Economic Impact Analysis of *WINDPOWER DEVELOPMENT* in Southwest Minnesota

Prepared for
Southwest Regional Development Commission
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Slayton, MN 56172

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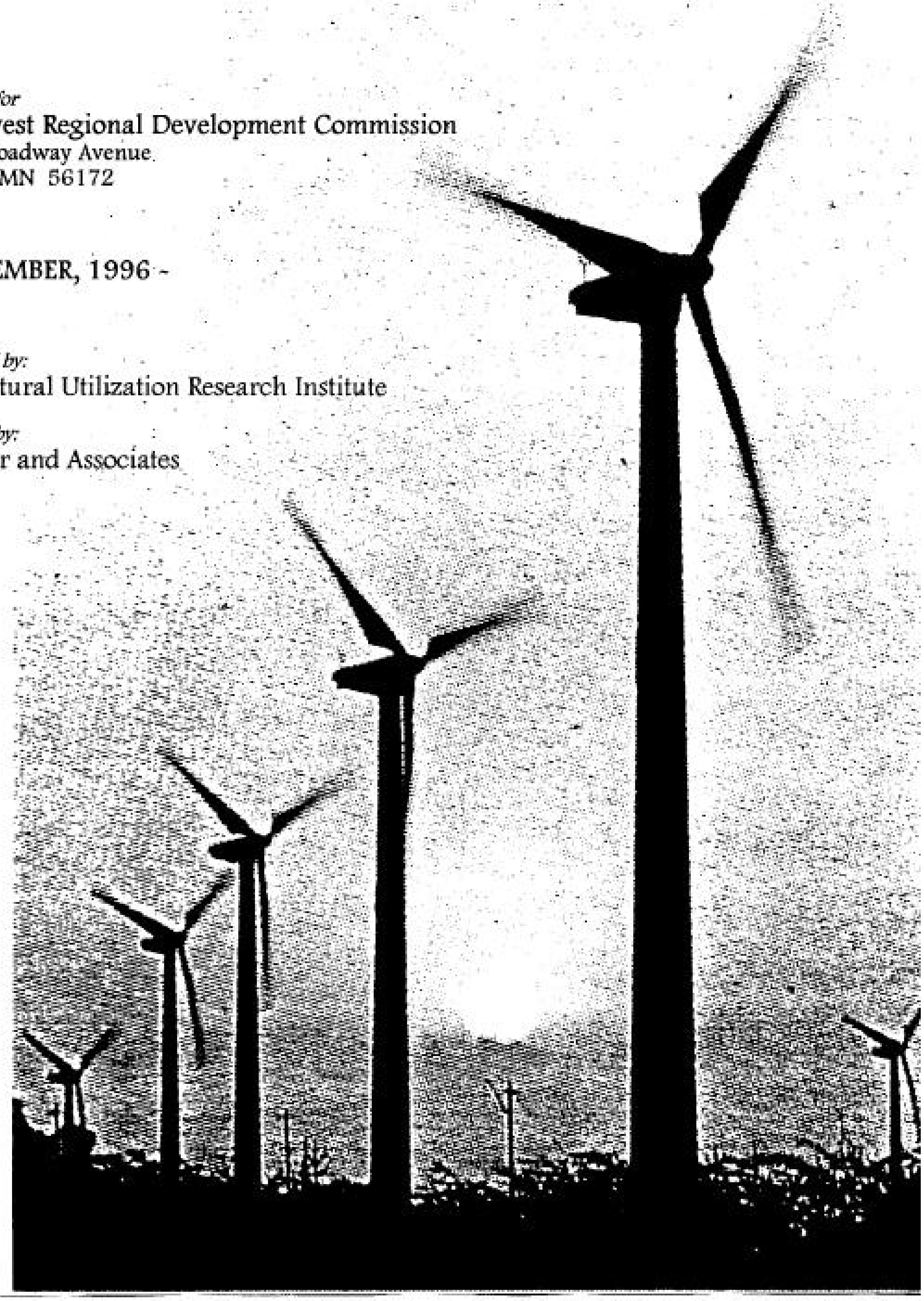

Windpower Economic Impact Analysis In Southwestern Minnesota

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Executive Summary

Information describing character and location of the development of Southwest Minnesota's wind resource, and this development's relationship to the local communities, is essential to making decisions on the framework for future planning. To gather this information and to better understand the economic impacts of this development, The Southwest Regional Development Commission contracted the Agricultural Utilization Research Institute to carry out this analysis. This comprehensive study provides an economic impact analysis for both large-scale wind power developments and disbursed generation in Southwest Minnesota.

This report summarizes the preliminary research conducted to assess the costs and job creation of wind energy development. We then input those findings into a 53 industry regional economic model developed by Wilbur Maki Associates. The model captures the direct and indirect economic effects that occur as expenditures and income, from wind energy development, ripple through all industries that are linked to Southwest Minnesota's economy.

The primary research for this report was accumulated from interviews with individuals representing the wind industry, government agencies, banks, nonprofit organization, private business, and utilities. Secondary research included a review of relevant documents which pertain to the subject of this analysis. Highlights of this study include the following:

Indirect and Induced Effects

Summary

Economic dependence of rural areas on essentially one industry--agriculture--contributes to a "boom-and-bust" economy that is characterized by a high volatility of income and earnings. Careful examination of the commodity disbursements of the agriculture and food industries in the six-county area shows the extreme dependence of this sector on export markets. Local markets are almost entirely other industries that make up the intermediate demand sector of the local economy. These include the meat packing and dairy products manufacturing businesses that also ship most of their production to markets outside the six-county area.

Shipments of locally-produced products to both local and export markets generates the income for purchasing the production inputs of labor and capital, and intermediate products used in the production processes. Unlike the product disbursements, however, industry input purchases in the six-county area are reported for the local area, given the method of measuring the primary inputs of labor and capital used in local production, namely, at the place of production.

The overall impact of windpower development derives in part from the multiplier effects of the additional economic activity generated by the project. It also derives from the composition of resource use and the balance between labor-intensive and capital-intensive resources. For the six-county area, the indirect effects due to linkages of the energy industry to its supplier is minimal, given the lack of such suppliers and the conditions for their location in the area. Only the induced effects resulting from the spending of (1) the wages and salaries received by local residents from employment in the local energy-producing industry or in the property-tax supported local government and (2) net revenue payments received from the sale of locally-produced energy add to the direct effects of local windpower development. The spending on consumption items, of course, increases the demand for imported consumer goods along with the increase in producer demand for labor. The level of imports and the conditions for establishing a business that competes successfully against the imports may change sufficiently to warrant the founding of a new local business.

The total effect is typically less than twice the direct effect. The economic (i.e., the so-called "Type III") multiplier is less than two. The sum of the indirect and induced effects in the six-county area is less than one-half of its corresponding value, for example, in the Twin Cities metropolitan area. This means that more than one-half of the "spillover" effects of windpower development in the six-county area accrue to other areas, with the largest spillover occurring during the facility construction period of Phase II through Phase V. The dispersed production alternative yields the smallest spillover to other areas as evidenced by its higher ratio of total employment to direct employment change. Enlarging the local impact area to include more counties would, of course, increase the multiplier effect, but only slightly. Over several years and over a geographically larger market area, however, the gradual growth of new businesses capitalizing on productive local labor resources and low-cost community infrastructure and services would result in the internalization of more and more of the indirect and induced effects, thus further enhancing the local impact of new business development.

Direct Impacts

Land Owner Revenues

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 for a particular piece of land with favorable wind resources by either purchase or lease of the land itself. Of all the local groups that benefit from wind energy development, rural land owners could reap the greatest rewards. The development of a wind project in agricultural areas provides an additional source of income to rural land owners through leasing and royalty agreements. In the case of locally owned disbursed development, it also can produce a revenue stream through electricity sales. Wind turbines occupy 4% or less of the land area required for a wind power project and, in most cases, farming operations need not be greatly affected. NSP (Northern States Power Company) estimates they will spend around 5 million dollars on land rights for each of Phases II, III, IV and V. This is in addition to the 1.5 million dollars that were expended on Phase 1.

Property Taxes

Direct economic benefits on future development will be obtained through the payment of property taxes on improvements made to the property. Given the present status of the tax laws and the uncertainty of exact locations, this analysis estimates that the affected counties will see an increase of between $200,000 and $400,000 per year in tax revenue for each 100 megawatts of development that occurs.

Job Creation

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 each of the 100 megawatt projects outlined in the analysis, the equivalent of 65 to 85 full-time jobs may be created during the construction phase. This number varies due to the additional transmission and distribution requirements for the different phases. Local contractors and suppliers are often used for some of the construction activities. The use of local equipment, supplies and services provided to the crew also benefit the local economy during the construction period. This analysis has concluded that during construction on each of the 100 megawatts that are developed, approximately $1.5 million will be expended on construction materials and supplies and between $850,000 and $1 million will be expended on local goods and services.

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. This analysis finds that 10 full-time operations and maintenance jobs will be created for every 100 megawatts of installed wind power capacity. The operation of a wind project results in the purchase of local goods and services in the form of construction materials, construction equipment, maintenance tools and supplies, maintenance equipment, and manpower essentials such as food, clothing, safety equipment, and other articles. Support services such as accounting, banking, and legal assistance are also required. This report estimates that approximately $400,000 per year will be expended to the local economy from operations and maintenance for each 100 megawatts of development.

Disbursed Generation

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 power projects that sell the electricity to a utility. Under the right circumstances, locally owned wind power projects 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 profit that might otherwise leave the area with a private developer. Wind turbines under local ownership could be located either in clusters or disbursed widely across many farms, similar to those now commonly found in parts of northern Europe. This analysis shows that, provided access to the required capital, locally owned disbursed generation can produce 25 to 150 more jobs and $700 thousand to $4.3 million in total value added than the Phase II scenario and can have a much larger impact on the local economy in the form of retained revenues from the local ownership of the turbines. The study provides a detailed cash flow analysis and local economic impact projections for this type of development.

Impact Areas

The analysis of the impact area of the proposed developments indicates that there is physically enough land, with 7 meters per second wind speeds, to accommodate 1100 megawatts of wind development. Even though the area can physically handle 1000 megawatts, the constraining factor appears to be sufficient transmission to move the power from large projects such as the 100-megawatt projects outlined in section V and VI of this report. The first 225 megawatts of the NSP mandate (Phases I, II, III) will take most of the available line capacity on the 115-KV line that runs just south of Lake Benton, MN. After the first three projects are completed, NSP estimates that 21.2 million dollars per 100 megawatts will be required to build transmission for phases IV and V of the mandate. Disbursed generation does not require the transmission upgrades like the larger projects as turbines can be interconnected on existing three phase distribution lines with little or no modification to the system. The analysis of the impact area of this report indicates that between 150 and 200 megawatts of disbursed generation could be installed provided arrangements are established with the Rural Electric Cooperatives to wheel the power to the end buyer or NSP.

Conclusions

Results of this study indicate that further development of wind energy in southwest Minnesota may contribute to the rural economy via salary and wages, land owner revenues, property taxes and job creation. These impacts can be enhanced by deployment of the disbursed energy generation model alone and/or in concert with the concentrated energy generation model to alleviate some level of cost related to transmission fine development by the power company. To advance the development utilizing the disbursed model, certain important policy adaptations related to funding opportunities and a simplified power purchase contract must be addressed.

I. Introduction

Wind power has been utilized as a method to produce electrical energy for many years in Minnesota. However, it was not until recent legislation, which requires Northern States Power (NSP) to put on-line 425 megawatts (Mw) of wind generated electrical energy by the year 2002, that it became a subject of debate on defining the best model for development for the people of Minnesota. Considering that the Buffalo Ridge area of Southwestern Minnesota is being targeted as the prime development location, the Southwest Regional Development Commission felt it necessary to conduct a comprehensive analysis of the economic impact of this development.

In today's highly volatile economy it is not enough to assert that the goal of a state energy policy is to assure adequate energy supplies at a reasonable cost and to expect that such a policy automatically will assist in the creation of new jobs and new community development opportunities. Rather, we must ask specific questions such as how can energy development be shaped to produce new employments Or, how can energy management strategies be designed to give communities more control over their development opportunities? In short, providing adequate energy supplies must be coupled with the efficient management and development of energy resources that enhances the economic well-being of our communities and the state(7).

The purpose of this study is to provide an assessment of the local economic impacts of construction and operations of wind energy production facilities. Projections of local economics will be developed for communities that appear likely to experience substantial effects. Two development models are considered, one of which is a large wind farm project (100 megawatt increments), and the second is disbursed generation (100 megawatts developed in 10 megawatt and 600 KW increments). These projections are designed to assist local officials and others in determining the significance of the potential impacts, in terms of the ability of local systems (economic, public service, fiscal) to absorb the project-induced effects.

The impact projections of this report are based on actual wind energy development costs and detailed cost estimates of proposed projects. These quantified statistics are then applied to a regional economic model. This model, developed by Wilbur Maki of Wilbur Maki Associates (WMA), provides a tool that can be used to fully evaluate regional policies. The model captures the detail of the economy (i.e., 53 sectors, 25 types of demand, 94 occupations, and 202 age/sex cohorts) as well as key interrelationships within the economy(19).

The original reasoning for this analysis was that a wide range of options existed in Southwest Minnesota as to the value of developing the wind resource, Some felt it was the salvation of Southwest Minnesota and others felt that it was a potential drain on the local economy. The truth likely lies somewhere in between and this analysis seeks to quantify the impacts. As part of that analysis, it was determined that it would be valuable to understand how impacts to the local economy might be affected by local versus outside ownership structures. The intent is to offer state and local policymakers a reference of complete economic data and analytical tools to assist them in the difficult task of designing well-reasoned wind energy development policies. This study is not meant to provide the means to predict but to help understand the implications for developing the wind energy resource in Southwest Minnesota.

II. Impact Areas

The development areas of windpower, according to available wind monitoring data, indicate the primary wind resource area in Minnesota occurs on the Buffalo Ridge in Southwestern Minnesota. In the Southwest corner of Minnesota, there is approximately 1260 square miles of land area with 7 m/s wind speed average at 46 meters as shown in Figure 2. 1. Table 2-1 identifies the land requirements for Phases I, II and III of the NSP mandate. It also defines the total development land mass for actual usable land for development.

Table 2-1

Land Used For 25 MW Kenetech Project and Land Required For a 100 MW Windfarm

Kenetech 25 MW Project

Total acres - 2800
Average width - 1.1 miles
Length - 4 miles
Project total land use - 4.4 sq. miles
Actual acres used for pads and roads - 20.5 acres. * Does not include land used for NSP substation.

According to the site boundary maps produced by NSP for Phase II and Phase III (Figure 2.2), the site boundaries are as follows:

Phase II Northern Site

Total acres - 19,168
Average width - 2.85 miles
Length - 10.5 miles
Project total land use - 30 sq. miles
Actual acres used for pads and roads are estimated to be 70 acres

Phase III Southern Site

Total acres - 13,750
Average width - 2.5 miles
Length - 8.5 miles
Project total land use - 21.25 sq. miles
Actual acres used for pads and roads are estimated to be 60 acres

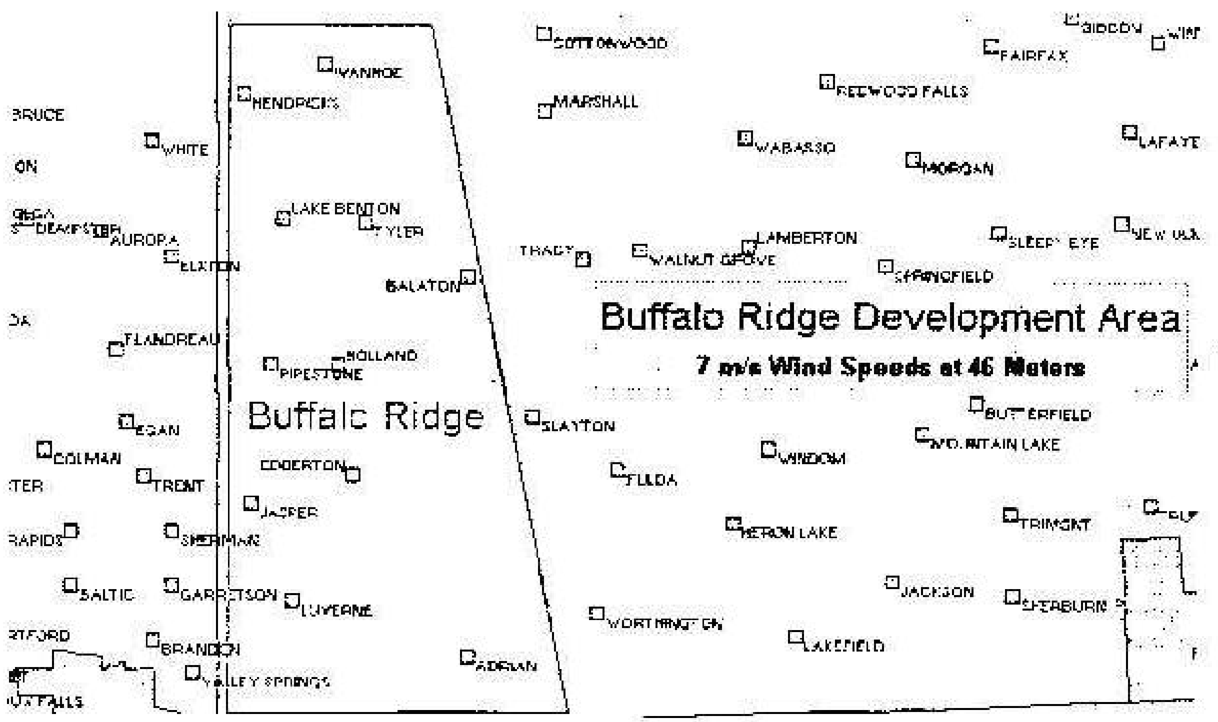
In the southwest corner of Minnesota there are approximately 1260 sq. miles of land area with 7 m/s wind speed average at 46 meters.

