House Energy and Commerce Committee
Subcommittee on Energy and Air Quality

Hearing on "Unlocking America's Energy Resources: Next Generation"

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Written Testimony of
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Mr. Chairman and members of the Committee, I am Victor Abate, Vice President, Renewable Energy at GE Energy. I appreciate the opportunity to testify today on the future of renewable energy.

GE is a power generation technology leader with leading experience in biomass, solar and wind technology. At GE, we believe renewable energy will be an integral part of the world energy mix throughout the 21st Century. Today, I'd like to focus specifically on the wind industry, but would welcome questions on other renewables. I will address my testimony to three issues: the state of wind technology today; costs associated with wind energy; and opportunities to drive costs down in the future through continued technology advancement.

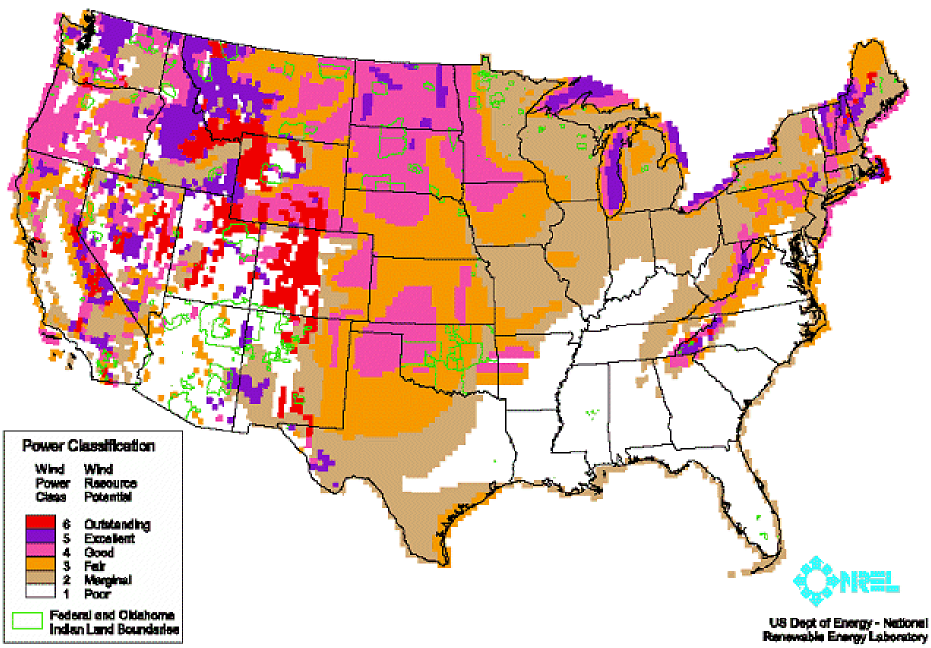
Wind Energy and the US Energy Future

Wind energy can become a significant player in the US energy portfolio and is the most commercially viable renewable energy resource today. The industry has recently seen record-breaking growth; in 2005, the US installed 2,431 MW of wind energy contributing to a total installed base of 9,149 MW, which is enough energy to serve 2.3 million homes. Although today's wind technology supplies less than 1 percent of US electric generation, the total installed base has nearly doubled over the last three years. Wind energy is currently being used to generate power in 30 states.

The two critical factors for success in the wind industry are 1) the quality of the wind resource, and 2) advances in wind turbine technology. The US is well positioned in both of these areas.

When compared to Germany, the country with the world's largest wind energy installed base, and other top country wind installers, the US has significantly better wind resources. In fact, the American Wind Energy Association (AWEA) claims that current US wind resources have the potential to supply up to three times the total electricity generated in the US today.

Figure 13. Wind Resource Potential



Tapping the potential of wind as an energy source makes use of this abundant, domestic, low to zero carbon emissions resource while reducing overall US dependence on imported energy. For example, a 100 MW wind farm in New York State would produce the energy equivalent to 590,000 barrels of oil per year and displace 260 million pounds of carbon dioxide per year. Furthermore, wind is a fixed cost source of electricity which hedges rising prices for other energy sources, such as natural gas and oil.

In January, President Bush stated that the US could one day generate up to 20 percent of its electricity needs through wind technology. We believe that this vision is achievable through continued technology advancement.

