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The Effect of Wind Energy Development On State and Local Economies

Wind energy has received renewed attention as a resource with the potential to generate significant amounts of electricity in various locations throughout the United States. Fuel price escalation and federal and state tax incentives spurred the growth of the U.S. wind energy industry in the 1980s, mostly in California. Since the early commercial California installations, wind energy technology has dramatically improved and achieved significant cost reductions. Wind-generated electricity today can be cost competitive with conventional fossil fuel generation in many parts of the country. The lower costs**,** coupled with the raised environmental consciousness of the public, has fed to increasing consideration of wind energy development in other areas of the United States and around the world. As the market for wind energy increases, regions outside California are including wind energy in their generation expansion plans. For the most part, these areas have little or no experience with the technology or the development of wind energy projects. The effect of a robust market for wind energy on state economics is likely to be different from that of traditional gas or other fossil-based technologies. The objective of this paper is to qualitatively identify and describe the processes through which state and local economics are affected by wind power development.

Any business development in a region has both a direct and an indirect effect on the local and regional economies. A new wind power project will directly affect an area through purchase of goods and services, generation of land use revenue, taxes, and employment. Secondary or indirect effects of wind energy development within a region are more difficult to qualify but include increased spending power, economic diversification and the use of indigenous resources.

Direct economic effects

Several direct effects from the development of a wind power project include land owner revenues, revenues to local governments from property taxes, the creation of jobs and the effect on local services.

Land owner revenues

With most conventional fossil fuel plants, the location of the fuel source is of secondary concern, since the fuel generally is purchased and transported to the generation facility. In the case of a wind power plant, the fuel -- or wind resource -- is site-specific and non-transportable. As a result, wind rights for a project must be secured either by purchase or lease for a particular piece of land with favorable wind resources.

A new wind power project will directly affect an area through purchase of goods and services, generation of land use revenue, taxes, and employment. Of all local groups that benefit from wind energy development, rural land owners could reap the greatest rewards. The

development of a wind project in an agricultural area makes the land more productive and provides an additional source of income to rural land owners from leasing and royalty agreements. Wind turbines occupy 4 percent or less of the land area required for a wind power project and, in many cases, farming operations may not be greatly affected.

Land purchase

Several options exist to secure the wind rights to a piece of land. An obvious approach is land purchase. Although this has occurred for some wind projects, it generally is not the most desirable option for the project developer because of the additional expense for an already capital-intensive project. Leasing the land or obtaining easements is a more common arrangement. In some cases, however, utilities can purchase land for a wind energy project and include this cost in the rate base. For independent power producers (IPP), a leasing agreement generally is more beneficial to the project cash flow.

In some locations, it may be possible to purchase only the land required for roads and foundations instead of the entire area required for the project. For the first Buffalo Ridge wind power plant in Minnesota, Northern States Power (NSP) purchased 150-foot wide strips of land on which to install its wind turbines. As a utility, NSP was able to include the cost of the land for this project in the rate base.1

Land lease

Land leases can be structured in several ways. The most common in the wind industry is to base lease payments on a percentage of gross revenue. In some cases, this percentage is fairly low in the initial years of operation, escalating in later years as the equipment debt is repaid. In other cases, a minimum lease payment is included in the contract on a per-turbine or per-acre basis, with additional payments tied to revenue. Lease payments range from 2 percent to 10 percent or more of gross revenues on an annual basis, depending upon competing land uses. In the Altamont Pass area of California, for example, leases were negotiated to escalate to fairly high rates because of the competing residential development for Bay Area commuters. In the Midwest, lease rates are generally fixed at lower rates over the lease period because of the remoteness of the areas or the lack of competing land uses. Generally, a guaranteed minimum annual payment is included in a lease to cover periods in which the project may be inoperable.

Economic benefits to a land owner from a wind project

- 20 MW wind plant operates at 25% capacity
- Average energy payment = 5 cents per kWh
- Gross annual revenue = more than $2 million
- Land owner lease = 2% of gross annual revenue or approximately $43,800

The economic benefits to a land owner from a lease agreement can be illustrated by an example. A 20 megawatt (MW) wind project operating with a 25 percent capacity factor that receives an average energy payment of 5 cents per kilowatt hour (kWh) will produce more than $2 million in gross revenue annually. The benefit to the land owner if the lease terms specify 2 percent of gross revenue is approximately $43,800 per year. The Union of Concerned Scientists estimates that a farmer could increase the return on his or her land anywhere from 30 percent to more than 100 percent by leasing a small fraction for wind turbines.2

In Minnesota, terms for one lease include a payment of $1,000 for wind monitoring and turbine siting activities with subsequent payments of $750 per turbine and a quarterly payment equal to 2 percent of gross operating revenues, escalating to 4 percent if the project is actually built. In this example, the lease includes a clause that requires the project developer to pay the increase in property taxes that result from equipment installation.3

Land leases also generally include provisions for protecting the land upwind from any future development that could affect the wind resource on the project site. Additional parcels of land upwind sometimes are leased to prevent interference with the wind resource.