1260 total sq. miles
-75% low lands, roads, farms, towns
315 sq. miles of actual usable wind land

Development Areas

Assuming an average of 28 sq. miles of land required to develop 100 megawatts, southwestern Minnesota could physically accommodate 1100 megawatts of wind power development. The constraining factor to this level of development of large 100 megawatt projects in the impact area of the study, is the availability of adequate transmission.

Figure 2.1



Buffalo Ridge Development Area consists of two sites along Buffalo Ridge. The first site is identified as being northwest of the city of Lake Benton and the other southeast of town as shown in Figure 2.2. As shown in Table 2.1 the northwest site has a total of 19,168 acres in contrast to the southern site which has a total of 13,750 acres. This difference, even though both projects are scheduled to be 100 megawatts, is caused by the complexity of the terrain in the northern site which requires the turbine spacing to be greater and more widespread. As the developments move southeastward the total land requirements will probably decrease as the ridge flattens out.

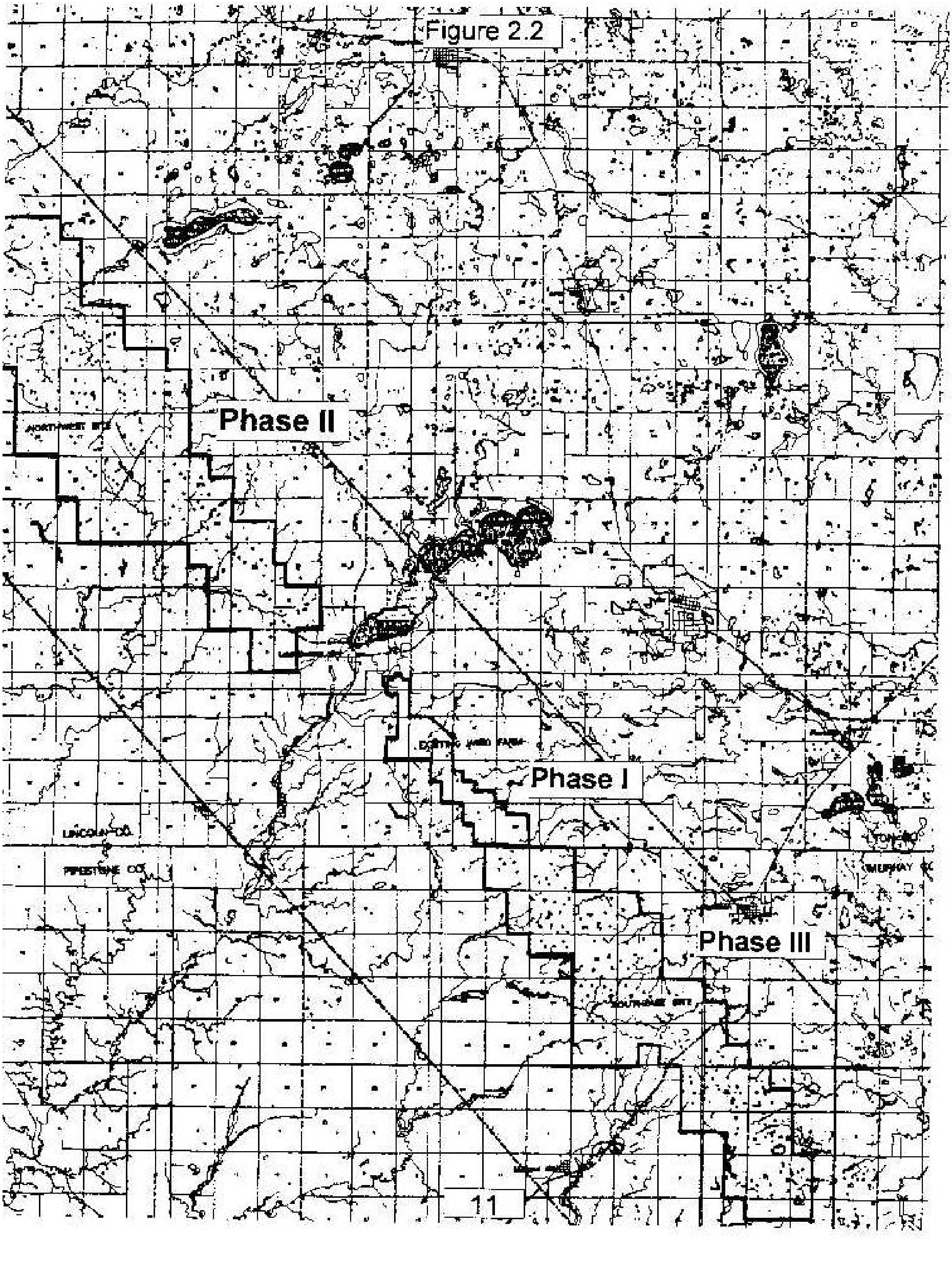
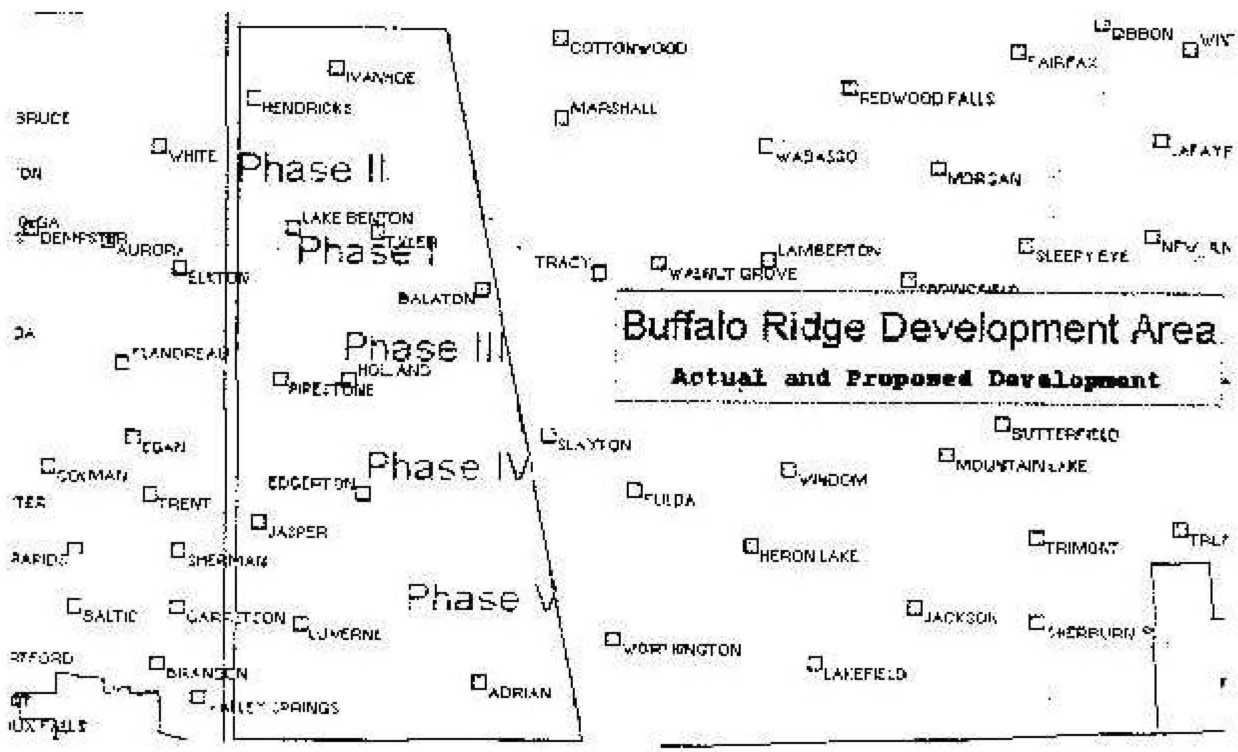


Figure 2.2
Phase II
Phase I
Phase III
LINCOLN CO.
PIPESTONE CO.
11

The amount of electricity that a windfarm produces is not so much site-dependent as it is turbine hub height dependent. A slightly lower elevation can be compensated for by a taller tower to keep the turbines rotor in the better wind resource for electric generation. The southeast site is in Pipestone County, The two sites tendered are similar in many ways. Estimates of capital cost are similar. Land use patterns and the potential for environmental impacts are not significantly different. The boundaries of the two sites tendered were established based on the examination of a number of possible layouts and sizes of turbines. All the proposed sites are approximately identified according to the phase of construction in Figure 2.3.

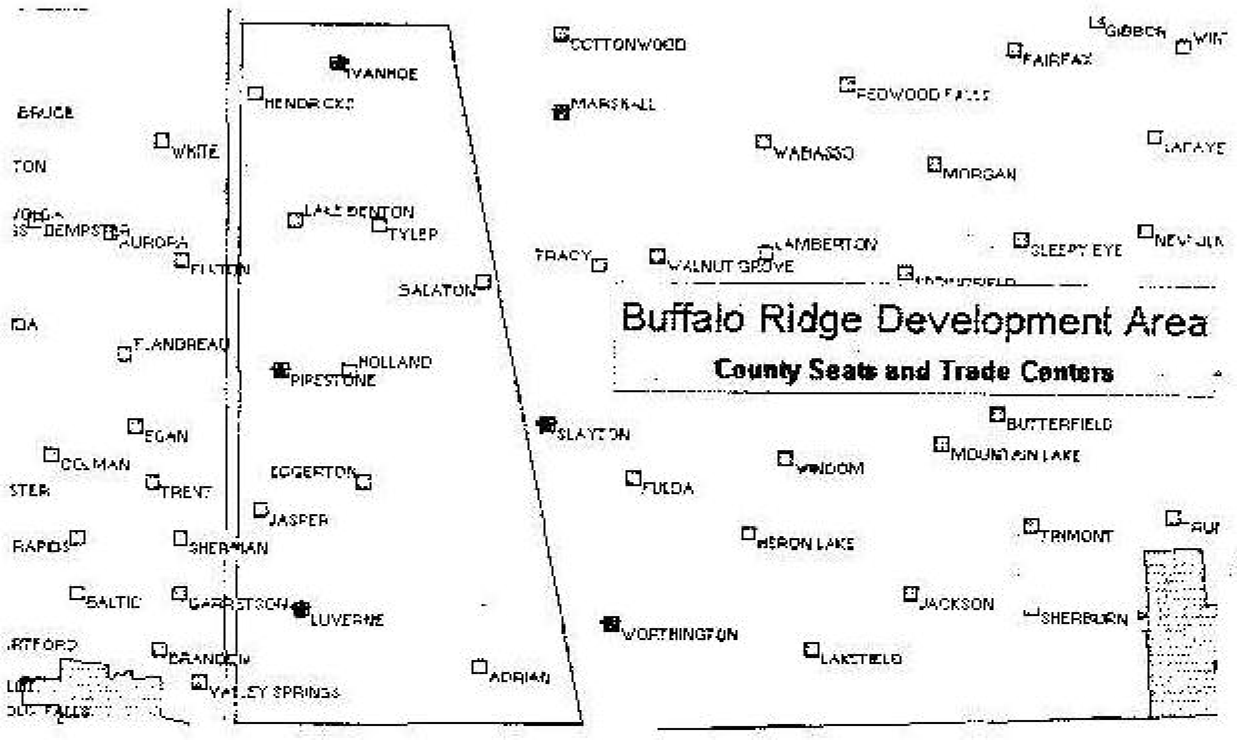
Figure 2.3



Trade Areas

Lincoln County has a population according to the 1990 census figures, of 6,872 residents. Lincoln County has an approximate land area of 334,365 acres. Ivanhoe is the county seat and is located approximately 14 miles north of Lake Benton along U.S. Highway 75 and Minnesota State Highway 19. The major trade areas of Lincoln County are Ivanhoe, Lake Benton, Tyler and Hendricks. Lake Benton is the closest city to Phases I, II, and III. Lake Benton has a population of, 693. Tyler is also near these developments and has a population of 1,257[6].

Figure 2.4



As shown in Figure 2-4, the nearest locations that could provide additional services, such as shopping, entertainment, and larger eating establishments would be Pipestone or Marshall. Pipestone is 18 miles south of Lake Benton on U.S. Highway 75 while Marshall is located approximately 40 miles to the northeast of Lake Benton. While Pipestone, which has a smaller population, is closer in miles to the site locations, Marshall, with a larger trade center, would provide the widest selection of goods and services.

Lyon County is home to 24,789 residents according to the 1990 census figures. The land area of Lyon County is approximately 709 square miles. Marshall, with a population of 12,026, is the county seat for Lyon county and is the largest trade center in Southwest Minnesota. Marshall is located at the crossroads of five highways and serves as a major industrial and retail center for its surrounding communities.

Pipestone County is located immediately south of Lincoln County and has a population of 10,473, according to the 1990 census figures. 296,887 acres make up Pipestone County. Located along U.S. Highway's 75 and 23 and State Highway 30, Pipestone is the county seat, and has a population of 4,774. The next largest community offering a broader choice, in almost every area, would be Marshall, located 45 miles to the northeast of Pipestone along U.S. Highway 23. Ruthton and Edgerton would be the other lesser trade areas in Pipestone County.

Directly to the east of Pipestone County is Murray County. Murray County has it's county seat located in Slayton which sits along U.S. Highway 59 and State Highway 30, approximately 30 miles east of Pipestone. Slayton with a population of 2,147 residents, has a sizable retail trade, but does not have the industrial base that the larger surrounding communities possess. Marshall and Worthington would be the larger communities closest to Slayton that would offer a wider array of opportunities, goods and services. The other trade cities in Murray County are considerably smaller localities. Worthington, the county seat of Nobles County, which has a population of 9,977, is one of the major trade areas of the very southern part of Minnesota. It supports a wide variety of goods and services which could accommodate the needs of wind farm development.

To the south of Pipestone County is Rock County. Luverne is the county seat and has a population of 4,568 residents. Luverne is south of Pipestone by approximately 25 miles, It is located very near Interstate 90 and finds itself seated on U.S. Highway 75. Luverne is approximately 30 miles east of Sioux Falls, South Dakota. The other trade cities in Rock County are all, once again, considerably smaller localities.

Labor Areas

The labor force for the wind development Phases I through IV would be from the cities in the counties discussed above. It can be expected that a significant portion of these jobs will be filled by experienced workers from the windpower industry relocating to southwest Minnesota. The wind technician program at the Jackson Technical College located in Jackson, MN will be providing training for local residents to access opportunities in the wind industry.

For the purpose of this analysis, the trade center boundaries are defined by the county lines of the affected counties discussed above. These boundaries will also be used for the development of the regional economic modeling assessment.