Current Wind Energy Technology

The key measure of the ability to generate electricity from wind energy is the turbine's "capacity factor." Capacity factor is defined as the ratio of the actual energy produced by a turbine over a time period versus the maximum energy the turbine could produce if operated at full nameplate rating over the same time period. For example, a 1 MW unit can produce a maximum of 168,000 kWh of electricity in one week. If the turbine actually produces 84,000 kWh, it would have a capacity factor of 50% for that week.

The capacity factor for state-of-the-art wind turbines has increased substantially since 2002. As shown on the chart below, in 2002, the best-in-class capacity factor of wind turbines was less than 36% at a wind speed of 8 meters per second (m/s)(a speed which is representative of the quality of US wind resources). In 2006, the capacity factor of the best-in-class machines has risen to approximately 47%. **As a point of reference, a one-point increase in capacity factor over the US wind installed base could produce enough electricity to support 90,000 average US households.**

Three key factors influence the turbine capacity factor: blade size, turbine efficiency and availability, and the wind resources at the site. Increases in rotor sizes and turbine availability have contributed to the significant jump in the capacity factor.

Since 2002 rotor sizes in similar wind regimes have increased by 17% from 70.5 meters to 82.5 meters, thereby increasing the energy capture of the turbine **by over 35%. This also benefits energy production by allowing the turbine to begin generating power at lower wind speeds.**

Availability refers to the percentage of time that a wind turbine is ready to generate power. In 2002, availability of then state-of-the-art wind turbines was less than 85 percent. As the result of technology advances in remote monitoring, diagnostics and the utilization of GE

reliability modeling, today's wind turbines have availability of more than 97 percent. A one percent increase in availability over the US wind installed base could produce enough electricity to support 28,000 average US households.

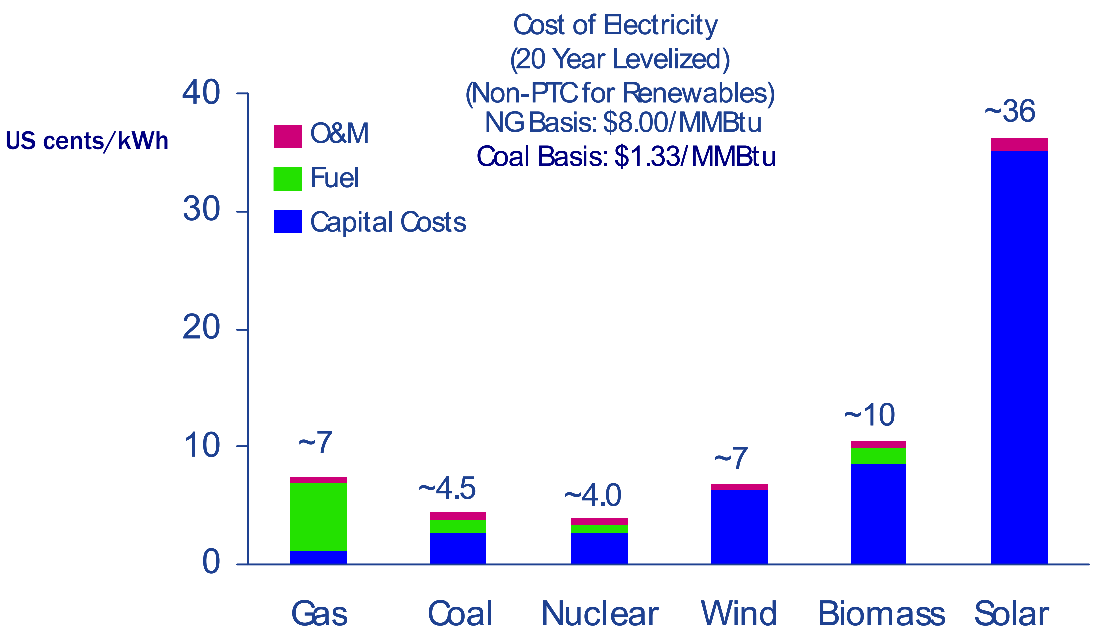
Proper siting of wind turbines also is critical to energy production and capacity factor. As shown below, siting the same 1.5xle unit at an 8 m/s average site versus a 7 m/s average site will create a 9 point increase in the capacity factor, from 38% to 47%.