Other land use considerations

Effect on existing or planned land use

Wind energy development is compatible with many existing land uses such as grazing and other agricultural operations. In these locations, leasing the land for wind energy development provides additional revenue without seriously interrupting existing operations. Wind project developers -- whether utilities or IPPs -- are not interested in expanding their business to take over agricultural pursuits; therefore, a leasing agreement is beneficial to both parties.

Publicly-owned lands

Some states have considered designating state-owned land or making special arrangements for renewables on state land to promote renewable energy development. For the Lower Colorado River Authority (LCRA) wind project in west Texas, a unique arrangement was made to build the project on easements controlled by the Texas General Land Office. Traditionally, the General Land Office has leased state lands for oil and gas production. Revenue from those leases flows into the state's Permanent School Fund, which helps to finance Texas public schools and universities. More than $3 million will be generated for public education through the LCRA wind project.4

In both the San Gorgonio and Tehachapi areas of California, a large percentage of the wind projects are installed on federally-owned Bureau of Land Management (BLM) land. Significant land lease revenues flow to the federal government as a result of these leases.

Rural land owners could reap the greatest benefits from wind energy development.

Property taxes

Direct economic benefits also are obtained from wind energy development through the payment of property taxes on improvements made to the property. California wind companies pay annual properly taxes to local governments of $10 million to $13 million. In San Gorgonio Pass, the city of Palm Springs actually extended its boundaries to an unincorporated area developed for wind energy to take advantage of the tax revenues. In Washington, property taxes for proposed wind projects are estimated at approximately $10 to $14 per $1,000 investment.

In some states, wind energy projects are exempt from property taxes for the increased value of the property due to the wind plant development. In North Dakota, for example, wind turbines are exempt from property taxes for five years; in Iowa and Minnesota, wind systems are exempt from state sales tax. In Minnesota, a property tax exemption was passed for wind projects to promote renewable energy development. After the state Legislature enacted legislation requiring utilities to develop a significant amount of wind energy in the state, the Legislature determined that the tax incentives were no longer necessary and the legislation was changed to exempt from property taxes only systems that produce less than 2 MW. Larger projects now are subject to a partial property tax.

Job creation

As in most business ventures, wind energy projects create jobs. In general, the employment opportunities associated with a wind power plant are in construction, operation and maintenance and manufacturing. Compared to conventional generation options, wind development creates more jobs per dollar invested and per kWh generated. A study conducted by the New York State Energy Office found that 10 million kWh of electricity produced by wind energy generates 27 percent more jobs in the state than the same amount of energy produced by a coal plant and 66 percent more jobs than a natural gas combined-cycle power plant.5 For fossil fuel plants, a significant portion of the annual cost represents the cost of fuel rather than labor.

Construction

Construction jobs for a wind project are relatively short-term assignments during the construction phase of the development process. Construction time for a wind project is generally a year or less, depending on the size of the project. For a 50 MW project, the equivalent of 40 full-time jobs may be created during the

construction period. Typical personnel requirements include construction management, electricians, heavy equipment operators, security personnel, and general laborers for assembly and civil works.

Operation and maintenance
The number of people employed by a wind power plant during commercial operation depends on the number of turbines and the administrative structure of the project. In California, two to five maintenance people generally are required for each 100 turbines, and at least one operations person for each five to 10 maintenance people may be needed. Kenetech Windpower's Buffalo Ridge 25 MW project expects to employ three full-time people to operate and maintain the project's 76 wind turbines.6

Although a wind power plant operates automatically, operators may be employed to monitor the plant and address any system alarms. Operators also may function as maintenance dispatchers and record keepers. Their skills include computer literacy, inventory management, job and equipment scheduling, performance record keeping, statistical trend analysis and data processing. Requirements for these employees depend upon the sophistication and capabilities of the central control and monitoring system and the size of the project. Some operation centers are located far from the wind power plant site. Smaller projects may employ only a limited staff that is responsible for both operation and maintenance. Depending upon the ownership structure and proximity of the sites, maintenance crews and operations people can be used for several projects.

In some states, wind energy projects are exempt from property taxes for the increased value of the property due to the wind plant development. **Domestic manufacturing of wind turbine components and related equipment**
The American Wind Energy Association (AWEA) estimates that wind turbine and component manufacturers directly contribute to the economies of 44 states. These companies manufacture and market towers, gearboxes, blades, monitoring equipment and other wind energy-related equipment. For example, Fiber-Science of Salt Lake City recently announced the award of a contract for blades for Enercon turbines. To fulfill the contract, the company plans to add 30 new employees to its current staff of 44.7 NRG, a Vermont company, manufactures wind resource assessment equipment and employs approximately 15 people. Kenetech Windpower, the largest U.S. wind turbine manufacturer, employed approximately 1,200 people in 1995 (including maintenance staff).8