III. Evaluation of 25 MW Kenetech Project

Kenetech Windpower's Buffalo Ridge Windplant project is a 25 megawatt (MW), independent power plant comprised of 73-350 kilowatt (KW) wind turbines. Sited near the town of Lake Benton, in Lincoln County, Minnesota, the windplant produces power for sale to Northern States Power Company (NSP) under a long-term contract. This 25 MW windplant is Phase I of NSP's commitment to install 425 MW of wind generated electricity by the year 2002. Phase I shows higher than usual construction costs as it was built during the harsh winter months which makes construction difficult and expensive. The project's first turbines came on-line in March and were fully commissioned in May of 1994. This project is owned by a limited partnership which includes LG&E Energy Corporation, Allstate Project Finance, and Nations Financial Capital Corporation. The project is operated and maintained by Kenetech Windpower, Inc. On May 30th, 1996, Kenetech Windpower filed Chapter 11 under the bankruptcy code. In their previous 10K filing to the Securities Exchange Commission, they wrote off a $248 million loss for fiscal year 1995 which included a $141.4 million write-off relating to the capitalized engineering cost and future liabilities for warrantee obligations, for problems associated with the 33M-VS wind turbine. It is not totally clear, at this point, who will be responsible for the operations and maintenance or the represented warrantees to ensure the ongoing operation of the facility.

Table 3-1

Expenditure Parameters for Phase I

(1) Total Project Costs	$27,000,000
(2) Land Easement Costs	$1,500,000
(3) Employment Costs During Construction*	$1,204,500
(4) Local Expenditures on Materials**	$447,000
(5) Local Expenditures on Goods and Services**	$280,000
(6) Annual Revenues Generated by the Facility***	$3,250,000
(7) Annual Property Taxes Payable	0
(8) # of O&M Personnel ****	5
(9) Project O&M $'s/year to Local Economy	$197,500
(10) Transmission Expansion Costs	$2,600,000

Total Annual Do1lars to Local Economy

Year 0- 1	2+3+4+5	$3,431,500
Years 1-25	9	$197,500

*Table 3-2

**Table 3-4

***Revenues have been calculated estimating annual production of 62.5 Mwh at S.052 / Kwh. Kenetech nor NSP would give actual figures

****O&M costs derived from Table 3-4

The project encompasses approximately 2800 acres of privately owned land which was secured by NSP under easement. NSP has estimated the cost of land easements for Phase I to be $1.5 million. Under the easement arrangement, the land owner compensation was $5,000 per turbine, $1,200 per acre for facility strip, and $450 per acre for buffer zone. Table 3-1 is a complete overview of the expenditure parameters for Phase I. This table provides all economic factors that have relevant impact on the local economy, not only during the construction phase, but also the ongoing operations and maintenance phase of the project. The total project cost is estimated to be $27 million. Actual figures from Kenetech were not obtainable.

Table 3-2

Kenetech 25 MW Windfarm
Estimated Cost of Labor

Job Types	# of Workers	Hours on the Job	Total Man/Hr	Ave Wage	Total wages Per Class
Electricians	10	1500	15000	$15.50	$232,500
Elec. Labor	6	1500	9000	$8.50	$76,500
Backhoe Operators	4	600	2400	$15.00	$36,000
Crane Operators	2	1500	3000	$18.00	$54,000
Tower Erectors	12	1500	18000	$13.50	$243,000
On-site Supervisors	3	1500	4500	$25.00	$112,500
Site Manager	1	1500	1500	$32.00	$48,000
Civil Engineer	1	1500	1500	$30.00	$45,000
Secretary	1	1000	1000	$8.00	$8,000
Foundation Crew	20	900	18000	$12.00	$216,000
Road Contractors	6	400	2400	$12.00	$28,800
HV Electricians	4	400	1600	$25.00	$40,000
Commissioners	8	400	3200	$18.50	$59,200
Met Tower Crew	4	100	400	$12.50	$5,000
	82				$1,204,500

As shown in Table 3-2, employment construction costs for Phase I are identified by job type that yield a total labor cost of $1,204,500. The information for the labor cost breakdown was generated by interviews with people who worked on the project from the beginning and discussions with subcontractors who performed various tasks to complete the project. The last three categories of this table are defined as high voltage electricians, who basically install the high voltage distribution system of the wind farm; commissioners, are the people who actually put the turbines on line and debug the turbines after initial installation; and the met tower crew, installs all of the meteorological equipment such as anemometers and data loggers which provide the wind farm with the required wind resource information,

One primary concern with windfarm development in Southwest Minnesota is how many of the dollars spent on the development of wind projects actually stay in the area communities during the construction phase. The information on the disbursement of these dollars was compiled by personal interviews with local community economic development officials, suppliers of construction materials, and goods and service providers.

Table 3-3

Local Expenditures on Construction Materials and Supplies for Phase I

Lumber and Building Materials	$20,000
Concrete	$400,000
Metal Fabrication	$7,000
Hardware and Supplies	$20,000
	$447,000

Local Expenditures on Goods and Services for Phase I

Gasoline/Diesel Fuel	$40,000
Propane Gas	$20,000
Food and Meals	$70,000
Lodging	$150,000
	$280,000

Table 3-3 illustrates a listing of the expenditures of construction materials of goods and services for Phase 1. Most of the dollars expended in these categories during the construction phase were spent in and around the Lake Benton and Tyler communities with the exception of lodging, and some food, which were expended mainly in the Pipestone area due to the presence of adequate facilities to service these needs. In general, a few people in the Lake Benton area indicated they had a good short-term increase in business but a few indicated they had been a bit disappointed as they expected more.

Another important economic impact to the local economy is the ongoing Operations and Maintenance (O&M) Expenditures on the project. Table 3-4 lists the associated costs for personnel and equipment for a 25 MW project. The information for the Operations and Maintenance figures for this report was compiled from interviews with windfarm operators in California and Minnesota who have been, and are presently involved in, these types of activities. Also in Table 34, the actual dollars to the local economy are shown. This category shows how many dollars actually filter into the local economy as opposed to the total Operations and Maintenance costs for such a project.

Table 3-4
Annual Operations and Maintenance Costs for Phase I

Position/Item	Number	Annual Cost to Project	Expected $'s to Local Economy
Wind Technician I*	2	$65,000	$52,000
Wind Technician II**	2	$96,000	$77,000
Site Manager ***	1	$55,000	$44,000
Maintenance Building	1	$18,000	$1,500
Service Trucks	2	$16,000	$1,000
Boomtruck	1	$30,000	$2,500
Insurances		$10,000	$1,500
Fuel	4000 gals.	$5,000	$5,000
Tools and Misc. Supplies		$12,000	$12,000
Spare Parts Inventory		$100,000	$1,000
		$407,000	**$197,500**

*Includes wage @ $12.50/hr plus all payroll taxes ie: Workmans comp, unemployment, etc.
**Includes wage @ $18.50/hr plus all payroll taxes ie: Workmans comp, unemployment, etc,
***Includes wage @ $21.00/hr plus all payroll taxes ie: Workmans comp, unemployment, etc.

IV. Installed Cost of Wind Power Capacity

Numerous federal and state programs and policies have contributed to the current status in future plans of commercial wind development in this region. Wind power development in southwest Minnesota is being driven by public policy through legislative mandate. This mandate does not rely on the economic competitiveness of wind power for the selection of the technology. However the declining cost of wind generated electrical power likely made such a mandate politically feasible.

One of the reasons windpower is being recognized and utilized as a serious energy resource is the maturity of the technology and windpower's cost competitiveness. This statement is based on the European technology, which over the last few years, has shown an impressive track record of reliability and performance. This track record is documented and detailed in Windpower Monthly's "Wind Stats"[18], which is a quarterly publication that provides operational data on wind power generation in Europe and America. In southwest Minnesota the industry has yet to prove itself since the projects that are on line in this region to date consist of older first generation machinery (Marshall Municipal Project--5 turbines built in 1985) and machines that were prematurely brought to commercial operation before they were completely tested for design defects which inherently cause unreliability and poor performance, and ultimately the failure of a company (Kenetech Phase I). The industry has more than a decade of experience and over 3100 MW of capacity installed worldwide[2]. According to the U.S. Department of Energy and the American Wind Energy Association, since the first commercial wind facilities were installed in California in the early 1980's the windpower industry has produced steady and impressive gains in cost productivity [15].

- Capital costs have declined from $3000/KW to between $900-1000/KW.
- Reliability has improved from around 60% to more than 98%.
- Operating costs have declined from $.05/Kwh to less than $.01.
- The cost of producing electricity from wind has fallen from $.35/Kwh to between $.05 and $.07 depending on site and financing (with or without federal $.015)

Table 4-1 shows the breakdown of all relative costs in the development of a windpower project. For analysis in this report 600 KW turbines were chosen. This size of machine is in the middle of 500-700 KW class of machines that are commercially available from several experienced manufacturers and have long track records of successful operation. This table is divided into 3 basic categories. The first is for a single 600 KW turbine which would be utilized by a farmer or small business person involved in disbursed wind generation. The second category describes a 10 MW project which could be undertaken by a group of farmers forming a partnership or a cooperative and small wind developers. The 10 MW project utilizes 17-600 KW machines. The third category is a breakdown for a 100 MW project utilizing 166-600 KW turbines. These are calculated in 1995 dollars.

The cost figures in Table 4-1 were compiled from actual installation costs of turbines in the Midwest and information obtained from windfarm developers in California and Europe. These project costs reflect both hard and soft costs required to complete a wind project to it's relevant size.

Table 4-1

Project Costs Utilizing 600 KW Turbines

	600 Kilowatt 1 Turbine	**% of Total**	**10 Megawatt 17 Turbines**	**% of Total**	**100 Megawatt 166 Turbines**	**% of Total**
Concrete	$9,000	1.52%	$150,000	1.47%	$1,300,000	1.32%
Rebar	$5,000	0.84%	$77,000	0.75%	$664,000	0.68%
Backhoe	$1,250	0.21%	$17,000	0.17%	$120,000	0.12%
Tower Imbed/Bolts	$8,000	1.35%	$128,000	1.25%	$1,250,000	1.27%
Foundation Labor	$3,000	0.51%	$50,000	0.49%	$500,000	0.51%
Crane	$10,000	1.68%	$150,000	1.47%	$1,250,000	1.27%
Support Crane	$1,000	0.17%	$17,000	0.17%	$125,000	0.13%
Transformer	$8,500	1.43%	$145,000	1.42%	$1,250,000	1.27%
Erection Labor	$3,000	0.51%	$50,000	0.49%	$500,000	0.51%
Drop Cable	$250	0.04%	$8,000	0.08%	$66,000	0.07%
Electrical Labor	$3,750	0.63%	$55,000	0.54%	$550,000	0.56%
Wire	$3,750	0.63%	$60,000	0.59%	$500,000	0.51%
Roads and Site Prep	$2,250	0.38%	$35,000	0.34%	$330,000	0.34%
QC Supervision	$2,500	0.42%	$30,000	0.29%	$250,000	0.25%
HV Line Extension	$8,000	1.35%	$125,000	1.22%	$900,000	0.92%
Construction Total	**$69,250**	11.66%	**$1,097,000**	10.75%	**$9,555,000**	9.73%
HV Sub/Intercon	$6,000	1.01%	$400,000	3.92%	$3,100,000	3.16%
Turbines/600 KW	$445,000	74.92%	$7,325,000	71.76%	$68,890,000	70.12%
Towers - 50m	$70,000	11.78%	$1,150,000	11.27%	$10,800,000	10.99%
Land Easements	$1,000	0.17%	$180,000	1.76%	$5,000,000	5.09%
Site Certificate	$1,500	0.25%	$29,000	0.28%	$250,000	0.25%
Bid Process/PPA	$1,250	0.21%	$27,000	0.26%	$650,000	0.66%
Project Total	**$594,000**	100.0%	**$10,208,000**	100.0%	**$98,245,000**	100.0%

Table 4-2 lists the labor hours required for the installation of 600 KW wind turbine. These numbers are based on actual experiences of wind turbine manufacturers and developers for the installation of the foundation and erection of a turbine in the 500 KW to 700 KW class. These numbers are used later in the calculation for labor costs for disbursed generation and large windfarm installations.

Table 4-2

Erection and Foundation Labor Requirements for a 600 KW Wind Turbine Installation

Description Of The Work	**Hours**
Organizing the Site	4
Unloading the Equipment	10
Preparation of Tools, Etc.	5
Assembly of the Rotor	12
Mounting of the Nacelle	2
Mounting of the Tower	9
Erection of Tower	5
Craneing of Nacelle	10
Craneing of Rotor	12
Tightening of the bolts	20
Dropping Cables	32
Electrical Installation	10
Preliminary Test Run	6
Cleaning	3
Torque of Bolts	14
Various	6
Total Labor Hours for Erection	**160**

Foundation Labor Requirements for a 600 KW Wind Turbine

Description of Work	**Hours**
Organize Site	4
Lay-Out	4
Excavation	10
Unload Steel	4
Set Rebar	60
Set-Up Forms	30
Set Anchor Bolts	24
Pour Concrete	16
Remove Forms	4
Backfill	4

Total Foundation Labor Hours	**160**

V. Phase II and III

This section of the study discusses Phase II and III, each of which are 100 MW projects. Along with the 25 N4W Phase I, the total of these projects will constitute 225 MW of the 425 MW required by legislation.

NSP is in the process of securing wind development rights from land owners on the Buffalo Ridge for these two phases. Three parties, (NSP, Zond, and Kenetech) have secured development rights over the significant portion of both the Northwest site which will accommodate Phase II and the Southeast site which will be used for Phase III[5] (see Figure 2.2). In light of the recent Kenetech bankruptcy filing, NSP and Kenetech have agreed to a settlement which will transfer all of Kenetechs' land options in three southwest Minnesota counties, earmarked for Phase II and Phase III, to NSP. The effect on the site selection process, if any, of the pattern and extent of development rights ownership by third parties, likely will be examined by the Minnesota Environmental Quality Board.

NSP will contract to purchase all of the electrical energy produced by both of these 100 MW projects. Ownership, construction and operation responsibilities have been determined for Phase II through the competitive bid process. In the Request For Proposal (RFP) process, an independent evaluator recommended NSP select Zond Minnesota Development Corporation II which is a developmental subsidiary of Zond Systems, Inc. based in Tehachapi, California, to supply the first 100 MW of wind energy to the NSP system by the end of 1996[10]. According to the RFP, construction for this project was to begin in late Fall of 1995, but due to legal problems encountered in land acquisition and inability for NSP and Zond to reach an agreement on the power purchase contract, construction on the project has not yet been started as of August 1996. The final contract between NSP and Zond must be approved by the Minnesota Public Utilities Commission before Zond can move forward.

For Phase II, Zond Systems proposes to construct the turbines and associated facilities in the site designated by the Minnesota Environmental Quality Board [4]. This area is located just to the Northwest of Lake Benton in Lincoln County (see Figure (2.2). This site encompasses a total of 19,168 acres of privately owned land which is being secured under easement by NSP (see figure 2.3). NSP has estimated the cost of land easements for Phase II to be $5 million. Under the easement arrangement, the land owner compensation was $5,000 per turbine, $1,200 per acre for facility strip, and $450 per acre for buffer zone. The turbines are to be arranged in strings where there will be approximately 550 feet or more between turbines. Strings will generally be 1,600 feet or more apart to minimize interference and turbulence during operation. Service roads will be constructed along the strings to provide access to construction and maintenance vehicles. Approximately 70 acres will be taken out of agriculture production. An operations and maintenance facility will be either constructed or leased in the Lake Benton area.

NSP has designated an area just to the Southeast of the existing Kenetech site as the proposed development site for Phase III (see Figure 2.2). This site encompasses a total of

13,750 acres of privately owned land which is being secured under easement by NSP (see figure 2.3). The Request For Proposals for Phase III is slated to be out during the 3rd or 4th quarter of 1996 pending approval by the proper overseeing entities. NSP has estimated the cost of land easements for Phase III to be $5.1 million[3]. Under the easement arrangement, the land owner compensation is to be $5,000 per turbine, $1,200 per acre for facility strip, and $450 per acre for buffer zone. Phase III is scheduled to be completed by the end of 1998.

Table 5-1 is a complete overview of the expenditure parameters for Phase II and Phase III. This table provides the economic factors that have relevant impact on the local economy, not only during the construction phase, but also during the ongoing operations and maintenance of the project. All economic analysis for the 100 MW facilities in this report are done assuming a turbine size of 600 KW (166-600 KW = 99.6 MW). This assumption was made to keep the projects linear in comparison. It has been announced that Zond will be utilizing a turbine in the 600 to 700 KW class for Phase II.

