Ohio University’s WEAV Lab Prospects for Wind Energy Resources in Southeastern Ohio (Athens, Ohio)

As the price of fossil fuels continues to fluctuate, wind turbines are becoming more efficient and less expensive. These two developments increase opportunities for wind energy development in regions with moderate winds and varied, or “complex,” terrains. Areas such as these in the Appalachian foothills are characterized by ridges, hills and valleys. While these land features can reduce local winds, they can also focus them, potentially creating unexpectedly favorable localized sites.

Now, Ohio University professor of mechanical engineering, Dr. Carole Womeldorf, seeks to add new information to that discussion. She suggests that with the right prospecting approach, cost-viable wind resources in rural areas such as Appalachia can be located. Locating the best wind near where the power will be used may turn out to be less expensive than offshore wind development or trans-continental transmission.

For these reasons, and the potential economic benefits, Womeldorf and student colleagues in the WEAV Laboratory are conducting the WEAV Feasibility Study. Designed as a regional-scale visualization and wind resource assessment of southeastern Ohio, the study utilizes a meso-scale strategy to locate the best wind resource in a variable terrain region.

“Locating the best wind in a region that is currently off the wind energy development map is a tough challenge,” says Womeldorf. However it’s a challenge she intends to take on through WEAV research, with the goal of transforming what was once thought of as the problem of complex terrain for wind development into an advantage. With a low-density population, the southeastern Ohio region has the potential to serve as a test bed for wind mapping software and prototype development for the next wave of wind models all the while opening possibilities for profitable wind development.

“Many local, regional, national and international people have contributed toward this goal,” Womeldorf notes, “[that is] using this WEAV assessment to find the best wind and enable cutting-edge turbine technology to make regional wind energy development a reality.”

In 2009, the WEAV team initiated the “Feasibility Study For Wind Energy Development in Appalachian Ohio.” The study includes synergistic evaluations of multiple components: 1) data-acquisition of upper level, high-quality wind data for two years; 2) GIS terrain elevation and land use information; and 3) a computational fluid dynamics model to predict the winds across the complex terrain.
Ohio University’s WEAV Lab Prospects for Wind Energy Resources Continued

Data collection began in December 2009 with the construction of a wind-monitoring site atop the WOUB Center for Public Media FM-TV tower. What makes the WEAV project’s monitoring site particularly unique is the height for data recording; to account for the variability in wind patterns, 23 different monitors reaching six heights up to 800 ft. have been recording data over a two-year period. Combining the wind data with high resolution GIS terrain information will soon yield regional wind maps generated from WindSim, a commercial wind simulating computational fluid dynamics (CFD) software.

With preliminary wind maps scheduled for completion the summer of 2012, WEAV plans to initiate Phase 2 in the fall of 2012 – validation measurements. The purpose of these validation measurements is twofold: 1) to evaluate the initial mapping and identify limitations of the mapping approach and, if possible, 2) to provide bankable wind information to communities in southeastern Ohio about local wind energy development potential.

Future goals of the project will focus on improvements in the computer models to extend their range of velocities in large, complex terrain regions, with the goal of evolving southeastern Ohio into a test bed to develop more accurate wind mapping tools for sites around the world.

From the data and maps generated in Phases 1 and 2, WEAV’s goal is to locate and validate the best 1% of wind resource, or “sweet spots,” in this region, which they predict may have significant viability in terms of levelized costs of energy with newer, taller more efficient wind turbines. In fact, the WEAV team estimates from previous wind maps that the best 1% of the surveyed area (20 sq. miles) may have wind speeds at or greater than 6.5 m/s at 100 m height. If half of that is usable, the team projects it could host about 100 1.5 MW turbines with the potential to generate enough energy (500 GWh) to provide clean, renewable power for over 45,000 homes annually.

With the ability to identify cost-viable wind resources in the complex terrain of the Appalachian region, the WEAV feasibility study has the potential to contribute a significant economic boost to southeastern Ohio, positioning it and the WEAV lab to be important leaders in the future distributed energy economy in Appalachia and beyond.

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