

Wind Resource Correlation in Southeast Wyoming

Thomas Parish and Jonathan Naughton

Overview

The development of transmission in southeast Wyoming is needed if the outstanding wind resources in the State are to be significantly developed. The transmission is necessary to export the wind-generated electricity from Wyoming to markets further west and south. High voltage DC & AC lines will be used for the long-distance transmission, and collector lines will deliver power from the point of generation to collector stations for subsequent delivery to the high voltage export lines. Due to the desire for electricity generated using wind power, it is important to maximize the amount of wind-generated electricity carried by the high voltage transmission lines. It may be possible to locate the collector stations such that they collect wind-generated power from locations that have very different wind resources. If two wind power generation sites were related in such a way that, when winds at one site are high, they are low at the other, then these two sites would be well suited to both supply power to the high voltage transmission lines.

Southeast Wyoming contains several different regions with wind resources that are at the same time excellent but of a different nature. These different wind resources are largely due to the effects of terrain. For example, the high mountains of south central Wyoming, the low altitude in the continental divide in central Wyoming, and the Laramie Mountains in the east yield a range of different wind conditions. It is known that diversifying the wind resource reduces the variability of the wind power produced. However, characterization of the different winds in southeast Wyoming from a wind energy power production viewpoint has not been performed or at least is not publically available.

An initial characterization of winds important for wind energy power production in southeast Wyoming is the focus of the proposed work. Low level winds predicted by operational forecast models are used for this purpose. By determining the correlation between winds at different locations for different time periods, the relationship between the winds at various locations may be characterized. If the winds at two locations are highly correlated, then it indicates that the winds tend to be high at these locations at the same times. However, if the winds at two locations are highly anti-correlated, then it would indicate that the winds are typically high at one location while they are low at the other. Selecting collection point locations near generation points that are somewhat anti-correlated would allow the amount of wind on the high voltage transmission lines to be maximized.

Statement of Work

The specific objectives of the wind resource correlation effort are given below.

1. Extract appropriate low level winds from operational forecast models.
2. Determine correlations for several points in SE Wyoming where wind turbines would be located.
3. Interpret the correlation information for suggested sitings of the collector stations.

Personnel

The following personnel will carry out this work.

1. Thomas Parish, Professor, Atmospheric Science, College of Engineering and Applied Science
2. Jonathan Naughton, Associate Professor, Mechanical Engineering, College of Engineering and Applied Science
3. Jared Baker, MS Student 2, Mechanical Engineering, College of Engineering and Applied Science

Approach and Deliverables

We have already investigated the data sets to be used and have determined how to access them to extract the data needed for this analysis. Standard correlation approaches will be used to determine the correlations between selected wind sites and the remainder of southeast Wyoming. Interpretation of these results will be provided in terms of the diversity of the wind resource and its importance to the siting of the collector stations.

Schedule and Deliverables

The work proposed here is anticipated to be complete by the end of September, 2010. The results of the analysis and their interpretation will be provided in a report.

Budget and Description

Salary and Benefits

Naughton	\$ 1,992.05
Parish	\$ 2,031.25
Baker	\$ 1,200.00
Total	\$ 5,223.30

Salary and Benefits

- Thomas Parish – 25 hours – Determination of data sets to be used and interpretation of the results.
- Jonathan Naughton – 25 hours – Analysis methods and interpretation of the results.
- Jared Baker – 120 hours – Implementation of data analysis.

Approval

Lloyd Drain, Executive Director Wyoming Infrastructure Authority