Table 5-1
Economic Parameters for Phase II and Phase III (200 Megawatts)

		Phase II 1996	**Phase III 1998**
(1) Total Project Cost*		$98,245,000	$102,065,000
(2) Annual Revenues Generated by the Facility **			
Years 1-10		$15,720,000	$16,244,000
Years 10-30		$7,860,000	$9,170,000
(3) Total Construction Costs*		$9,555,000	$11,452,100
(4) Transmission Expansion Costs*		$4,000,000	$6,600,000
(5) Land Easement Costs *		$5,000,000.00	$5,100,000.00
(6) Local Expenditures on Materials***		$1,442,000	$1,495,000
(7) Local Expenditures on Goods and Services***		$857,000	$892,000
(8) Employment Costs During Construction****		$2,398,400	$2,705,200
(9) Annual Property Taxes (a) Years 1-5 *****		$208,592	$231,657
(b) Years 6-11 *****		$379,035	$452,284
(c) Years 11-30 *****		$331,655	$357,155
(10) Project O&M $/Year to Local Economy		$404,000	$404,000
(11) Annual Loss of Ag Crop Production		$7,000	$7,000
Dollars to Local Economy per Year			
Year 0-1	(5+6+7+8-11)	$9,690,400	$10,185,200
Years 1-5	(9a+10-11)	$605,592	$628,657
Years 5-11	(9b+10-11)	$776,035	$849,284
Years 11-30	(9c+10-11)	$728,655	$754,155

* Table 5-2
** Revenues have been calculated estimating annual production of 262,000,000 Kwh
Phase II at $.04 levelized over 30 years @ $.06 for years 1-10 and $.03 - 10-30 (NSP IRP)
Phase III at $.044 levelized over 30 years @ $.062 for years 1-10 and $.035 - 10-30 (NSP IRP)
*** Table 5-3

**** Table 5-4
***** Based on property tax laws passed in 1995 - (see Table 8-1)

It should be noted that a capacity factor of 30% is assumed for Phase II and III which is 5% higher than the capacity factor for Phase I as noted in NSP's Integrated Resource Plan(17). This is accomplished by the utilization of higher towers (46 meters vs. 35 meters) and higher reliability of the turbines utilized in Phase II and III. This is based on the performance records of on-line technology which is in operation in similar wind resource conditions in western Europe and limited run time of like technology in northern Iowa. You will note in Table 5-1 that there is a complete breakout of dollars to the local economy. This includes the actual loss of net crop revenues which is estimated to be $100 per acre or $7000. These figures are the base numbers used in the regional economic model to establish the secondary and tertiary impacts of these projects.

Table 5-2 shows the breakdown of relative costs for the development of Phase II and Phase III. As stated before, for the analysis in this report, 600 KW turbines have been chosen. This size machine is in the middle of 500-700 KW class of machines that are commercially available from several experienced manufacturers and have long track records of successful operation. This table identifies the various categories of the construction phase and the soft costs for the two yet to be built 100 MW projects. Costing numbers were compiled by securing estimates from suppliers, subcontractors and wind farm developers for the construction, labor and equipment(16). The estimates for the soft costs (i.e. site certificate and bid process) come from the staff and employees of Minnesota Environmental Quality Board, Northern States Power, and Minnesota Public Utilities Commission.

Table 5-2
Phase II and III Project Costs Utilizing 600 KW turbines

	Phase II	**% of Total**	**Phase III**	**% Of Total**
Concrete	$1,300,000	1.32%	$1,350,000	1.32%
Rebar	$664,000	0.68%	$677,280	0.66%
Backhoe	$120,000	0.12%	$122,500	0.12%
Tower Imbed/Bolts	$1,250,000	1.27%	$1,275,000	1.25%
Foundation Labor	$500,000	0.51%	$510,000	0.50%
Crane	$1,250,000	1.27%	$1,275,000	1.25%
Support Crane	$125,000	0.13%	$127,500	0.12%
Transformer	$1,250,000	1.27%	$1,275,000	1.25%
Erection Labor	$500,000	0.51%	$510,000	0.50%
Drop Cable	$66,000	0.07%	$67,220	0.07%
Electrical Labor	$550,000	0.56%	$561,000	0.55%
Wire	$500,000	0.51%	$510,000	0.50%
Roads and Site Prep	$330,000	0.34%	$336,600	0.33%
QC Supervision	$250,000	0.25%	$255,000	0.25%
HV Line Extension	$900,000	0.92%	$2,600,000	2.55%
Construction total	$9,555,000	9.73%	$11,452,100	11.22%
HV Substation	$3,100,000	3.16%	$4,000,000	3.92%
Turbines/600 KW	$68,890,000	70.12%	$69,578,900	68.17%
Towers-50m	$10,800,000	10.99%	$11,016,000	10.79%
Land Easements	$5,000,000	5.09%	$5,100,000	5.00%

Site Certificate	$250,000	0.25%	$255,000	0.25%
Bid Process/PPA	$650,000	0.66%	$663,000	0.65%
Project Total	**$98,245,000**	**100.00%**	**$102,065,000**	**100.00%**

Table 5-3 illustrates a listing of the expenditures of construction materials and goods and services for Phase II and Phase III expressed in 1996 dollars. For Phase II, most of the dollars expended in these categories during the construction phase should be spent in and around the Lake Benton, Ivanhoe, and Tyler communities (see Figure 2.4). Similar to Phase I, most of the lodging, and some food, probably will be expended in the Pipestone area, and more than likely some in the Marshall area, due to the presence of adequate facilities to service these needs. For Phase III most of the dollars expended in these categories during the construction phase should be spent in and around the Lake Benton, Holland, Ruthton, and Pipestone communities (see Figure 2.4). Most of the lodging and some food will probably be expended in the Pipestone area due to the presence of adequate facilities to service these needs. The information on the expected destination of these dollars was compiled by personal interviews with local community economic development officials, suppliers of construction materials, and goods and service providers in the expected impact areas.

The increased expenditures for Phase III over Phase II is primarily due to the increased labor and construction costs associated with the additional high voltage line extension and transmission requirements projected by Northern States Power.

Table 5-3

Local Expenditures on Construction Materials and Supplies

	Phase II	**Phase III**
Lumber and Building Materials	$75,000	$76,500
Concrete	$1,300,000	$1,350,000
Metal Fabrication	$22,000	$22,500
Hardware and Supplies	$45,000	$46,000
	$1,442,000	**$1,495,000**

Local Expenditures on Goods and Services

Gasoline/Diesel Fuel	$152,000	$155,000
Propane Gas	$45,000	$46,000
Food and Meals	$210,000	$216,000
Lodging	$450,000	$475,000
	$857,000	**$892,000**

As shown in Table 5-4, employment construction costs for Phase II and Phase III are broken down by job types to produce a total labor cost of $2,398,400 for Phase II and $2,705,200 for Phase III. The major difference between the two apparently similar projects, comes from the fact that Phase III requires over $2.5 million in additional high voltage line extension and transmission work. The information for the labor cost breakdown was generated by interviews with wind farm developers who had developed projects of similar nature and discussions with subcontractors who performed various tasks on wind farm construction projects in Minnesota, Europe and California. The local labor cost rates were based on actual wages paid on wind projects completed in this region. Most of the job types are self explanatory with the possible exception of the last three which are high voltage electricians who install transmission and distribution lines, commissioners who program the control systems and put the turbines on-line, and met tower crew which is the crew that installs the metrological data collection towers and loggers.

Table 5-4

Construction Employment Breakdown for Phase II and III

Phase II Job Types	**Number of Workers**	**Hours on the Job**	**Total Man/hrs**	**Average Wage($)**	**Total Wages per Class($)**
Electricians	7	2600	18200	1.7	$309,400
Elec. Labor	4	2600	10400	8.5	$88,400
Backhoe Operators	2	1600	3200	1.5	$48,000
Crane Operators	4	2600	10400	18	$187,200
Tower Erectors	10	2600	26000	14	$364,000
On-site Supervisors	4	2600	10400	25	$260,000
Site Manager	1	2800	2800	32	$89,600
Civil Engineer	1	2700	2700	30	$81,000
Secretary	1	1100	1100	8	$8,800
Foundation Crew	12	2100	25200	12.5	$315,000
Road Contractors	6	700	4200	12	$50,400
HV Electricians	8	2600	20800	25	$520,000
Commissioners	3	1200	3600	18.5	$66,600
Met Tower Crew	2	400	$00	12.5	$10,000
	65				**$2,398,400**

Phase III	**Number of**	**Hours on**	**Total**	**Average**	**Total Wages**
Job Types		**Workers**	**the Job**	**Man/hrs**	**Wage($)**
per Class($)					
Electricians	7	2600	18200	16	$291,200
Elec. Labor	4	2600	10400	8.5	$88,400
Backhoe Operators	2	1600	3200	15	$48,000
Crane Operators	4	2600	10400	18	$187,200
Tower Erectors	10	2600	26000	14	$364,000
On-site Supervisors	4	2600	10400	25	$260,000
Site Manager	1	2800	2800	32	$89,600
Civil Engineer	1	2700	2700	30	$81,000
Secretary	1	1100	1100	8	$8,800
Foundation Crew	12	2100	25200	12.5	$315,000
Road Contractors	6	700	4200	12	$50,400
HV Electricians	13	2600	33800	25	$845,000
Commissioners	3	1200	3600	18.5	$66,600
Met Tower Crew	2	400	800	12.5	$10,000
	70				**$2,706,200**

The ongoing operations and maintenance of large projects like Phase II and III will have a long term economic effect on the local trade area economy closest to were the project is

physically located as discussed in section II of this report. Table 5-5 lists the associated costs for personnel and equipment for a 100 megawatt wind farm project. The information for the operations and maintenance figures for this report were compiled from interviews with windfarm operators in California and Minnesota who have been and are presently involved in these types of activities. The expected dollars entering the local economy is shown in Table 5-5. This category shows how many dollars may filter into the local economy as opposed to the total operations and maintenance costs for such a project.

Table

Annual Operations and Maintenance Costs for 100 Megawatt Wind Farm

Position/Item	**#**	**Annual Cost to Project**	**Expected $'s to Local Economy**
Wind Technician I	4	$130,000 *	$104,000
Wind Technician II	4	$190,000 **	$154,000
Secretary	1	$15,000	$12,500
Site Manager	1	$65,000 ***	$54,000
Maintenance Building	1	$25,000	$2,500
Service Trucks	4	$25,000	$2,500
Boomtruck	1	$50,000	$2,500
Site Road Maintenance		$25,000	$10,000
HV Electrical Maintenance		$40,000	$2,000
Insurances		$40,000	$5,000
Fuel	8000 gals.	$10,000	$10,000
Tools and Misc. Supplies		$40,000	$40,000
Spare Parts Inventory		$250,000	$5,000
		$905,000	**$404,000**

*Includes wage @$12.50/hr plus all payroll taxes ie: Workmans comp, unemployment, etc.
**Includes wage @$18.50/hr plus all payroll taxes ie: Workmans comp, unemployment, etc.
***Includes wage @ $26.00/hr plus all payroll taxes ie: Workmans comp, unemployment, etc.

VI. Phase IV and V

This section of the study discusses Phases IV and V of the NSP mandate each of which are slated to be 100 MW projects. Along with the total 225 MW from Phases I, II, and III, all five Phases will constitute the 425 MW required by legislation under the Prairie Island mandate.

NSP is not sure as to where Phases IV and V actually will be located. For the basis of this study, it is assumed that these last two phases will be located on the Southeastern end of the Buffalo Ridge in Southwest Minnesota (see Figure 2.2). If the present method of operation persists, NSP will secure land development rights over a significant portion Nobles and Murray counties which will accommodate the development of Phase IV and Phase V. Sites selected by NSP will have to be examined and approved by the Minnesota Environmental Quality Board.

Table 6-1

Economic Parameters for Phase IV and Phase V (200 Megawatts)

		Phase IV	**Phase V**
(1) Total Project Cost*		$118,247,000	$118,533,700
(2) Annual Revenues Generated by the Facility **			
Years 1-10		$18,340,000	$19,126,000
Years 10-30		$10,480,000	$12,052,000
(3) Total Construction Costs*		$19,287,000	$19,463,700
(4) Transmission/Substation Expansion Costs* $21,200,000		$21,200,000	
(5) Land Easement Costs *		$5,100,000	$5,100,000
(6) Local Expenditures on Materials***		$1,548,000	$1,575,000
(7) Local Expenditures on Goods and Services***		$1,100,000	$1,100,000
(8) Employment Costs During Construction****		$3,784,100	$4,074,900
(9) Annual Property Taxes (a) Years 1-5*****		$183,640	$180,104
(b) Years 6-11*****		$334,221	$335,070
(c) Years 11-30*****		$292,443	$293,187
(10) Project O&M $'s/Year to Local Economy*****		$404,000	$404,000
(11) Annual Loss of Ag Crop Production		$7,000	$7,000
Dollars to Local Economy Per Year			
Year 0-1	(5+6+7+8-11)	$10,425,122	$10,742,922
Years 1-5	(9a+10-11)	$580,640	$577,104
Years 5-11	(9b+10-11)	$731,221	$732,070
Years 11-30	(9c+10-11)	$689,443	$690,187

*Table 6-2

**Revenues have been calculated estimating annual production of 262,000,000 Kwh

Phase IV at $.05 levelized over 30 years @ $.07 for years 1-10 and $.04 - 10-30 (NSP IRP)
Phase V at $.055 levelized over 30 years @ $.073 for years 1-10 and $.046 - 10-30 (NSP IRP)
***Table 6-3
****Table 6A
*****Based on property tax Wm passed in 1995 - (see Table 8-1)
******Table 6-5

NSP probably will contract to purchase all of the electrical energy produced by both of these 100 megawatt projects, as in the previous phases. Also, as before, ownership, construction, and operation responsibilities will be determined through the competitive bid process. Table 6-1 is a complete overview of the expected expenditure parameters for Phase IV and Phase V. This table provides the economic factors that will have an impact on the local economy not only during the construction phase, but also the ongoing operations and maintenance phase of the projects. Economic analysis for the 100 megawatt facilities within this report are done assuming a turbine size of 600 KW. This assumption was made to keep all of the projects linear in comparison. It should be noted that a capacity factor of 30% is assumed for Phase IV and V, which is the same capacity factor for Phase II and III. This was accomplished by the utilization of higher towers (60 meters vs. 50 meters), which according to wind shear figures accumulated by Minnesota Department of Public Service (MnDPS) and private developers will keep the hub height of the turbines in the approximately same wind resource. Table 6-1 shows a complete breakout of dollars anticipated to impact the local economy. This includes the net loss from croplands of $117 per acre or $7000 which is slightly higher than Phases II and III due to higher land productivity. These figures are the base numbers to be used in the regional economic model to establish the secondary and tertiary impacts of these projects.

Table 6-2

Phase IV & Phase V Project Costs Utilizing 600 KW Turbines

	Phase IV	**% Of Total**	**Phase V**	**% of Total**
Concrete	$1,350,000	1.25%	$1,375,000	1.27%
Rebar	$700,000	0.65%	$714,000	0.66%
Backhoe	$125,000	0.12%	$127,500	0.12%
Tower Imbed/Bolts	$1,300,000	1.20%	$1,326,000	1.22%
Foundation Labor	$520,000	0.48%	$530,400	0.49%
Crane	$1,250,000	1.16%	$1,275,000	1.18%
Support Crane	$130,000	0.12%	$132,500	0.12%
Transformer	$1,275,000	1.18%	$1,300,500	1.20%
Erection Labor	$520,000	0.48%	$530,400	0.49%
Drop Cable	$68,000	0.06%	$69,000	0.06%
Electrical Labor	$570,000	0.53%	$581,400	0.54%
Wire	$679,000	0.63%	$690,000	0.64%
Roads and Site Prep	$340,000	0.31%	$346,800	0.32%
QC Supervision	$260,000	0.24%	$265,200	0.24%
HV Line Extension	$10,200,000	9.44%	$10,200,000	9.42%
Construction Total	$9,087,000	8.41%	$9,263,700	8.55%
HV Substation	$11,000,000	10.18%	$11,000,000	10.15%

Turbines/600 KW	$69,750,000	64.56%	$69,750,000	64.38%
Towers - 60m	$12,100,000	11.20%	$12,210,000	11.27%
Land Easements	$5,200,000	4.81%	$5,200,000	4.80%
Site Certificate	$260,000	0.24%	$260,000	0.24%
Bid Process/PPA	$650,000	0.60%	$650,000	0.60%
Project Total	**$108,047,000**	100.0%	**$108,333,700**	100.0%

Table 6-2 shows the breakdown of all relative costs for the development of Phase IV and Phase V. As stated before, for the analysis in this report, 600 KW turbines have been chosen. This size machine is in the middle of 500-700 KW class of machines that are commercially available from several experienced manufacturers and have long track records of successful operation. This table identifies the various categories of the construction phase and the soft costs for the two, yet to be built, 100 megawatt projects. Costing numbers for this table have been compiled through securing estimates from suppliers, subcontractors and wind farm developers for the construction, labor, and equipment. These estimates for the soft costs come from the staff and employees of Minnesota Environmental Quality Board, Northern States Power, and Minnesota Public Utilities Commission.