Capacity Factor and AEP on GE 1.5s and 1.5xle Turbines

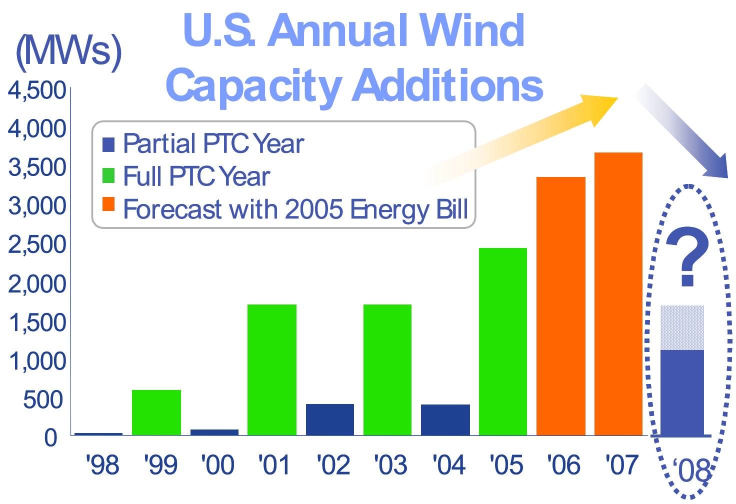
	1.5S 2002 State of Art Technology	**1.5XLE** 2006 State of Art Technology
Rotor Size	70.5m	82.5m
Availability	85%	97%
Capacity Factor @ 8 m/s	36%	47%
Annual Energy Production @ 8 m/s (Kwh)	4,730,000	6,176,000
Capacity Factor @ 7 m/s	28%	38%
Annual Energy Production @ 7 m/s (Kwh)	3,679,000	4,993,000

Costs

Since 1980, the cost of wind-generated electricity has seen an 80 percent price reduction as the result of technology advancements in availability, efficiency and output. Today, the Cost of Energy for wind, exclusive of any incentives, is 7 cents/kWh.



Wind is more competitive when the 1.9-cent per kWh production tax credit for wind is applied. The Federal production tax credit provides a necessary economic incentive for power producers to generate power from wind. As illustrated below, the role of the production tax credit in stimulating the installation of wind generation is clear. When the wind production tax credit has been allowed to expire, new installed capacity has dropped dramatically in the following year due to lack of component availability. Therefore, a more stable incentive for wind generation can support the long-term investment by suppliers needed to assure that manufacturing capability is available for critical components.



*Current PTC expires December 31st, 2007

For example, today we are seeing a supply-constrained industry where suppliers are unable to provide key components such as blades and gearboxes, limiting the number of wind turbines being manufactured. To meet the market demand in 2006 and 2007, the supply chain needs to make multi-million dollar investments in production capacity. However, unless OEMs can assure suppliers of a future market, suppliers may not make the long-term investments that are necessary. A predictable incentive policy is essential if we are to grow the wind industry in the US.

Wind Technology Advances for the Future

GE is investing more than $70 million annually in advancing wind turbine technology to further lower the cost of electricity. These efforts are focused in three key areas: larger and more efficient rotors, advanced loads management and enhanced grid stabilization.

The rotors on wind turbines define the energy capture capabilities of the unit. This energy capture is a function of two parameters: rotor diameter and blade efficiency. Larger rotors capture more energy, but typically increase the up tower mass of the unit and therefore, increase the weight and cost of the supporting structures. Utilization of higher technology and lighter weight material will allow longer blades without increased weight. In addition, advances in computer modeling will allow significant increases in blade efficiency through increased understanding of the complex flow fields around turbine blades.

The rotor is also a key contributor to the loads characteristics of the wind turbine. Advances in passive and active loads management techniques, through advanced controls and materials, will allow increases in turbine size without proportional growth in weight.

Voltage regulation is key to electrical grid stability. Wind turbines have progressively increased their capability to stay on line during grid voltage fluctuations and assist with voltage regulation. In the future, wind turbines will be a vital part of grid voltage stabilization through advanced power electronics which will be capable of managing grid voltage, even when the wind is not blowing.

Continued development of low speed wind technologies – an important focus of government/industry research and development partnerships – will allow the use of wind turbines in lower class wind locations that would otherwise not be economically feasible.

Conclusion

In conclusion, wind power is a cleaner, viable offset to fossil fuel generation. The U.S. is well positioned to benefit from this ample, domestic resource and it is evident that wind can become a significant player in the US energy mix through its proven technology and strong growth. Predictable incentives, however, are still needed to sustain this momentum and drive costs down.

Thank you for the opportunity to present this testimony. I look forward to your questions.