Evaluation of the Wind Energy Conversion Facility Pilot Loan Program

Submitted in accordance with 1997 Minnesota Session Laws, Chapter 216

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EXECUTIVE SUMMARY:

The purpose of this report is to make recommendations on whether to permanently change the Agricultural Improvement Loan Program offered by the Minnesota Rural Finance Authority (RFA) to allow for increased participation by the state in wind energy conversion facility loans.

Wind Energy Markets for Minnesota Farmers.

The development of wind generation in Minnesota has proceeded largely because of a legislative initiative. In 1994, Northern States Power Co. (NSP) made a commitment to buy or produce 425 megawatts (MW) of wind-powered electricity by 2002. NSP chose to purchase wind energy in five phases and contracted with developers like Enron Wind Corp. of California to meet this objective.

The first 25 megawatts of wind energy originated along the Buffalo Ridge in southwestern Minnesota before the 1994 legislation, since this area offered viable wind resources. Additional projects are also located on rural lands along the Buffalo Ridge. Farmers in this area have achieved financial benefit from these wind farms largely through lease and royalty agreements with developers.

Capital and Operating Costs for Wind Energy Facilities.

The cost of energy associated with wind turbines designed for wind farms can be divided into components of capital costs, operations and maintenance costs, and the levelized costs of overhaul and major subsystem replacement. A Wind Energy Series, Issue Paper 11 published in January 1997 by the National Wind Coordinating Committee estimates the total Cost of Energy at 4.37 cents/kWh.

Development Models for Wind Energy Ownership.

A survey was mailed to 400 farmers along the Buffalo Ridge in Lincoln, Pipestone, Rock, and Nobles counties to determine their comfort level toward investing in wind energy. Respondents were asked if they were to be involved in the development of wind energy, what participation level would they prefer? Twelve percent (12%) of farmers responded that they would own and operate wind turbines themselves; seventeen percent (17%) of the farmers prefer to be part of an investment pool or cooperative; fifty nine (59%) of the respondents would prefer to either sell wind rights to a developer or lease wind rights and make money as a percentage of the sale of electricity; twelve percent (12%) of the respondents chose not to be involved in wind energy development.

Farmers believe that a rural electric cooperative offers a natural home for wind energy development. Cooperatives are frequently located in rural areas and often serve geographically dispersed populations. The traditional concept of an agricultural cooperative creates difficulty in accurately measuring patronage in wind businesses. However, a cooperative formed by farmers holding an ownership interest in a wind generation facility could provide economic benefits based on kWh generated.

Minnesota communities have taken initiatives to "municipalize" wind energy with community support and ownership. An example of this ownership model is Moorhead Municipal Public Service. More than 400 Public Service customers have signed up as charter members of the Capture the Wind Program. Wind power subscribers will pay a half-cent more per kilo-watt hour for the power.

Financing Requirements for Wind Energy Facilities

Profitability of wind energy facilities is dependent upon capital and operating costs, sales price of electricity, contract terms, ownership structure, financing terms, and wind energy incentives. State of the art facilities of a 600 to 750 kW size offer increased performance and reliability. However, these generators have an installed cost of $1,000 to $1,100 per installed kW capacity. Farmers believe that they must take advantage of economies of scale to harvest the wind economically. Their view emphasizes the importance of reducing capital cost and of increasing reliability. These goals represent one of the leading economic tradeoff issues faced by wind turbine designers.

Farmers responding to the Wind Energy Survey indicated that there were a number of factors that deterred them from individually owning and operating a wind turbine. Foremost, was the capital costs of a wind energy facility. Farmers also cited lack of understanding of wind energy economics, lack of operating knowledge, difficulty selling electricity and low profits as barriers to individual ownership.

RFA participating lenders in Southwestern Minnesota had little to no loan activity for wind generation facilities. One bank had advanced money to a borrower for the purpose of financing, improving, or adding to a wind energy project. The size of the loan was between $25,000 to $50,000. Rural lenders viewed individual ownership of wind energy projects as unproven and indicated that they would rely on applicants financial resources unrelated to the project in order to make a credit decision.

Features of the Wind Energy Pilot Loan Program

The 1997 legislative session authorized a wind energy conversion facility pilot loan program available through the RFA. The RFA will participate in 45% of the principal amount of a loan up to $500,000. The RFA has not received an application under the Wind Energy Pilot Loan Program. The loan program is not attractive to farmers due to the collateral requirement of a real estate mortgage. European countries have price agreements in place and the Power Purchase Agreement becomes collateral for the loan.

Increased State Participation

Based on the above, the RFA recommends that no permanent changes be made to the Agricultural Improvement Loan Program offered by the RFA to allow for increased participation by the state in wind energy conversion facility loans. However, given the level of interest by farmers along the Buffalo Ridge to be part of an investment pool or cooperative, the legislature may consider incentives directed toward a rural electric cooperative or other ownership models.