Table 6-3 illustrates a listing of the expected expenditures for construction materials and goods and services for Phase IV and Phase V. Most of the dollars expended in these categories during the construction phase should be spent in and around the Pipestone, Slayton, Luverne, and Worthington communities (see Figure 2.4). These communities have adequate facilities to service these needs. The information on the expected destination of these dollars was compiled by personal interviews with local community economic development officials, suppliers of construction materials, and goods and service providers in the expected impact areas.

The increased expenditures for Phases IV and V over Phase III is due primarily to the increased labor and construction costs associated with the additional high voltage line extension and transmission requirements projected by Northern States Power. The major difference between these 100 megawatt projects and the apparently similar 100 megawatt projects of Phase 11 and Phase III are that Phases IV and V require $21.2 million each in additional high voltage line extension and transmission work. These extension figures come from discussions with NSP staff and their 1996-2010 Integrated Resource Plan.

Table 6-3

Local Expenditures on Construction Materials and Supplies

	Phase IV	**Phase V**
Lumber and Building Materials	$85,000	$85,000
Concrete	$1,350,000	$1,375,000
Metal Fabrication	$29,000	$30,000
Hardware and Supplies	$84,000	$85,000
	$1,548,000	**$1,575,000**

Local Expenditures on Goods and Services

Gasoline/Diesel Fuel	$200,000	$200,000
Propane Gas	$50,000	$50,000
Food and Meals	$250,000	$250,000
Lodging	$600,000	$600,000
	$1,100,000	**$1,100,000**

As shown in Table 6-4, employment construction costs for Phase IV and Phase V are identified by job type to produce a total labor cost of $3,784,100 for Phase IV and $4,074,900 for Phase V. The information for the labor cost breakdown was generated by interviews with wind farm developers who have developed projects of similar nature and discussions with subcontractors who performed various tasks on wind farm construction projects in Minnesota, Europe and California. The local labor cost rates were based on actual wages paid on wind projects completed in this region.

Table 6-4
Construction Employment Breakdown for Phase IV and V

Phase IV Job Types	**Number of Workers**	**Hours on the Job**	**Total Man/hrs**	**Average Wage ($)**	**Total Wages per Class ($)**
Electricians	7	2600	18200	16.5	$300,300
Elec. Labor	3	2600	7800	9	$70,200
Backhoe Operators	4	1600	6400	15.5	$99,200
Crane Operators	5	2600	13000	18.5	$240,500
Tower Erector's	10	2600	26000	14.5	$377,000
On-Site Supervisors	6	2600	15600	25.5	$397,800
Site Manager	1	2800	2800	32.5	$91,000
Civil Engineer	1	2700	2700	30.5	$82,350
Secretary	1	1100	1100	8.5	$9,350
Foundation Crew	12	2100	25200	13	$327,600
Road Contractors	6	700	4200	12.5	$52,500
HV Electricians	25	2600	65000	25.5	$1,657,500
Commissioners	3	1200	3600	19	$68,400
Met Tower Crew	2	400	800	13	$10,400
	86				**$3,784,100**

Phase V Job Types	**Number of Workers**	**Hours on the Job**	**Total Man/hrs**	**Average Wage ($)**	**Total Wages per Class ($)**
Electricians	7	2600	18200	17	$327,964
Elec. Labor	3	2600	7800	9	$74,412
Backhoe Operators	4	1800	6400	15.5	$105,152
Crane Operators	5	2600	13000	19	$261,820
Tower Erectors	10	2600	26000	15	$413,400
On-Site Supervisors	6	2600	15600	26	$429,936
Site Manager	1	2800	2800	33	$90,389
Civil Engineer	1	2700	2700	31	$81,273
Secretary	1	1100	1100	9	$10,494
Foundation Crew	12	2100	25200	13	$347,256
Road Contractors	6	700	4200	13	$57,876

HV Electricians	25	2600	65000	26	$1,791,400
Commissioners	3	1200	3600	19	$72,504
Met Tower Crew	2	400	800	13	$11,024
	86				**4,074,900**

Table 6-5 lists the associated costs for personnel and equipment for a 100 megawatt wind farm project. The information for the Operations and Maintenance figures for this report was compiled from interviews with windfarm operators in California and Minnesota who have been and are presently involved in these types of activates. Also in Table 6-5 the expected dollars to the local economy is presented. This category shows dollars expected to filter into the local economy as opposed to the total Operations and Maintenance costs for such a project.

Table 6-5

Annual Operations and Maintenance Costs for 100 Megawatt Wind Farm

Position/item	**#**	**Annual Cost**	**Expected $'s to Local Economy**
Wind Technician I*	4	$130,000*	$104,000
Wind Technician II**	4	$190,000**	$154,000
Secretary	1	$15,000	$12,500
Site Manager***	1	$65,000***	$54,000
Maintenance Building	1	$25,000	$2,500
Service Trucks	4	$25,000	$2,500
Boomtruck	1	$50,000	$2,500
Site road maintenance		$25,000	$10,000
HV Electrical maintenance		$40,000	$2,000
Insurances		$40,000	$5,000
Fuel	8000 gals.	$10,000	$10,000
Tools and Misc. Supplies		$40,000	$40,000
Spare Parts Inventory		$250,000	$5,000
		$905,000	**$404,000**

* Includes wage @ $12.50/hr plus all payroll taxes ie: Workmans comp, unemployment, etc,

** Includes wage @ $18.50/hr plus all payroll taxes ie: Workmans comp, unemployment, etc.

*** Includes wage @ $26.00/hr plus all payroll taxes ie: Workmans comp, unemployment, etc

VII Development of Additional 400 Megawatts of Large Scale Wind Farms

According to the same Minnesota legislative directive that requires Northern States Power to have 425 megawatts of wind generation on line by the end of year 2002, also requires Northern States Power to complete an additional 400 megawatts subject to the resource planning and least cost planning requirements described in Minnesota Statutes, Section 216B.2422.

This section briefly looks at the costs and potential economic parameters involved in such a development. The complete economic modeling of these additional 400 megawatts while contemplated, was not done in this analysis. If this additional 400 megawatts is developed, it in all likelihood may not be placed in southwest Minnesota because of transmission constraints in the impact area outlined in section II. Therefore its development may not have a direct impact on this area of the state, upon which this study is focused.

To achieve the cost estimates for this section, the numbers calculated for Phase V have been multiplied by a factor of four. There probably are factors of Phase V that do not relate to these additional developments. Given that it is a complete unknown as to where these projects would be installed it is impossible to project more exacting figures.

Table 7-1

Expenditure Parameters for 400 Megawatt Buildout

(1) Total Project Cost		$474,134,800
(2) Annual Revenues Generated by Facilities*		
	Years 1-10	$76,504,000
	Years 10-30	$41,920,000
Total Construction Costs		$77,854,800
Employment Costs During Construction		$16,191,600
Local Expenditures on Materials		$6,300,000
Local Expenditures on Goods and Services		$4,400,000
Annual Property Taxes	(Yearsl-5) **	$720,416
	(Years 6-11)**	$1,340,280
	(Years 11-Out)**	$1,172,748
Project O&M $'s/Year to Local Economy		$1,616,000
Transmission Expansion Costs		$84,800,000

*Revenues have been calculated estimating annual production of 1,048,000,000 Kwh at $.055 levelized over 30 years @ $.073 for years 1-10 and $.04 for 10-30
**Based on property tax laws passed in 1995

VIII. Wind Development Property Taxation

As a result of a 1994 Minnesota Legislative directive to Northern States Power, large scale development of wind power is currently occurring in southwest Minnesota. This type of development receives preferential property tax treatment under Minnesota Statute. Uncertainty has been expressed by county officials and others about how development of large scale wind power will impact property tax revenues, Under Minnesota tax statute, wind power projects of 2 megawatts or less are totally exempt from property tax. This was done to provide an incentive for local farmers and small business people to become actively involved in producing wind generated electricity as a "cash crop".

For the purpose of this analysis, it is assumed that the basic Minnesota property tax system will remain in place over the life of the wind farm developments (30 years). At this time, there is substantial debate on the future of the property tax system in Minnesota, and not just for wind power development. Where that debate leads can only be speculative, therefore this report can only provide estimates based on what is known now. Minnesota law established tax rates for commercial property at 3% for the first $100,000 of property value and 4.6% for value in excess of $100,000. For wind power development, the tower foundation is taxed for the first five years. Starting in year six, the foundation and 30% of the tower value is taxed. The statutory tax rate is multiplied by the assessed value of a property to determine tax capacity. Local tax rates, based on local revenue needs, are then multiplied against a property's tax capacity to determine the actual tax paid on a specific property[(8)]. Because of the impact that local budgets and tax base have on actual tax paid, tax capacity is the simplest way to compare the local impacts of a development across jurisdictions. Each jurisdiction (counties, townships, schools districts and special purpose units of government) establishes a tax rate according to its revenue needs. This local rate is expressed as a percent of the total tax capacity found within that jurisdiction. Property taxes levied against a property are based upon the sum of the local tax rates for all the taxing jurisdictions in which the property is located. This sum of local tax rates is then multiplied by the property's tax capacity to determine the tax owed[(9)].

Property is taxed based on its assessed market value. This value is typically established by the local Assessor. Base valuation is the construction cost of the foundation and 30% of the tower cost. Valuation of wind power plants are more complex as depreciation of the machinery is included in the valuation. The Minnesota Department of Revenue has recommended that wind turbines be depreciated at 2.5% per year until the facility is depreciated 25%. Thus, in 11 years the value stabilizes. It is the intention of the Minnesota Department of Revenue to have the county or local assessors value the wind energy systems. The assessors may choose to value the systems using other methods such as considering income generated by the wind turbines. The estimated tax revenues from a 100 MW wind farm under the above listed tax policy scenarios for Lincoln Co., Pipestone Co., Murray Co., and Nobles Co. are outlined in Table 8-1, Phase I was installed under earlier tax exemption statute.

Table 8-1

Property Taxes Using 166 - 600 KW Turbines

	Phase I	**Phase II**	**Phase III**	**Phase IV**	**Phase V**
	25 MW	100 MW	100 MW	100MW	100MW
	Lincoln Co.	Lincoln Co.	Pipestone Co.	Murray Co.	Nobles Co
Foundation Costs	$18,000	$22,500	$23,000	$23,500	$24,000
Class Tax Rate	N/A	4.60%	4.60%	4.60%	4.60%
Ave. County Tax Rate Multiplier	N/A	122.55%	129.00%	103.30%	99.20%
Number of Turbines	73	166	166	166	166
Taxes to County (Year 1-5)	0	$208,592	$224,449	$183,640	$180,104
30% Value of Tower	$16,000	$21,000	$21,500	$22,000	$22,500
Class Tax Rate	N/A	4.60%	4.60%	4.60%	4.60%
Ave. County Tax Rate Multiplier	N/A	122.55%	129.00%	103.30%	99.20%
Taxes to County (Year 6-1 1)	0	$379,035	$408,177	$334,221	$328,026
Taxes to County (12-beyond)		$331,655	$357,155	$292,443	$287,023

The above tables have been computed utilizing average tax rate multipliers from the townships within each of the listed counties. Due to the fact that the exact locations for Phases II thru V have not been precisely identified, calculating detailed actual tax impacts are hypothetical and speculative. This information was cross referenced with work that has been completed by Mark Lindquist of the Southwest Regional Development Commission, and though the methodology was different, both analysis reached virtually the same conclusions on the amount of tax revenue generated by the anticipated wind projects[14].

The Phase II project which is slated to go into Lincoln County is expected to consume about 19,000 acres in total windright easements. The actual acres that will be taken out of agricultural production is estimated to be 70 acres. This represents a possible tax loss of $1500 at the present agricultural tax rate. The actual loss of net crop revenues is estimated to be $100 per acre or $7000. However, the decrease in land and tax value only takes the loss of aggregate used land values into account. It does not consider other market orientated perceptions that might decrease values This would include, but not be limited to, perceptions of decreased formability, wind generators as a nuisance, etc.

The tax benefits to host communities are sensitive to the size of the taxing jurisdictions' budgets and existing tax base. The smaller the tax base the less revenue is generated, but the more taxes are reduced on the other properties. The smaller the tax base the less revenue is generated, but the more other tax payers experience tax relief It should also be noted that actual tax revenues would be increased if wind farms are located in multiple counties, school districts or even townships[14].

IX. Disbursed Generation Model of 100 MW in 600 KW Increments

While California-style wind farm development is being repeated in select locations at the top of the Buffalo Ridge in Southwest Minnesota, future growth in the development of this resource can early be compared to the European wind energy experienced[1]. Due to land availability and utility grid constraints, the size of wind farms tend to be smaller in Europe, in many cases one or two machines. Also, laws of the countries encourage the farmers and small business people, in windy areas, to take advantage of this natural resource and become actively involved in producing electrical energy for their own communities. An article in a recent Danish newspaper stated that wind power has rescued many family farms from demise. The income from their new **cash crop** has allowed them to continue farming and maintain their lifestyle.

As shown earlier in Section II of this report, there is literally thousands of square miles of good, wind swept land in southwest Minnesota. Even though finding good wind land for a large wind farm is not a problem, the ability to control large tracts of contiguous property with good transmission access, is an obstacle. One of the major criteria in developing large wind farms in the Midwest, or anywhere for that matter, is transmission access and a path to move the power to the load centers. There are numerous excellent wind resource areas in this region, but without a way to deliver the power to the consumer, large wind farms will not be developed. However, by utilizing disbursed generation, similar to the European model, these developmental problems could be diffused and in the process a more widespread method of economic development would be created in the rural areas of southwest Minnesota. Disbursed generation does not mean that every farm will have its own small wind turbine, since this may not be always be economically viable. Wind energy can be developed in a modular fashion utilizing utility grade turbines scattered throughout the countryside in open, windy locations, where interconnection to the grid can be accommodated without the duplicating of large interconnect substations and building of transmission lines. If the turbines cannot be directly interconnected to the purchasing utility the power could be wheeled through the vast network of power lines owned by the Rural Electric Cooperatives who service the rural communities at a cost. These turbines would be owned and operated by the local farmers or small business owners or local groups who could form cooperatives, The ability to create new jobs and at the same time keep our energy dollars in our local communities, would have economic benefits. For example, by being on-line and producing peak output when annual demand charges are measured by the generation utilities, the small power producer could help shave that demand peak for their distribution utility, thus earn a share of the demand savings and keep those dollars in their community.

Disbursed generation holds potential for bng term income for rural communities, and is technically compatible with the electrical infrastructure. The European disbursed generation model. has shown that the technology is ready, and farmers and small business people that live in windy areas, can become actively involved in the production of electrical energy. It could provide more disbursed economic development and more importantly, keeps the energy dollars in the local community.

Table 9-1 is a complete overview of the expenditure parameters for the disbursed generation model of approximately 100 MW utilizing 166-600 KW turbines which equal a total of 99.6 MW. The assumed capacity factor for this analysis is 30%. Even though the turbines will be disbursed over a fairly large area, it is assumed to be within the 7 m/s wind areas discussed in Section II of this report. Also, the output of the turbines is calculated at a hub height of 60 meters. This table provides the economic factors that have relevant impact on the local economy, not only during the construction phase, but also during the ongoing operations and maintenance of the project.

