TEXAS TECH UNIVERSITY
Wind Science and Engineering
Research Center

Dr. Andrew Swift
Director
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Texas Tech University
Before the
Committee on Science and Technology
Subcommittee on Energy and Environment
U.S. House of Representatives

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"New Roadmaps for Wind and Solar Research and Development"

Good afternoon. Thank you, Mr. Chairman and Members of the Committee. My name is Andrew Swift and I appreciate this opportunity to provide testimony on the importance of wind energy research.

Background:

I am a faculty member in Civil Engineering at Texas Tech University in Lubbock, Texas, and have been engaged in wind energy research and education at the university level since the late 1970s. I presently serve as the Director of the Wind Science and Engineering Research Center at Texas Tech University which has conducted wind-related research and education since 1970, and offers the only multidisciplinary Ph.D. degree program in Wind Science and Engineering in the nation.

The university is located on the High Plains of West Texas and is at the geographic epicenter of thousands of Megawatts and billions of dollars of large, utility scale wind turbine development in the southern Great Plains region - to include eastern New Mexico, southern Colorado, western Oklahoma and the Panhandle of Texas. The wind resources are excellent and the people of the region are familiar with the wind, windmills historically used for water pumping, and integrating energy production from the land (typically oil and gas) with ranching and agriculture. Texas is ranked first in the nation in wind power installed capacity.

Wind Energy Overview and Barriers to Development:

Over the past decade, wind power has been the fastest growing source of new bulk electrical power generation in the US and the world. Wind energy is a clean, domestic and renewable source of electrical energy. Additionally, unlike thermal power plants which use large amounts of water for cooling, wind energy generation uses no water – an important fact in the Great

Plains wind corridor where water resources are severely strained. Current US wind power capacity is approximately 28 Gigawatts, generating sufficient electrical energy to power approximately 10 million US households - a small fraction of current US electrical energy consumption. Robust growth is expected to continue, with the US DOE projecting that wind energy could provide 20% of the total US electrical energy needs by the year 2030 [1].

The US DOE report, completed in spring 2008, outlined the costs, benefits and barriers to successfully developing the 300 GW of installed wind power capacity, more than ten times the current capacity, needed to meet the 20% goal. The report has been generally well received by the wind energy community and most are supportive of the 20% target. In outlining barriers to attaining the goal, the need for expanded electric transmission resources to move wind-generated electrical energy from high wind resource areas to load centers was emphasized. However, the report also points to the critical need for additional research and development to reduce capital costs, increase performance and reliability and reduce environmental impacts of wind turbine power generation as compared to the current state of the technology. The report also points to the need for accelerated wind energy workforce development to meet industry needs. Let me focus on four points:

1. ***Wind Turbine and Wind Farm Turbine Research Needs:***

   Decreased capital cost, improved performance and improved reliability of both individual wind turbines and entire wind farm multiple turbine arrays will require significant investments of research and development funds. These are actually two separate research thrusts and the proposed "Wind Energy Research and Development Act of 2009" addresses these two programmatic needs.

   The first will require improvements in individual wind turbine technology such as improved generators, gear boxes and drive trains, improved rotor designs and controls technology, and advanced components and materials. Investment and emphasis on individual component areas will combine to improve the entire wind turbine.

   The second research thrust will also require significant investment but must address system level, multiple wind turbine array issues and must be approached in a different manner. Access to wind farm data is currently very difficult to obtain due to the private nature of wind farm ownership. Wind inflow characterization, wake turbulence and wind turbine array response measurements are very much needed to address current unexplained decreases in performance and reliability. Answers to these system and array questions will require public funding of research and a very different approach than the component research. It is important that the research data and results be in the public domain, benefitting the entire US wind industry thereby assuring the adoption of best practices throughout the industry, reducing negative impacts, improving reliability and

performance and providing energy at the lowest cost from the nation's wind turbines and wind farms [2]. The AWEA Action Plan Report [3] provides excellent detail of the required research thrust areas and should be a template for implementation.

2. ***Wind Power Forecasting Research:***

Since wind is an intermittent source of power generation, integration studies of wind with the electric grid system and the proposed "smart grid" are needed. Full integration of wind resources will require area-wide load balancing and dispatch and will rely heavily on high fidelity wind and wind power forecasting so that power is delivered reliably and all resources are utilized to their potential.

This will require the atmospheric science community to approach forecasting of wind on a variety of temporal and spatial scales and with an accuracy not usually associated with weather forecasting. The solution will require a synergistic approach to research and development and a strong partnership between the atmospheric science community and wind power generation community. These research topics are not listed in the current bill, but should be considered for inclusion in the program.

3. ***Research Funding as a Technology Investment:***

The proposed research program, the "Wind Energy Research and Development Act of 2009" addresses the points made above and represents a significant, and much needed, increase in wind energy related research funding at the proposed level of $200 million per year through 2014. The amount is reasonable when compared with other federal energy research programs or when viewed as an investment in technology advancement. Assuming growth rates in wind capacity from the 20% wind energy by 2030 report of approximately 15 Gigawatts per year, each 1% increase in performance due to technology improvement will represent approximately $300 million net present value of revenue over the life of the turbines installed that year – a 50% increase over the proposed annual federal investment.

4. ***Education and Workforce Development:***

The DOE 2030 report estimates a wind energy workforce of 180,000 direct jobs at full capacity. Estimates by Texas Tech University economics faculty and Wind Science and Engineering staff estimate that approximately 20 to 25,000 of these will be professional jobs requiring a university education. Significant wind energy programs at universities require active and knowledgeable faculty and strong student enrollment. It is very important that universities partner in real and synergistic ways with industry and DOE laboratory personnel in these research programs. Not only do the faculty and student researchers bring new ideas and innovation to the research agenda, they bring the

connections back to the university for new programs in wind energy and opportunities for students. Wind energy is strongly multidisciplinary and faculty and students are needed to support this industry not only in engineering for new turbine designs and development, but also in atmospheric science for wind and power forecasting and resource assessment, in ecology to study and minimize wildlife impacts, in project management and financial analysis, in agriculture and economics to integrate the technology with agriculture interests throughout the central US wind corridor, and so forth. Inclusion of strong university, industry and government research and education funding and partnerships are crucial to effective wind energy workforce development in support of this industry.

This is an exciting time to work in wind power. I believe if research and education investments are made on the scale proposed and comparable with support of other sources of electrical power that this industry can provide 20% of the nation's electrical energy by 2030 - providing a clean, affordable and domestic source of renewable power to the citizens of our nation.

Endnotes:

[1] "20% Wind Energy by 2030", USDOE, www.20percentwind.org

[2] Texas Tech University has proposed a National Wind Resource Center and publically funded wind farm on university land near Amarillo, Texas for the purpose of obtaining operational wind farm data. That project is under consideration in the FY 2010 Federal Budget process.

[3] "Action Plan to Achieve 20% Wind Energy by 2030", American Wind Energy Association, Research and Development Committee.