defined the windy areas of the non-excluded land as having at least 7.0 m/s annual average wind speed and assumed that 5 MW of turbine nameplate ratings could be installed per square kilometer of windy land. The 40,000 MW wind potential estimate corresponds to 8,000 sq. km of windy land, which represents about 8% of the Indiana total land area.

Another way the wind energy industry evaluates the available wind resource is by determining the net capacity factor for a proposed wind power plant. In this case, an annual wind speed of 7 m/s corresponds to a 30% net capacity factor (based on a commercial state-of-the-art wind turbine). This net capacity factor assumes that for a typical wind plant operation, 12% of the potential power generated by the wind plant is lost due to down time, icing, array effects, and other factors before the energy enters the electricity grid.

The Indiana maps (especially the 100-m map) show that higher wind resource areas (wind speed at least 7 m/s) are generally found across the northern two-thirds of Indiana, with the very best region located in northwestern Indiana. Indiana's wind potential may double in the coming years, as new wind turbine technology and taller towers (100 m and higher) are utilized. We are encouraged that recent tall tower measurement data in northwestern Indiana, collected after the new maps were completed, verified the good wind resource in that region.