Table 9-1

Economic Parameters for Disbursed Generation Model 100 MW in 600 KW Increments

(1) Total Project Cost*			$98,604,000
(2) Annual Revenues Generated by the Facility			
	Years 1-10****		$18,592,000
	Years 11-30****		$10,624,000
(3) Total Construction Costs*			$11,495,500
(4) Transmission Expansion Costs*			$1,328,000
(5) Land Easement Costs *			$0
(6) Local Expenditures on Materials**			$1,600,000
(7) Local Expenditures on Goods and Services**			$400,000
(8) Employment. costs during Construction*****			$2,505,250
(9) Annual Property Taxes (a) Years 1-5 ***			$0
(b) Years 6-Out ***			$0
(10) Project O&M $'s/Year to Local Economy****			$1,245,000
(11) Annual Revenuer Retained After Debt Service****			
	(a) Years 1-5		$672,300
	(b) Years 6-10		$2,332,300
	(c) Years 11 -30		$8,673,500
Dollars to Local Economy			
	Year 0-1	(5+6+7+8)	$4,505,250
	Years 1-5	(9a+10+lla)	$1,917,300
	Years 6-10	(9b+10+llb)	$3,577,300
	Years 11-30	(9b+10+llc)	$9,918,500

*Derived from relevant line items in Table 9-2 and multiplied by 166 to equal 100 megawatts
**Table 9-3
***Taxes based on 1995 legislation

****Revenues derived from cash flow analysis Exhibit 9A and multiplied by 166 to equal 100 MW
*****Table 9-4

Table 9-2 shows the breakdown of all relative costs for the development of disbursed generation models. This table identifies the various categories of the construction phase and the soft costs for a single turbine, a 1.2 MW or two turbine project, and a 10 MW or 17 turbine project. Note how the economies of scale start to apply as the projects get bigger in size. Costing numbers for this table were compiled through securing estimates from suppliers, subcontractors and wind farm developers for the construction, labor, and equipment. The estimates for the soft costs come from the staff and employees of Minnesota Environmental Quality Board, Northern States Power, and Minnesota Public Utilities Commission.

Table 9-2

Disbursed Generation Project Costs Utilizing 600 KW Turbines

	.6 MW 1 turbine	**% Of Total**	**1.2 MW 2 turbines**	**% of Total**	**10 mw 17 turbines**	**% of Total**
Concrete	$9,000	1.52%	$18,000	1.52%	$150,000	1.47%
Rebar	$5,000	0.84%	$10,000	0.84%	$77,000	0.75%
Backhoe	$1,250	0.21%	$2,500	0.21%	$17,000	0.17%
Tower Imbed/Bolts	$8,000	1.35%	$16,000	1.35%	$128,000	1.25%
Foundation Labor	$3,000	0.51%	$6,000	0.51%	$50,000	0.49%
Crane	$10,000	1.68%	$20,000	1.68%	$150,000	1.47%
Support Crane	$1,000	0.17%	$2,000	0.17%	$17,000	0.17%
Transformer	$8,500	1.43%	$17,000	1.43%	$145,000	1.42%
Erection Labor	$3,000	0.51%	$6,000	0.51%	$50,000	0.49%
Drop Cable	$250	0.04%	$500	0.04%	$8,000	0.08%
Electrical Labor	$3,750	0.63%	$7,500	0.63%	$55,000	0.54%
Wire	$3,750	0.63%	$7,500	0.63%	$60,000	0.59%
Roads and Site Prep	$2,250	0.38%	$4,500	0.38%	$35,000	0.34%
QC Supervision	$2,500	0.42%	$5,000	0.42%	$30,000	0.29%
HV Line Extension	$8,000	1.35%	$16,000	1.35%	$125,000	1.22%
Construction Total	**$69,250**	11.66%	**$138,500**	11.66%	**$1,097,000**	10.75%
HV Sub/Intercon	$6,000	1.01%	$12,000	1.01%	$400,000	3.92%
Turbines/600 KW	$445,000	74.92%	$890,000	74.92%	$7,325,000	71.76%
Towers - 60m	$70,000	11.78%	$140,000	11.78%	$1,150,000	11.27%
Land Easements	$1,000	0.17%	$2,000	0.17%	$180,000	1.76%
Site Certificate	$1,500	0.25%	$3,000	0.25%	$29,000	0.28%
Bid Process/PPA	$1,250	0.21%	$2,500	0.21%	$27,000	0.26%
Project Total	**$594,000**	100.0%	**$1,188,000**	100.0%	**$10,208,000**	100.0%

Exhibit 9A is a cash flow analysis of a single 600 KW turbine project that would be typical for a farmer or small business person, or a small group thereof to own and operate. Operations and maintenance (O&M) of such an installation would come from the turbine supplier or a local

Exhibit 9A
600 KW Wind Turbine Electrical Generation Project
Projected Annual Production 1600000 Kwh's

Revenue	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11-30**
Energy Sales	$112,000	$112,000	$112,000	$112,000	$112,000	$112,000	$112,000	$112,000	$112,000	$112,000	$64,000
Total Revenue	$112,000	$112,000	$112,000	$112,000	$112,000	$112,000	$112,000	$112,000	$112,000	$112,000	$64,000
Expenses											
Insurance	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500
Land Rent	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500
O&M	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500
Spare Parts	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000
Elec. Usage	$250	$250	$250	$250	$250	$250	$250	$250	$250	$250	$250
Total Oper. Exp.	$11,750	$11,750	$11,750	$11,750	$11,750	$11,750	$11,750	$11,750	$11,750	$11,750	$11,750
Gross Oper. Profit	$100,250	$100,250	$100,250	$100,250	$100,250	$100,250	$100,250	$100,250	$100,250	$100,250	$52,250
Debt Service	$86,200	$86,200	$86,200	$86,200	$86,200	$86,200	$86,200	$86,200	$86,200	$86,200	$0
Owners Equity Repymt	$10,000	$10,000	$10,000	$10,000	$10,000	$0	$0	$0	$0	$0	
Cash Flow	$4,050	$4,050	$4,050	$4,050	$4,050	$14,050	$14,050	$14,050	$14,050	$14,050	$52,250

Assumptions
$594,000 Total Project Cost
Down Payment $50,000
Debt - $544,000 @ 10% for 10 years
Energy @ $.07 for first 10 years and $.04 for last 20 years = $ 05 levelized over 30 year contract
Wind Projects of 2 Megawatts or less are exempt from Property Tax
Expected production levels based on 7.5 m/s with a turbine hub height at 60 meters representing a 30% capacity factor
Wind Turbine Design Life of 30 Years
Cash flow does not consider any depreciation tax benefits,state production payments, or tax credits

service provider trained by the manufacturer of the equipment. O&M costs stay linear throughout since a properly and regularly maintained machine should not incur additional scheduled, costs. The spare parts reserve fund will satisfy additional small parts replacement that might be required plus accumulate as a source to cover any unscheduled problems that insurance does not cover. The $50,000 down payment assumed in the analysis is recovered in the first 5 years in the form of owner equity repayment, or possibly could come from sweat equity by participating in the preparation and installation of the project, which is commonly done in individually owned projects. This downpayment--in the form of cash or labor--does represent an outflow of resources from the regional economy that could have been utilized for other activities. While in reality this outflow will occur in year one, this cost to the regional economy is accounted for by excluding the repayment of owner equity from regional economic benefits in years one through five. Any real or perceived farm production losses are covered by the land rent payment which is in both the cash flow projection and the project cost breakdown in Table 9-2

Financing of Disbursed Generation and Regional Banking

Under the assumptions for the cash flow analysis in Figure 9. 1, debt for the project is calculated at 10% interest. This assumption was developed through discussions with local financing institutions in conjunction with recent legislation that provides eligibility for Farm-Generated Wind Energy Production Facilities from the Minnesota Department of Agriculture. Financing is obviously the key to the successful development of disbursed wind generation and can make or break any project. In discussions with the local and regional banks it was made clear that anyone who is interested in financing a wind project must be in good credit standing with the lender. With that, most local banks can loan up to 20% of its capital surplus as the only loan limit to its customers. The smaller local banks could loan up to $500,000 to a customer in good standing provided they have confidence in the proposed technology. Minnesota Valley Bank in Redwood Falls, MN and other larger regional banks in Pipestone, Worthington, and Luverne could loan up to $1,000,000 to a customer in good standing again, with confidence in the technology. It was stated by the loan officers that the banks in Southwest Minnesota could handle $200,000,000 in disbursed generation over a five year span. If the these projects would qualify under the FHA program it would be much easier since only 10% would count against the farmers lending limit. These banks have been researching the technology and are interested in the value added cooperative method of development. They would like to see a pilot project established that yields the operations and maintenance costs along with the cashflow to increase comfort in providing capital for more projects. In general, all of the bank officials interviewed were positive and upbeat about the possible development of disbursed generation and the opportunities it could bring the local economy.

Table 9-3 illustrates a listing of the expected expenditures for construction materials and goods and services for the development of 100 MW of disbursed generation in 600 KW increments. Most of the dollars expended in these categories during the construction phase should be spent throughout the impact area described in section II (Figure 2.4). These communities have adequate facilities to service these needs. The information on the expected destination of these dollars was compiled by personal interviews with local community economic development officials, suppliers of construction materials, and goods and service providers in the expected impact areas.

Table 9-3

Local Expenditures on Construction Materials and Supplies on 100 MW Deployed in 600 KW Increments

Lumber and Building Materials	$70,000
Concrete	$1,495,000
Metal Fabrication	$5,000
Hardware and Supplies	$30,000
	$1,600,000

Local Expenditures on Goods and Services

Gasoline/Diesel Fuel	$150,000
Propane Gas	$2,000
Food and Meals	$174,000
Lodging	$74,000
	$400,000

As shown in Table 9-4, employment construction costs for the disbursed generation model are listed by job types to produce a total labor cost. The information for the labor cost breakdown was generated by interviews with wind farm developers who have developed projects of similar nature and discussions with subcontractors who performed various tasks on wind farm construction projects in Minnesota, Europe and California. The local labor cost rates were based on actual wages paid on wind projects completed in this region.

Table 9-4
Construction Employment Breakdown 100 MW of Disbursed Generation

Job Types	Number of Workers	Hours on the Job	Total Man/Hrs	Average Wage ($)	Total Wages per Class ($)
Electricians	7	2600	18200	$16.50	$300,300
Elec. Labor	3	2600	7800	$9.00	$70,200
Backhoe Operators	4	1600	6400	$15.50	$99,200
Crane Operators	5	2600	13000	$18.50	$240,500
Tower Erectors	10	2600	26000	$14.50	$377,000
On-Site Supervisors	6	2600	15600	$25.50	$397,800
Site Manager	1	2800	2800	$32.50	$91,000
Civil Engineer	2	2700	5400	$30.50	$164,700
Secretary	3	1100	3300	$8.50	$28,050
Foundation Crew	12	2100	25200	$13.00	$327,600
Road Contractors	6	700	4200	$12.50	$52,500
HV Electricians	4	2600	10400	$25.50	$265,200
Commissioners	4	1200	4800	$19.00	$91,200
	67				**$2,505,250**

X. Disbursed Generation Model of 100 Megawatts in 10 Megawatt Increments

Another development strategy which is being actively pursued by wind developers and farmers looking to form wind cooperatives, is building projects in 10 megawatt increments. This approach is a blend of smaller local ownership strategies and large development economies of scale. If you compared 17 single owned turbines with a 10 MW project utilizing the same number of machines, little difference in total costs is seen because the economies of scale advantage is offset by much larger substation and interconnect costs[11].

Table 10-1 is a complete overview of the expenditure parameters for 10 MW project. This table provides the economic factors that have relevant impact on the local economy, not only during the construction phase, but also during the ongoing operations and maintenance of the project. As stated before, economic analysis for the 10 MW facilities in this report assume a turbine size of 600 KW. By assuming the use of 17-600 KW turbines, the actual installed capacity is 10.2 MW. This accounts for the difference in total revenue when compared to the 166-600 KW projects discussed earlier.

Table 10-1

Economic Parameters for Disbursed Generation Model 100 MW in 10 MW Increments

(1) Total Project Cost *			$102,080,000
(2) Annual Revenues Generated by the Facility			
	Years 1-10****		$19,040,000
	Years 10-30****		$10,880,000
(3) Total Construction Costs*			$10,970,000
(4) Transmission Expansion Costs*			$1,250,000
(5) Land Easement Costs *			$1,800,000
(6) Local Expenditures on Materials**			$1,600,000
(7) Local Expenditures on Goods and Services**			$400,000
(8) Employment costs during Construction*****			$2,505,250
(9) Annual Property Taxes	(a) Years 1-5***		$199,208
	(b) Years 6-11***		$364,125
	(c) Years 11-30***		$318,610
(10) Project O&M $/Year to Local Economy****			$1,245,000
(11) Annual Revenuer Retained After Debt Service****			
	(a) Years 1-5		$618,800
	(b) Years 6-10		$2,176,750
	(c) Years 11-30		$8,611,390
Dollars to Local Economy			
	Year 0-1	(5+6+7+8)	$6,305,250
	Years 1-5	(9a+10+lla)	$2,063,008
	Years 6-10	(9b+10+llb)	$3,785,875
	Years 11-30	(9c+10+11c)	$10,175,000

*Derived from relevant line items in Table 10-2 and multiplied by 10 to equal 100 megawatts
**Table 10-3
***Taxes based on 1995 legislation averaged over the counties in the impact area outlined in Sec.II
****Revenues derived from cash flow analysis Exhibit 10A and multiplied by 10 to equal 100 MW
*****Table 10-4

Table 10-2 shows the breakdown of relative costs for the development of a 10 megawatt project. This table identifies the categories of the construction phase and the soft costs for this size project. Costing numbers for this table were compiled by securing estimates from suppliers, subcontractors and wind farm developers for the construction, labor and equipment. The estimates for the soft costs come from the staff and employees of Minnesota Environmental Quality Board, Northern States Power, and Minnesota Public Utilities Commission.

Table 10-2
Disbursed Generation Project Costs Utilizing 600 KW Turbines

	10 MW 17 turbines	**% of Total**
Concrete	$150,000	1.47%
Rebar	$77,000	0.75%
Backhoe	$17,000	0.17%
Tower Imbed/Bolts	$128,000	1.25%
Foundation Labor	$50,000	0.49%
Crane	$150,000	1.47%
Support Crane	$17,000	0.17%
Transformer	$145,000	1.42%
Erection Labor	$50,000	0.49%
Drop Cable	$8,000	0.08%
Electrical Labor	$55,000	0.54%
Wire	$60,000	0.59%
Roads and Site Prep	$35,000	0.34%
QC Supervision	$30,000	0.29%
HV Line Extension	$125,000	1.22%
Construction Total	$1,097,000	10.75%
HV Sub/Intercon	$400,000	3.92%
Turbines/600 KW	$7,325,000	71.76%
Towers - 60m	$1,150,000	11.27%
Land Easements	$180,000	1.76%
Site Certificate	$29,000	0.28%
Bid Process/PPA	$27,000	0.26%
Project Total	$10,208,000	100.00%

Exhibit 10A is a cash flow analysis of a 10 megawatt project that would be typical for a group of farmers, a small wind development entity, or a coop. Operations and maintenance of such an installation would come from the turbine supplier or a local service provider trained by the manufacturer of the equipment. O&M costs stay linear throughout as a properly and regularly maintained machine should not incur additional scheduled costs. The spare parts set a side fund will take care of additional small parts replacement that arise plus accumulate as source to cover unscheduled problems that insurance does not cover. The $850,000 down payment assumed in

Exhibit 10A
10 MW Wind Turbine Electrical Generation Project
Projected Annual Production 27200000 Kwh's

Revenue	1	2	3	4	5	6	7	8	9	10	11-30
Energy Sales	$1,904,000	$1,904,000	$1,904,000	$1,904,000	$1,904,000	$1,904,000	$1,904,000	$1,904,000	$1,904,000	$1,904,000	$1,088,000
Total Revenue	$1,904,000	$1,904,000	$1,904,000	$1,904,000	$1,904,000	$1,904,000	$1,904,000	$1,904,000	$1,904,000	$1,904,000	$1,088,000
Expenses											
Insurance	$42,500	$42,500	$42,500	$42,500	$42,500	$42,500	$42,500	$42,500	$42,500	$42,500	$42,500
Land Rent	$8,500	$8,500	$8,500	$8,500	$8,500	$8,500	$8,500	$8,500	$8,500	$8,500	$8,500
O&M	$110,000	$110,000	$110,000	$110,000	$110,000	$110,000	$110,000	$110,000	$110,000	$110,000	$110,000
Spare Parts	$15,000	$15,000	$15,000	$15,000	$15,000	$15,000	$15,000	$15,000	$15,000	$15,000	$15,000
Elec. Usage	$4,000	$4,000	$4,000	$4,000	$4,000	$4,000	$4,000	$4,000	$4,000	$4,000	$4,000
Property Tax	$19,920	$19,920	$19,920	$19,920	$19,920	$34,125	$34,125	$34,125	$34,125	$34,125	$31,861
Total Oper. Exp.	$199,920	$199,920	$199,920	$199,920	$199,920	$214,125	$214,125	$214,125	$214,125	$214,125	$211,861
Gross Oper. Profit	$1,704,080	$1,704,080	$1,704,080	$1,704,080	$1,704,080	$1,689,875	$1,689,875	$1,689,875	$1,689,875	$1,689,875	$876,139
Debt Service	$1,472,200	$1,472,200	$1,472,200	$1,472,200	$1,472,200	$1,472,200	$1,472,200	$1,472,200	$1,472,200	$1,472,200	$0
Owners Equity Repymt	$170,000	$170,000	$170,000	$170,000	$170,000	$0	$0	$0	$0	$0	
Cash Flow	$61,880	$61,880	$61,880	$61,880	$61,880	$217,675	$217,675	$217,675	$217,675	$217,675	$876,139

Assumptions
$10,208,000 Total Project Cost
Down Payment $850,000 put up by equity partners or coop members
Debt - $9,358,000 @ 10% for 10 years
Energy @ $.07 for first 10 years and $.04 for last 20 years = $.05 levelized over 30 year contract
Property Tax payments are an estimate based on average tax rates of the counties in the impact area outlined in Section II
Expected production levels based on 7.5 m/s with a turbine hub height at 60 meters representing a 30% capacity factor
Wind Turbine Design Life of 30 Years
Cash flow does not consider any depreciation tax benefits,state production payments, or tax credits

the analysis is recovered in the first 5 years in the form of equity repayment, or possibility could come from sweat equity by participating in the preparation and installation of the project, which is commonly done in individual owned projects. This downpayment--in the form of cash or labor-does represent an outflow of resources from the regional economy that could have been utilized for other activities. While in reality this outflow will occur in year one, this cost to the regional economy is accounted for by excluding the repayment of owner equity from regional economic benefits in years one through five. Any real or perceived farm production losses are covered by the land rent payment which is in both the cash flow projection and the project cost breakdown in Table 10-2.

