

Project: Wind Turbine Development

Brief Description: MSU-Bozeman and MSU-Northern will work together on multiple research and development project focused on wind turbine systems leading eventually to manufacturing of enhanced wind turbine system components. This could be part of a larger initiative in Montana for energy research.

Executive Summary:

Montana has the fifth largest wind resource of any state. Because of the increasing demands for power generation in the United States, and because there is an emphasis on “home-grown” power due to the volatility of oil prices, there is substantial interest in wind power generation site developments in Montana. North America has one of the largest wind resources in the world, yet it generates very little of its electrical power with wind (0.3%). A case in point, Germany generates more power with wind turbines than we do in all of North America (including Canada and Mexico).

The focus of the continued efforts by Montana will be fourfold.

1) We will continue to determine the durability and damage tolerance of wind turbine blades. This has been an ongoing activity at Montana State University for over 13 years. The project will help developers make prudent economic decisions regarding development and payback for wind turbine systems. These data will be available for any US development sites.

2) Currently, manufacturing of wind turbine blades is a major component cost. The blades can represent up to 30% of the initial system costs, and are often the limiting factor for the system lifetime. MSU will continue its manufacturing studies, and will engage local manufacturing companies to commercialize its developments. In particular, shipping costs of utility grade components is a major portion of the costs, and local manufacturing will minimize these costs.

3) As a third component, MSU will work with its surrounding states for site development. These will include utility-grade sites and stand-alone sites to enhance rural economic development activities. MSU already has a cooperative agreement in place with the University of Wyoming, and will extend its activities to the Dakotas, Idaho, Utah, Washington, and Oregon.

4) We will provide added-value technology to the wind turbine industry through our existing infrastructure in wind turbine research including power train/electrical generation systems (MSU Northern), and power quality and control (MSU Electrical Engineering). This is especially important as wind turbine manufacturers and developers engage Montana for its businesses, including manufacturing. Given that installed wind energy capacity in the US has been growing by 20%/year, this project is needed to sustain that growth [http://www.awea.org/pubs/factsheets/Market_Update.pdf]

This project is of national importance for several reasons. Among them:

- The wind turbine materials database will aid development of wind power in terms of life-cycle and ownership costs.
- The manufacturing studies will enhance current and future systems. It will also serve as a model on how to engage local manufacturing for wind turbine site development. This is very important to decrease manufacturing and installation costs.
- This project represents an opportunity to collaborate with surrounding states for wind turbine power generation development research.

Congressional Action Needed: MSU-Bozeman and MSU-Northern request a \$1,000,000 appropriation from the Energy and Water subcommittee.

Importance to Montana: This project is of profound importance to Montana. The results from this project will benefit Montana in several ways:

- The wind turbine blade materials and manufacturing studies will help for cost-effective wind turbine electrical power generation. This in turn will provide an electric power distribution throughout Montana to stimulate economic development. An infrastructure is already in place to immediately help the wind turbine industry.
- It will provide jobs during the development and operational phases of wind turbine power generation sites.
 - These jobs include:
 - Manufacturing wind turbine components (with substantial involvement from Native Americans)
 - Installation and maintenance (MSU Northern)
 - Basic research in wind turbine technologies
 - Every MW of installed capacity creates 2.5 job-years of direct employment [Source: American Wind Energy Association]
- It will serve as an opportunity to coalesce and extend its substantial history for wind turbine blade materials and manufacturing research.

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Talking Points

- Wind power offers the best “bang for the buck” for renewable energy sources. The cost/kW-hr is competitive with many new fossil-fuel electrical generation systems (at 3-5 cents/kW-Hr). Wind energy is good for the environment, and creates non greenhouse gas tax credits.
- Montana has the fifth best wind resource of any state, but only generates about 165,000 kW (utility grade). This is equal to only 500 moderate-sized hair blow driers! The estimated potential is 116,000, 000 kW! (1,000 kW can supply enough electricity for 240-300 typical American households)
- MSU has the most research in wind energy of any university in the US. This project allows application of the technology and enhances its breadth.
 - Mechanical and Chemical Engineering (wind turbine blade materials and manufacturing)
 - Electrical Engineering – fuzzy logic controllers
 - Power train – electrical energy conversion (MSU Northern)
- Montana has the most number of tribal lands of any state. Most of these areas have substantial wind energy resources. The Montana American Indian Research Opportunities (AIRO) Board of Directors has enthusiastically embraced the potential for development.
 - Local manufacturing
 - Revenue stream (land leases)
 - Education opportunities at Tribal Colleges
 - Involvement in high-tech industry (technology transfer)
- On a related topic, this project creates revenue streams for a declining agricultural economy. (Many wind turbine sites are co-incident with farm and ranch lands in Montana. Every MW of installed capacity creates 2.5 job-years of direct employment [Source: American Wind Energy Association])
- Montana is playing catch-up compared to other states in utility-grade wind turbine developments (Dakotas, Minnesota, Iowa, Wyoming, Texas, etc.; many of which have had congressional monies for development). This project is needed for Montana to be poised for home-grown, renewable power in the US.
- Montana State University has been hosting many wind turbine manufacturers and developers. This includes material manufacturers who want to focus products for wind turbine blades. Formalizing this with congressional support will help to meet the goals above, especially with respect to valued-added businesses and good paying jobs in Montana.
- Montana is using substantial state resources to study the combination of wind energy with hydrogen. The current focus is on producing hydrogen through hydrolysis of water, and utilizing hydrogen-based fuel cells for energy storage during periods of high demand, and low wind conditions. This is a major breakthrough for the practicality of wind turbines (supply versus demand for power; solves the energy storage problem!), and the use of hydrogen is attractive for generating non-greenhouse gas credits.
- Montana State University (Northern) is an untapped resource for the wind industry. It has an impressive track record of providing graduates who service the power train/energy conversion industries. In particular, its emphasis on mechanical power train – electrical power generation for the locomotive industry will provide trained individuals for the design, maintenance, and repair of wind turbine systems.
- Montana has conducted an extensive study [Cairns, et. al., *Wind Power in Montana*, available on CD-ROM] for “value-added” opportunities for Montanans in the manufacturing, site development, and research of wind turbines. This study was completed a couple of years ago, and the situation in Montana is relatively unchanged regarding “value-added” wind energy development. This congressional earmark is needed to realize these potentials.
- Simply waiting for developers to come in and place sites in Montana will not provide the national impact of the above project. Valuable high technology resources in Montana will be underutilized. Also, Global wind energy related activities are growing at a rate of 40%. The US needs this project to remain globally-competitive in this arena.
- Montana has been selected as one of six (6) states for DOE NREL Wind Technology Center’s “Wind for Schools” program. Montana State University (Robb Larson is the MSU Focal). This program is to stimulate awareness and education of wind energy. Other states and universities are: Idaho (Boise State), Kansas (Kansas State), South Dakota (SD School of Mines and Technology), Nebraska (University of Nebraska, Lincoln), Colorado (CU Boulder).