Local Services
The construction and operation of a wind project results in the purchase of local goods and services such as construction materials, construction equipment, maintenance tools and supplies and maintenance equipment, and manpower essentials such as food, clothing, safety equipment and other articles. As previously mentioned, support services such as accounting, banking and legal assistance also are required. Rental of local equipment for maintenance is common. One proprietary study for a wind developer indicated that approximately $0.5 million in annual local purchases would result from the operation of a 100 MW wind project in the area. The Kern County Wind Energy Association estimates that approximately $11 million is paid annually to local businesses for goods and services as a result of the wind energy projects in Tehachapi.9

While a wind power plant can have a substantial impact on the region, it has a minimal impact on the local and state infrastructure because of the high capital-to-labor ratio of the plant's operation. Additional employment and property taxes add value to the local economy without creating a substantial burden on the existing water and sewer system, transportation network, and emergency, education or other public services.

Development of regional cooperatives
Wind power projects can provide economic opportunities for local residents not only through royalty payments and jobs, but also through community investment in locally-owned wind cooperatives that develop wind power projects and sell the electricity to a utility. The cooperative development and ownership of wind power plants has proven successful in other countries. Although this has not been

practiced widely in the United States, several cooperative ventures have been proposed in the Midwest where successful cooperatives exist for ethanol, dairy production and farm supplies.

During commercial operation of a wind power plant, the number of people employed depends on the number of turbines and the project's administrative structure. Under the right circumstances, cooperatives could provide a way for local communities to gain additional economic benefits from wind energy development by retaining the return on investment and energy sales profits that might otherwise go to a private developer. Wind turbines under cooperative ownership could be located either in clusters or distributed widely across many farms. In Denmark, approximately two-thirds of the turbines are owned by individuals or cooperatives.

The viability of a regional cooperative depends heavily on the energy sales price obtainable for the project energy output. The 1995 Minnesota Legislature passed a law providing below-market loans and production incentives for individual and cooperatively-owned wind projects. To be eligible, the wind turbines must be located entirely on agricultural property used principally for farming. Advocates are hopeful that these two provisions will spur the creation of small land owner wind cooperatives similar to those commonly found in parts of northern Europe.

Individuals also can gain indirect benefits through a municipal government that owns a wind power project. For example, a municipally-owned project consisting of Nordtank turbines is located on a harbor in northern Europe. The turbines were installed on a breakwater and the revenues are to be used for harbor improvements. Waverly Light and Power and the Sacramento Municipal Utility District are two public utilities that own and operate wind power projects. initial projects of both utilities have been so successful that they hope to construct larger installations in the near future.

Indirect economic effects

Because businesses within a local economy are closely linked by business and personal purchasing patterns, direct benefits also have an indirect effect on the economy. The direct effects spur rounds of spending in the local and state economy, increasing the overall benefit to the area. Increased taxes from a wind power project will result in additional government spending on local, state and federal services. Another secondary impact, referred to as the induced effect, comes from additional household earnings from employment growth that results in increased household spending on goods and services. California's wind energy industry is estimated to employ 5,000 to 6,000 people when indirect impacts are considered.10 The Lower Colorado River Authority estimates that its wind power project will create $300 million in increased economic activity in the next 25 years.11 In Germany, three to four indirect jobs are estimated to be created for each direct job in the wind industry. A Danish study estimated that each job at a wind turbine manufacturer created 4.5 jobs among suppliers.12

Communities can invest in locally-owned wind cooperatives that develop wind power projects and sell the electricity to a utility. Additional value to local economies also results from increased diversification of the county and state economic bases. Economic diversification ensures greater stability to the economy by minimizing financial high and low cycles associated with a specific industry. This effect is particularly important in rural areas that tend to have a one-dimensional economy. Single dimension economies result in limited business interaction; therefore, more goods and services are imported and more dollars leave the region.

A state that imports most of its fossil fuel can receive a substantial employment and earnings benefit from developing indigenous renewable resources, because a larger fraction of the money spent for energy will remain within the state. Texas, for example, has lost its status as an exporter of energy and has become, instead, a net importer of energy. In citing reasons for pursuing the Texas wind power project, LCRA stated that it represents one way for the state to control its own energy future instead of importing out-of-state fuel from Wyoming and Montana. In another example, Portland, Oregon, announced an agreement

with Portland General Electric to purchase a portion of its electricity from wind power and stressed that the local development will result in more investment dollars staying in the Northwest.

Notes

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National Wind Coordinating Committee

The content and form of the papers in this series have been reviewed and approved by the National Wind Coordinating Committee. Committee members include representatives from investor-owned utilities, public utilities, state legislatures, state utility commissions, state land commissions, consumer advocacy offices, state energy offices and environmental organizations. The purpose of the National Wind Coordinating Committee is to ensure the responsible use of wind power in the United States. The committee identifies issues that affect the use of wind power, established dialogue among key stakeholders and catalyzes appropriate activities.

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