Table 10-3 illustrates a listing of the expected expenditures for construction materials and goods and services for the development of 100 MW of disbursed generation utilizing 10 megawatt increments. Most dollars expended in these categories during the construction phase should be spent throughout the impact area described in section II (see Figure 2.4). These communities have adequate facilities to service these needs. The information on the expected destination of these dollars was compiled by personal interviews with local community economic development officials, suppliers of construction materials, and goods and service providers in the expected impact areas.

Table 10-3

Local Expenditures on Construction Materials and Supplies on 100 MW Deployed in 10 MW Increments

Lumber and Building Materials	$70,000
Concrete	$1,495,000
Metal Fabrication	$5,000
Hardware and Supplies	$30,000
	$1,600,000

Local Expenditures on Goods and Services

Gasoline/Diesel Fuel	$150,000
Propane Gas	$2,000
Food and Meals	$174,000
Lodging	$74,000
	$400,000

XI. Local Economic Impact Projections Of Southwestern Minnesota Windpower Development

Wilbur Maki Associates prepared the local economic projections of Southwestern Minnesota for two development strategies, one concentrated in facility ownership, the other dispersed among local landowners. A regional computer modeling system, including a localized database, provided the statistical support for preparing the projection series. We present the findings under the headings of recent trends, model inputs, and model projections.

Recent Trends

Total employment serves as a key measure of economic growth. For the six-county area, total employment increased from nearly 38 thousand in 1985 to nearly 49 thousand in 1990 (Table 11-1). Based on two different trendlines, the projected 1995 employment ranges from a low estimate of slightly more than 561 thousand to a high estimate of nearly 72 thousand. The low estimate follows the trendline based on the reported 1985 and 1993 nonagricultural covered employment estimates of the Minnesota Department of Economic Security. The high estimate follows the trendline based on the detailed industry employment estimates for 1985 and 1990 presented in the Appendix. The difference between the two projections come largely from retail trade, private services, and government, particularly local government

Table 11 -1
Total Employment in Specified Industry, 1985,1990, and Projected 1995

	Estimated		Projected 1995	
	1985	1990	Low	High
Agriculture	6012	8351	9975	9975
Agri. services, for., fish., mining	384	380	466	376
Construction	2054	2775	2869	3749
Manufacturing	4784	6347	8519	8421
Trans., comm., public utilities	1664	1759	1418	1859
Wholesale trade	2174	2309	3084	2452
Retail trade	6172	8001	7704	10372
Fin., ins., real estate	1860	2593	2628	3615
Private services	7233	9163	9330	11608
Government	5206	7116	7140	9727
Federal	320	472	474	646
State	606	767	769	1048
Local	4280	5875	5895	8030
Total	37544	48794	60272	71878

Source: Wilbur Maki Associates

The private services sector was the largest employer in 1990, followed by agriculture and retail trade. It may have lost its first-place ranking by 1995, depending upon the continued strength in the growth of agricultural and retail trade employment. Data limitations for projecting the 1995 employment levels are more restrictive for agriculture than the non-agricultural sectors. In addition, the agriculture sector demonstrates the greatest volatility, not necessarily in employment, but earnings per worker.

The U.S. Department of Commerce uses a different procedure for projecting long-term trends than simply an extrapolation of recent trends. They take into account a number of factors affecting the long-term prospects for the export-producing sectors, like agriculture, as well as the residentiary sectors, like the retail stores and shops serving a local population. The long-term projections listed in Table 11-2 were prepared in 1992, however, with 1988 being the last year of the available statistical series (starting in 1973) for estimating the model. Apparently the events of the late 1980s were more important in affecting the 1990 levels of industry employment than the earlier years. Under-estimating the actual 1990 activity levels results in further under-estimation of the 1995 activity levels. The question remains, of course, whether or not the local economy can maintain the higher growth rates of the late 1980s into the 1990s and beyond.

Table 11-2

Industry Employment, Population, and Income, 6-County Area, 1983 to 2005

		Estimated		Projected		
Sector	Units	1983	1988	1995	2000	2005
Farm	thou.	9.1	8.2	7.7	7.6	7.3
Nonfarm	thou.	35.5	38.5	40.9	42.4	42.8
Private Nonfarm	thou.	29.2	31.7	34.1	35.4	36
Agri. Services, Mining	thou.	0.3	0.6	0.7	0.9	1.1
Construction	thou.	2.2	2.1	2.1	2.1	2.1
Manufacturing	thou.	4.7	5.2	5.5	5.5	5.7
Tran., Comm., Utilities	thou.	1.6	2	2.2	2.4	2.4
Wholesale Trade	thou.	2.7	2.9	3.1	3.1	3
Retail Trade	thou.	7.6	7.7	8	8.2	8.3
Fin., Ins., Real Estate	thou.	2.4	2.5	2.7	2.8	2.8
Private Services	thou.	7.7	8.7	9.8	10.4	10.6
Government, Total	thou.	6.1	6.7	6.8	6.8	6,8
Federal	thou.	0.5	0.8	0.8	0.9	0.8
State-Local	thou.	5.6	5.9	6	5.9	6
Total Employment	thou.	44.8	46.6	48.7	49.8	50.2
Total Population	thou.	88.2	83.9	82.3	82.5	82.7
All Values in 1995 Dollars:						
Total Earnings	mil.$	759	980	1084	1148	1199
Total Personal Income	mil.$	1,305	1,507	1,693	1,808	1,904
Per Capita Income	thou.$	14.8	18	20.6	21.9	23
Per Worker Earnings	thou.$	16.9	21	22.3	23.1	23.9

Source: U.S. Department of Commerce, Bureau of Economic Analysis, 1992

The long-term projections also show a slowing down of per capita income growth and of increases in per worker earnings, with increases in labor earnings being even less than personal income growth. Also significant is the lack of long-term projected growth in the government sector, unlike the projected employment based on the more recent trends.

Again, events of the late 1980s become the controlling factors in accounting for the high levels of government employment in the 1990s. However, success in reducing the federal budget deficits introduces a new set of scenarios that inevitably lead to correspondingly reduced levels of support for local governments.

The U.S. Department of Commerce provides still another local database for assessing the economic effects of local development efforts--the decennial censuses of population. Of particular interest to rural areas is the data on the journey to work. For each of the six counties, a large majority of the resident labor force finds employment in the county of residence, as shown in Table 11-3. The total available jobs in each county are fewer, however, than the total available workers. For only three of the six counties--Lyon, Nobles, and Pipestone, and only in the last two census periods, in-commuters exceeded out-commuters, as shown in Table 11-3. These three counties are the "growth counties" of the six-county area. Conversely, the census reports for Lincoln, Murray, and Rock counties continue to show more out-commuting than in-commuting.

Table 11-3

Commuting Status Employed Persons in 6-County Area, 1960-1990

Commuter Status	**1960**	**1970**	**1980**	**1990**
Lincoln County:				
Local Commuters	3166	2503	2832	2305
In-commuters	93	116	189	254
Out-commuters	284	285	470	592
Net In-commuters	-191	-169	-281	-338
Lyon County:				
Local Commuters	7088	8166	10729	11106
In-commuters	329	599	1229	1767
Out-commuters	574	996	613	772
Net In-commuters	-245	-397	616	995
Murray County:				
Local Commuters	4320	3321	3644	3255
In-commuters	151	158	143	281
Out-commuters	284	876	749	866
Net In-commuters	-133	-718	-606	-585
Nobles County:				
Local Commuters	7274	6138	8890	8326
In-commuters	465	531	1086	1530
Out-commuters	489	2182	403	784
Net In-commuters	-24	-1651	683	746
Pipestone County:				
Local Commuters	4134	3858	4160	3931
In-commuters	92	253	392	581

Out-commuters	357	544	295	482
Net In-commuters	-265	-291	97	99
Rock County:				
Local Commuters	3734	3339	4247	3427
In-commuters	148	258	336	306
Out-commuters	252	800	485	1004
Net In-commuters	-104	-542	-149	-698

Source: U.S. Bureau of the Census, Decennial Censuses of Population

When comparing the several sets of numbers on industry employment, we must adjust for the differences in counting employment. The Minnesota Department of Economic Security counts jobs and not persons. The U.S. Census of Population counts persons and not jobs when seeking responses on commuting. Because of one person holding more than one job, the job count exceeds the person count, typically by about 10 percent, varying, of course, by time and place, For rural areas with much part-time farming, the job count is typically more than 10 percent.

Economic dependence of rural areas on essentially one industry--agriculture--contributes to a "boom-and-bust" economy that is characterized by a high volatility of income and earnings. A prime measure of the area's dependency on agriculture is the proportion of total industry revenues acquired from agricultural and food product shipments to markets outside the area. In 1990, as. shown in Table 11-4, farm and manufacturing businesses in the six-county area shipped an estimated $1,094,000,000 of products to markets outside the area. This accounted for three fourths of the $1,414,000,000 in total exports--domestic and foreign--from the area. In short, agriculture accounted for three-fourths of the area's economic base. These are the industries that bring in "new dollars' into the area purchasing goods and services not produced in the area. Finally, lack of diversity in the non-export-producing, that is, residentiary, industries that cater to local residents--household, business, and government--accounts for a correspondingly high level of import dependency.

Table 11-4

Total Commodity Disbursements of Agriculture & Food Industries, 6-County Area, 1990

		Agriculture		**Food Products**		**Agr. &**
Commodity Disbursements:	**Total** (Mil.$)	**Livestock** (Mil.$)	**Crops** (Mil.$)	**Meat & Dairy** (Mil.$)	**Other Food** (Mil.$)	**Food Prod.** (Mil.$)
Final Demand:						
Pers. Cons. Exp., Low	139	0	0	4	0	4
Pers. Cons. Exp., Medium	280	1	0	5	0	6
Pers. Cons. Exp., High	142	0	0	2	0	3
Total Pers. Consumption	561	1	1	10	0	13
Federal, Non-Military	7	0	0	0	0	0
Federal, Military	12	0	0	2	0	2
State-Local, Non-Education	135	0	0	1	0	1
State-Local, Education	47	0	0	0	0	0
Total Government	201	0	0	3	0	3
Inventory Additions	5	0	1	3	0	4
Private Capital Formation	143	0	0	0	0	0
Total Investment	147	0	1	3	0	
Domestic Exports	1,302	45	159	762	75	1,040
Foreign Exports	112	2	36	12	3	54
Total Exports	1,414	47	195	774	78	1,094
Total Final Demand	2,323	48	196	791	78	1,114
Intermediate Demand:						
Total Intermediate Demand	668	213	30	53	3	300
Total Commodity Disbursements	*2,991*	*261*	*226*	*844*	*81*	*1,414*

Source: Wilbur Maki Associates

A careful examination of the commodity disbursements of the agriculture and food industries in the six-county area shows the extreme dependence of this sector on export markets. Local markets are almost entirely other industries that make up the intermediate demand sector of the local economy. These include the meat packing and dairy products manufacturing businesses that also ship most of their production to markets outside the six-county area.

Shipments of locally-produced products to both local and export markets generates the income for purchasing the production inputs of labor and capital, and intermediate products used in the production processes. Unlike the product disbursements, however, industry input purchases in the six-county area focus largely on the local area, given the method of measuring the primary inputs of labor and capital used in local production, namely, at the place of production, as shown in Table 11-5.

Table 11-5

Total Input Purchases of Agriculture & Food Industries, 6-County Area, 1990

Industry Input Purchases	Total (Mil.$)	Agriculture Livestock (Mil.$)	Crops (Mil.$)	Food Products Meat & Dairy (Mil.$)	Other Food (Mil.$)	Agri & Food Prod. (Mil.$)
Primary inputs:						
Employee Compensation	713	19	6	100	9	135
Indirect Taxes	137	23	5	2	0	31
Proprietorial Income	220	112	37	1	0	151
Other Income	220	(12)	29	42	2	60
Total Value Added	1,290	142	78	146	11	376
Intermediate Inputs:						
Domestic Imports	903	55	80	375	44	554
Foreign Imports	81	1	2	33	3	38
Total Imports	984	56	81	408	46	592
Local Purchases, Total	717	63	68	290	25	445
Local Pur.+ Imports	1,701	119	149	698	71	1,037
Total industry purchases	*2,991*	*261*	*227*	*844*	*82*	*1,413*
Earnings Per Worker (1 995	22,006	28,248	14,955	27,043	32,950	26,549
Industry Employment (Number)	48,794	5,350	3,001	3,757	261	12,369

Source: Wilbur Maki Associates

Conceivably, all of the production workers could commute to a site characterized by total absentee ownership. This scenario is even more starkly "import-dependent" if the intermediate inputs were all imported. This would be a business that uses its site simply to convert productive resources acquired from outside the area into exportable commodities shipped to markets also outside the area. Any economic development impact in such an area would be extremely small, given the existence of an essentially "hollow" economy, totally import-dependent. Such an economy could have high earnings per worker if a large proportion of total local employment were in the export-producing industries that can afford the higher earnings per worker. Earnings per worker in the six-county area are higher in the principal export-producing industries than in the rest of the economy. The estimated 1990 all-industry earnings per worker fall between the estimated 1988 and projected 1995 values in Table 11-2.

