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## AFFORDABLE RENEWABLE ENERGY Large-Scale Wind Energy Facilities

Technological advancements over the last two decades have transformed the wind energy market from a niche into a mainstream, competitive energy source. First introduced as a large-scale power source in the United States during the late 1970s, the price of wind energy production has declined 80% since then. With an average growth rate of 30% annually over the past five years (1997 to 2001), wind energy is the world's fastest growing energy source [1].

One major obstacle with which wind energy must contend is a perception that it is expensive. A contributing factor is that early wind development (early 1980s) ran a production cost of 38 cents per kilowatt-hour (kWh), well above the costs of conventional energy sources[2]. However, prices (unsubsidized) have fallen dramatically, to an estimated range of 4-6 cents per kWh[3]. Furthermore, projections indicate this price will continue to decline to a range of 2.5 to 3.5 cents per kWh for large-scale wind developments by 2005. Another contributing factor to the perception of high costs is that utilities often add a surcharge to customers for using "green energy." In reality, the average cost over a 30-year lifespan for facilities makes wind energy one of the cheapest forms of energy production.

The technology used to harness the wind has changed dramatically since 1981. A typical utility-scale wind turbine in 1981 had a rated capacity of 25 kW, while new turbines today are on the order of 1 MW or more. Tower heights have more than doubled from heights less than 100 feet in 1981 to more than 200 feet today. Turbines on taller towers are able to benefit from greater wind speeds at these higher heights (reduced affects from the surface). Combined with advances in turbine design and manufacturing, these technological advances have reduced unit costs to the point where wind farms are economically viable.

When comparing lifetime costs of various energy generation facilities, wind facilities are quite competitive. The American Wind Energy Association estimates unsubsidized costs, as of 1996, to be within a range of 4.0 to 6.0 cents per kWh, although recent large-scale wind farms have substantially lower lifetime costs due to economies of scale. Coal and natural gas were in a similar range, at 4.8 to 5.5 cents/kWh and 3.9 to 4.4 cents/kWh, respectively[3]. The gas shortages during the winter of 2001 drove prices up to the point where some gas power costs were running as high as 15 to 20 cents per kWh[4]. Coal, although inexpensive, is laden with environmental emissions concerns, and is imported to Oklahoma. With continued concerns about shortages of natural gas and the environmental costs of coal, wind energy provides a viable alternative.

In addition to costs, a major barrier has been financing. Wind facilities have high up-front capital costs, accounting for approximately 80% of the total lifetime costs of a facility. Because of the high up-front costs and uncertainties about the market, financial markets have not eagerly

embraced wind developments. However, some large developers have sufficient capital resources that they are able to develop multiple areas simultaneously to limit risk. It will be a while before small investors will be able to finance large wind developments, as financing costs may be up to 40% higher than for utility ownership or self-financed projects[5].

Despite these barriers, the number of wind farms has grown substantially over the last decade. In Texas alone, three large facilities have been developed in the past two years. In 2000, Bonneville Power Administration announced a request for proposals for 1,000 MW in new wind capacity. The request generated 25 proposals totaling 2,600 MW. As for Oklahoma, Chermac Energy Corporation, an Edmond based company, recently make publicized plans to develop 120 MW in new wind capacity near Buffalo, Oklahoma. Ironically, Chermac is a petroleum-engineering firm. According to its president, Jaime McAlpine, “Wind is a natural byproduct of Oklahoma’s geographical location, just as oil, gas, and coal are.”[6].

These large wind development projects provide tremendous benefits to local communities and counties. AWEA estimates a 100 MW development will generate about \$1 million in local tax payments and a minimum of \$260 thousand in lease payments annually[7]. These revenues are in addition to continued farming or ranching operations, because each turbine takes ¼ acre or less out of production even though the wind farm may extend across several miles. In addition to the tax and lease payments, construction of a 100 MW wind farm will generate approximately 40 temporary construction jobs and about 10 permanent skilled jobs. The creation of jobs and revenue will also benefit local businesses not directly associated with the wind farms.

Wind energy is capable of providing a source of power at a competitive price. Many of the barriers, especially cost and financing, are being overcome through technological advances and economies of scale. Oklahoma is a prime target for development of large wind energy facilities. Developers, local and out-of-state, are aggressively pursuing prime locations for new wind farms. As these locations are developed, the potential exists for millions of dollars in tax revenue, lease payments, and new jobs to be brought to rural areas of the state.

#### **NOTES:**

1. Source: American Wind Energy Association. 2001 Global Energy Market Report. <http://www.awea.org/pubs/documents/GlobalWEMarket2002.pdf> .
2. Source: American Wind Energy Association. “What are the factors in the cost of electricity from wind turbines?” <http://www.awea.org/faq/cost.html> .
3. American Wind Energy Association. “Comparative Costs of wind and Other Energy Sources”, Wind Energy Fact Sheet. <http://www.awea.org/pubs/factsheets.html> .
4. Wall Street Journal. “As Demands for Energy Multiply, Windmill Farms Stage a Comeback”, January 26, 2002, p. B1.
5. Wisner, Ryan, and Edward Kahn, 1996. “Alternative Windpower Ownership Structures.” Report No. LBNL-38921. Berkeley, CA: Lawrence, Berkeley National Laboratory.
6. The Daily Oklahoman. “2 Wind Power Plants Set for State”, August 21, 2001, p. 2-C.
7. American Wind Energy Association. “Wind Energy and Economic Development: Building Sustainable Jobs and Communities”, Wind Energy Fact Sheet. <http://www.awea.org/pubs/factsheets.html> .