Table 11-6

Contributions to Local Economy of Phases II to V and Disbursed Generation Strategies

	Phase II 100 MW (mil.$)	**Phase III 100 MW (mil.$)**	**Phase IV 100 MW (mil.$)**	**Phase V 100 MW (Mil.$)**	**100 MW In 600 KW lncr (mil.$)**	**100 MW In 10 MW lncr (mil.$)**
Annual Revenue Retained After Debt Service:						
Years 1 to 5	0	0	0	0	0.672	0.619
Years 6 to 1 0	0	0	0	0	2.332	2.lT7
Years 11 to 30	0	0	0	0	8.674	8.611
Year 1: Construction, Easements & Payroll:						
Concrete	1.300	1.350	1.350	1.375	1.495	1.495
Lumber & Bldg Mat	0.075	0.077	0.085	0.085	0.070	0.070
Metal Fabrication	0.022	0.023	0.029	0.030	0.005	0.005
Hardware & Supplies	0.045	0.046	0.084	0.085	0.030	0.030
Gasoline\Diesel Fuel	0.152	0.155	0.200	0.200	0.150	0.150
Propane Gas	0.045	0.046	0.050	0.050	0.002	0.002
Food and Meals	0.210	0.216	0.250	0.250	0.174	0.174
Lodging	0.450	0.475	0.600	0.800	0.074	0.074
Total, Except Wages & Easements	2.299	2.387	2.648	2.875	2.000	2.000
Land Easements (Not Included in Year 1)	0.400	0.408	0.416	0.416	0.014	0.014
Wages & Salaries	2.398	2.705	3.784	4.075	2.505	2.505
With 75% loading	1.799	2.029	2.838	3.056	1.879	1.879
Years 2 to 30:						
Maintenance Building	0.003	0.003	0.003	0.003	0.008	0.008
Boomtruck	0.003	0.003	0.003	0.003	0.008	0.008
Site Road Maintenance	0.010	0.010	0.010	0.010	0.031	0.031
HV Electrical Maintenance	0.002	0.002	0.002	0.002	0.005	0.006
Subtotal	0.017	0.017	0.017	0.017	0.052	0.052
Tools & Misc. Supplies	0.040	0.040	0.040	0.040	0.123	0.123
Parts Inventory	0.005	0.005	0.005	0.005	0.015	0.015
Subtotal	0.045	0.045	0.045	0.045	0.139	0.139
Service trucks	0.003	0.003	0.003	0.003	0.008	0.008
Fuel	0.010	0.010	0.010	0.010	0.031	0.031
Insurance	0.005	0.005	0.005	0.005	0.015	0.015
O&M. Total	0.080	0.080	0.080	0.080	0.245	0.245
Wages & Salaries	0.225	0.225	0.225	0.225	0.692	0.692
Property Taxes	0.209	0.232	0.184	0.180	0.000	0.199
Annual Crop Loss	0.007	0.007	0.007	0.007	0.007	0.007
Local Household Spending (Years 2 to 5)	0.506	0.529	0.481	0.477	0.930	1.129
With 75% Loading	0.379	0.396	0.360	0.358	0.697	0.847
Land Easements/Net Revenues (.75 Load)	0.300	0.300	0.300	0.300	0.515	0.475
Years 6 to 10:						
Wages & Salaries	0.225	0.225	0.225	0.225	0.692	0.692
Property Taxes	0.379	0.452	0.334	0.335	0.000	0.364
Annual Crop Loss	0.007	0.007	0.007	0.007	0.007	0.007
Local Household Spending (Years 6 to IO)	0.676	0.749	0.631	0.632	0.930	1.294
With 75% Loading	0.507	0.562	0.473	0.474	0.697	0.970
Land Easements/Net Revenues (.75 Load)	0.300	0.300	0.300	0.300	1.760	1.643
Years 11 to 30:						
Wages & Salaries	0.225	0.225	0.225	0.225	0.692	0.692
Property Taxes	0.332	0.357	0.292	0.293	0.000	0.319
Annual Crop Loss	0.007	0.007	0.007	0.007	0.007	0.007

Local Household Spending (Years 1 1 to 30)	0.629	0.654	0.589	0.590	0.930	1.248
With 75% Loading	0.471	0.491	0.442	0.443	0.697	0.936
Land Easemerits/Net Revenues (.75 Load)	0.300	0.300	0.300	0.300	6.516	6.469

Source: DanMar and Associates

Model Inputs

Implementation of the regional economic modeling system for use in projecting the impact of windpower development depends on an extensive set of data inputs ranging from expenditures for construction materials and construction worker payrolls to yearly operations and management expenditures. It also requires data on the income of local residents received from locally generated energy sales, and the disposition of this income.

For projecting windpower development impacts, we assume for each development phase and strategy a one-year construction period and three operating periods-the immediate post construction, a slightly longer operating period following the post-construction period, and a 20-year period for stabilizing and fine-tuning the windpower energy-generating activities. We focus on the contributions of each phase and strategy to the local economy by starting with measures of model inputs.

Table 11-6 summarizes the engineering-based estimates of energy production requirements under each energy development phase and strategy. First presented are the annual revenues retained within the area after debt service. These would increase sharply from the second to the third operating period. Operating revenues in Phases II through V would not remain in the area. Varying proportions of income payments to local resource owners occur under each of the six development phases. The owners of material inputs would use part of the income received from the energy-producing enterprises to pay for the imports. Income payments to workers converts to personal consumption expenditures at a 75 percent rate. This accounts income losses to the local economy due to federal and state tax payments, savings, and out-of-area personal spending., Income payments for land easements in Phases II through V also convert to personal consumption expenditures at a 75 percent rate as would the income payments to landowners in the two alternative development options and property tax payments in all phases, less the calculated crop losses due to facility construction and operations. For the most part, the model input differences among the first four development phases are small compared to the two phases under the dispersed generation strategy. The annual revenues retained in the area account for the largest differences among the two development strategies. The next largest differences occur in construction, particularly in wage and salary expenses.

Compared with the base year economic activity, as summarized earlier in Table 11-4 and Table 11-5, the local spending generated from windpower development is less than one percent of the total economic activity in the area. The direct effects, however, concentrate in the energy-producing sector where they amount to a much larger proportion of the activity in this sector.

Model Projections

Economic impact projections of the two windpower development strategy outcomes follow the reporting framework established earlier in the presentation of model inputs. They include both the initial construction impact of each development phase as well as the yearly operations and maintenance impact. We present the findings in two parts: the direct, or first-round, effects and the total effects, namely, those accruing from the spending of the labor income payments,

Table 11-7 lists the direct impact projections of three windpower development scenarios--Phase II and Phase V of the concentrated (or absentee) ownership development option and the 600KW dispersed production alternative. The key indicators of economic impact are total industry output, employee compensation, proprietorial income, total value added, and total employment. The earlier tables presented the base year values for each of these indicators

Table 11-7
Local Economic Effects (1995 $ Direct): Southwestern Minnesota Windpower Project

Change Source, By Period	**Phase II**	**Phase V**	**Disbursed Prod. (600 KW**
Year 1 (Labor):			
Total Industry Output (mil.$)	1.058	1.411	1.105
Employee Compensation (mil.$)	0.334	0.628	0.349
Proprietorial Income (mil.$)	0.22	0.159	0.23
Total Value Added (mil.$)	0.664	0.964	0.693
Total Employment (number)	24	35	25
Earnings Per Worker (thou.$)	20.3	19.5	20.3
Total Population (number)	40	59	41
Year 1 (Supplies):			
Total Industry Output (mil.$)	1.195	1798	1.057
Employee Compensation (mil.$)	0.516	0.567	0.475
Proprietorial Income (mil.$)	0.138	0.374	0.134
Total Value Added (mil.$)	0.789	1.128	0.717
Total Employment (number)	26	40	20
Earnings Per Worker (thou.$)	21.8	20.3	26.9
Total Population (number)	44	67	33
Years 2 to 5:			
Total Industry Output (mil.$)	0.477	0.464	0.866
Employee Compensation (mil.$)	0.154	0.15	0.287
Proprietorial Income (mil.$)	0.092	0.09	0.17
Total Value Added (mil.$)	0.292	0.284	0.546
Total Employment (number)	10	10	20
Earnings Per Worker (thou.$)	20.4	20.4	20.3
Total Population (number)	18	17	33
Years 6 to 10:			
Total Industry Output (mil.$)	0.552	0.664	1.598
Employee Compensation (mil.$)	0.177	0.213	0.518
Proprietorial Income (mil.$)	0.108	0.131	0.322
Total Value Added (mil.$)	0.344	0.41	1.005
Total Employment (number)	12	15	36
Earnings per Worker (thou.$)	20.4	20.4	20.3
Total Population (number)	20	25	60

Years 11 to 30:

Total Industry Output (mil.$)	0.531	0.601	4.396
Employee Compensation (mil.$)	0.171	0.193	1.401
Proprietorial Income (mil.$)	0.081	0.118	0.905
Total Value Added (mil.$)	0.325	0.37	2.76
Total Employment (number)	12	13	99
Earnings per Worker (thou.$)	18.7	20.4	20.3
Total Population (number)	20	22	165

Source: Wilbur Maki Associates

The summary table of projected direct effects thus presents a wide range in their values, depending on the initial model inputs. The economic model simply converts the initial inputs into industry outputs and the associated resources employed in producing these outputs. It also provides the corresponding estimates of employee compensation, proprietorial income, and total value added--the latter being the sum of the first two plus indirect business (i.e., production based) taxes. Each of these measures of direct effects represents the contributions of the several development options to the local economy.

In the case of population, the projected employment change triggers a corresponding change in population based on local population-to-employment ratios. This is appropriate when assessing a change over a period greater than one year and not for a one-year construction period . For the construction scenario, therefore, the population indicator serves as an indirect measure of the number of households that could be affected by commuting to the job site. If commuting were to occur and then continue because of a more attractive employment opportunity at or near the site of the newly constructed facility, net out-commuting would decline, in this case, because of the additional in-commuting. A reduction in out-commuting is an alternative way of representing a reduction in the local jobs gap that would have a different set of implications for the local economy, namely, that the earnings from nearby employment or the conditions of work are more favorable than those associated with the more distant employment.

The overall impact of windpower development derives in part from the multiplier effects of the additional economic activity generated by the project. It also derives from the composition of resource use and the balance between labor-intensive and capital-intensive resources. For the six-county area, the indirect effects due to linkages of the energy industry to its supplier is minimal because of the lack of such suppliers and the conditions for their favorable location in the area. Only the induced effects resulting from the spending of (1) the wages and salaries received by local residents from employment in the local energy-producing industry or in the property-tax supported local government and (2) net revenue payments received from the sale of locally-produced energy add to the direct effects of local windpower development. The spending on consumption items, of course, increases the demand for imported consumer goods along with the increase in producer demand for labor. The level of imports and the conditions for establishing a business that competes successfully against the imports may change sufficiently to warrant the founding of a new local business.

Table 11-8 summarizes the projected multiplier-enriched local effects of windpower development in the six-county area. The total effect is typically less than twice the direct effect. The economic (i.e., the so-called "Type III") multiplier is less than two. The sum of the indirect and induced effects in the six-county area is less than one-half of its corresponding value, for example, in the Twin Cities metropolitan area. This means that more than one-half of the "spillover" effects of windpower development in the six-county area accrue to other areas, with the largest spillover occurring during the facility construction period of Phase II through Phase V. The dispersed production alternative yields the smallest spillover to other areas as evidenced by its higher ratio of total employment to direct employment change. Enlarging the local impact area to include more counties would, of course, increase the multiplier effect, but only slightly. Over several years and over a geographically larger market area, however, the gradual growth of new businesses capitalizing on productive local labor resources and low-cost community infrastructure and services would result in the internalization of more and more of the indirect and induced effects, thus further enhancing the local impact of new business development.

Table 11-8
Local Economic Effects (1995 $ Total): Southwestern Minnesota Windpower Project

Change Source, By Period	Phase II	Phase V	Disbursed Prod. (600 KW)
Year 1 (Labor):			
Total Industry Output (mil.$)	1.926	2.721	1.81
Employee Compensation (mil.$)	0.6	1.007	0.703
Proprietorial Income (mil.$)	0.395	0.413	0.287
Total Value Added (mil.$)	1.176	1.665	1.158
Total Employment (number)	41	60	35
Earnings Per Worker (thou.$)	20.9	20.6	24.9
Total Population (number)	69	101	58
Year 1 (Supplies):			
Total Industry Output (mil.$)	2.151	3.282	2.011
Employee Compensation (mil.$)	0.805	1.023	0.627
Proprietorial Income (mil.$)	0.332	0.616	0.413
Total Value Added (mil.$)	1.35	2.004	1.228
Total Employment (number)	45	71	43
Earnings Per Worker (thou.$)	21.9	20.2	20.9
Total Population (number)	76	118	72
Years 2 to 5:			
Total Industry Output (mil.$)	0.861	0.838	1.571
Employee Compensation (mil.$)	0.272	0.265	0.505
Proprietorial Income (mil.$)	0.17	0.165	0.312
Total Value Added (mil.$)	0.52	0.506	0.964
Total Employment (number)	18	18	34
Earnings Per Worker (thou.$)	20.9	20.9	20.8
Total Population (number)	31	30	57
Years 6 to 10:			
Total Industry Output (mil.$)	0.998	1.201	2.912
Employee Compensation (mil.$)	0.315	0.378	0.923
Proprietorial Income (mil.$)	0.198	0.24	0.587
Total Value Added (mil.$)	0.604	0.728	1.783
Total Employment (number)	21	26	63
Earnings Per Worker (thou.$)	20.9	20.9	20.9
Total Population (number)	36	43	105
Years 11 to 30:			
Total Industry Output (mil.$)	0.97	1.087	8.028
Employee Compensation (mil.$)	0.303	0.343	2.528
Proprietorial Income (mil.$)	0.121	0.216	1.636
Total Value Added (mil.$)	0.581	0.658	4.907
Total Employment (number)	20	23	173
Earnings Per Worker (thou.$)	18	20.9	20.9
Total Population (number)	34	39	290

Source: Wilbur Maki Associates

According to the impact projections the dispersed production scenario produces 25 to 150 more jobs and $700 thousand to $4.3 million in total value added than the Phase II scenario. Associated with this contribution are the implicit challenges in learning and practicing the new technical skills for managing a totally new type of business.

Summary

Economic dependence of rural areas on essentially one industry--agriculture--contributes to a "boom-and-bust" economy that is characterized by a high volatility of income and earnings. Careful examination of the commodity disbursements of the agriculture and food industries in the six-county area shows the extreme dependence of this sector on export markets. Local markets are almost entirely other industries that make up the intermediate demand sector of the local economy. These include the meat packing and dairy products manufacturing businesses that also ship most of their production to markets outside the six-county area.

Shipments of locally-produced products to both local and export markets-generates the income for purchasing the production inputs of labor and capital, and intermediate products used in the production processes. Unlike the product disbursements, however, industry input purchases in the six-county area are reported for the local area, given the method of measuring the primary inputs of labor and capital used in local production, namely, at the place of production.

The overall impact of windpower development derives in part from the multiplier effects of the additional economic activity generated by the project. It also derives from the composition of resource use and the balance between labor-intensive and capital-intensive resources. For the six-county area, the indirect effects due to linkages of the energy industry to its supplier is minimal, given the lack of such suppliers and the conditions for their location in the area. Only the induced effects resulting from the spending of (1) the wages and salaries received by local residents from employment in the local energy-producing industry or in the property-tax supported local government and (2) net revenue payments received from the sale of locally-produced energy add to the direct effects of local windpower development. The spending on consumption items, of course, increases the demand for imported consumer goods along with the increase in producer demand for labor. The level of imports and the conditions for establishing a business that competes successfully against the imports may change sufficiently to warrant the founding of a new local business.

The total effect is typically less than twice the direct effect. The economic (i.e., the so-called "Type III") multiplier is less than two. The sum of the indirect and induced effects in the six-county area is less than one-half of its corresponding value, for example, in the Twin Cities metropolitan area. This means that more than one-half of the "spillover" effects of windpower development in the six-county area accrue to other areas, with the largest spillover occurring during the facility construction period of Phase II through Phase V. The dispersed production alternative yields the smallest spillover to other areas as evidenced by its higher ratio of total employment to direct employment change. Enlarging the local impact area to include more counties would, of course, increase the multiplier effect, but only slightly. Over several years and over a geographically larger market area, however, the gradual growth of new businesses capitalizing on productive local labor resources and low-cost community infrastructure and services would result in the internalization of more and more of the indirect and induced effects, thus further enhancing the local impact of new business development.

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Appendix

Table 1. Total employment, value added. and input purchases of specified industry, by type of outlay, Southwestern Minnesota Windpower Impact Area.. 1985.

Table 2. Total purchases of specified locally-produced commodities, by intermediate and final demand sectors, Southwestern Minnesota Windpower Impact Area, 1985.

Table 1. Total employment, value added, and input purchases of specified industry, by type of outlay, Southwestern Minnesota Windpower Impact Area, 1990.

Table 2. Total purchases of specified locally-produced commodities, by intermediate and final demand sectors, Southwestern Minnesota Windpower Impact Area, 1990.

Base Year Information

Base Year Coefficients

Local Economic Effects (direct: total): Table Listing

Scenario WIND_C2: Direct Effects

Scenario WIND_C2: Total Effects

Scenario WIND_C5: Direct Effects

Scenario WIND_C5: Total Effects

Scenario WIND_C6: Direct Effects

Scenario WIND_C6: Total Effects

Scenario PCE90C2: Direct Effects

Scenario PCE90C2: Total Effects

Scenario PCE90C3; Direct Effects

Scenario PCE90C3: Total Effects

Scenario-WIND_C22: Direct Effects

Scenario WIND_C22: Total Effects

Scenario WIND_C23: Direct Effects

Scenario WIND_C23: Total Effects

Scenario WIND_C24: Direct Effects

Scenario WIND_C24: Total Effects

Scenario WIND_C52: Direct Effects

Scenario WIND_C52: Total Effects

Scenario WIND_C53: Direct Effects

Scenario WIND_C53: Total Effects

Scenario WIND_C54: Direct Effects

Scenario WIND_C54: Total Effects

Scenario WIND_C62: Direct Effects

Scenario WIND_C62-. Total Effects

Scenario WIND_C63: Direct Effects

Scenario WIND_C63: Total Effects

Scenario WIND_C64: Direct Effects

Scenario WIND_C64: Total Effects