INTRODUCTION

Purpose of this Report

The purpose of this report is to evaluate the Wind Energy Conversion Facility Pilot Program and to recommend whether to permanently change the Agricultural Improvement Loan Program offered by the Minnesota Rural Finance Authority (RFA) to allow for increased participation by the state in wind energy conversion facility loans in accordance to Chapter 216 Minnesota Session Laws-1997.

Background

In 1994, Northern States Power Company (NSP) made a commitment to buy or produce 425 megawatts (MW) of wind-powered electricity by 2002. Part of that decision allowed NSP to store radioactive waste on Prairie Island. NSP chose to purchase that power in five compounding phases. Phase I was commissioned in May 1994 and comprises 73 wind generators or turbines generating 25 MW of power. Phase II comprises 143 turbines generating 107 MW of power. Phase III consists of 138 turbines generating 103 MW of power. Phase IV and V will include 200 MW of capacity. All phases must be operational by December 31, 2002, for NSP to meet the 425 MW requirement.

The 1997 legislative session authorized a wind energy conversion facility pilot loan program available through the RFA. RFA will participate in 45 percent of the principal amount of a loan up to $500,000. The legislation requires the RFA to report on its experience with the pilot program by January 15, 1999. The report is to include recommendations on whether to permanently change the Agricultural Improvement Loan Program offered by the RFA to allow for increased participation by the state in wind energy conversion facility loans.

Methodology

Minnesota Department of Agriculture staff conducted interviews with professional staff from Sustainable Resources Center, Minnesota for Energy Efficiency, Minnesota Agricultural Statistics and the University of Minnesota. The MDA staff scheduled meetings with developers and farmers invested in wind energy facilities. The Department mailed a survey to southwestern Minnesota agricultural lenders requesting information on credit standards for wind energy facilities. The Department also mailed a survey to farmers from the Buffalo Ridge area of southwest Minnesota to evaluate farmers interest and involvement in wind energy. The lender and farmer survey results are tabulated and shown in Appendices B and C.

Reports on other states' financial incentives directed to renewable energy technologies were reviewed. The agency reviewed information from the Energy Policy Research Institute (EPRI). Additional data was obtained through electronic means using a variety of resources from state and federal agencies.

Objectives

- To profile wind energy conversion facilities in Minnesota.
- To evaluate potential wind energy markets for Minnesota Farmers.
- To identify capital and operating costs for various wind energy facilities.
- To compare features of various wind energy ownership models.
- To determine financing requirements for wind energy facilities.
- To profile the loan features and eligibility requirements of the RFA Agricultural Improvement Loan Program.
- To evaluate the effectiveness of increased participation by the state in wind energy conversion facility loans.
- To determine whether or not to make permanent changes to the RFA Agricultural Improvement Loan Program.

WIND ENERGY PROJECTS SELECTED BY NSP

- Phase I

Commissioned in May 1994, NSP's first 25MW wind generation facility was built on 2,800 acres on the Buffalo Ridge. It included 73 wind turbines rated at 330 kW per unit for a total cost of $28 million. NSP bought the wind rights and easements from farmers. Kenetech built the machines. Erron Wind Corporation operates the wind generators.

- Phase II

Commissioned in September 1998, NSP's second 107 MW wind generation facility is located northwest of Lake Benton and encompasses 19,168 acres of privately owned land on the Buffalo Ridge secured under easement by NSP. Enron Wind Corporation of California built and operates the wind plants. Phase II includes 143 turbines rated at 750 kW per unit for an estimated total cost of $86 million.

- Phase III

Phase III will be constructed on the Buffalo Ridge in an area southeast of the existing Kenetech site (Phase I). The site encompasses a total of 13,750 acres of privately owned land, which is being secured under easement by NSP. Enron Wind Corporation of California will build and operate the wind plants. The facility will include 138 turbines rated at 750 kW per unit. Total cost is estimated at $83 million.

- Phase IV and V

Phases IV and V are under consideration by NSP and pending approval of the Minnesota Environmental Quality Board. Both phases will be capable of producing 100 MW of wind-generated electricity and must be operational by December 31, 2002, for NSP to meet the 425 MW requirement. Ownership, location and technology features of these phases are undetermined.

WIND ENERGY MARKETS FOR MINNESOTA FARMERS

Farmers and rural landowners in Minnesota have built a number of wind turbines over the last decade in an effort to be self-sufficient. Some of this development was encouraged by Minnesota law that requires utilities to purchase excess power from wind energy facilities smaller than 40 kilowatts at the retail rates.

The 1991 Minnesota Legislature exempted wind energy equipment from property taxes in an effort to encourage further development of wind generation facilities. Wind energy development in Minnesota advanced in 1994 with NSP's commitment to buy or produce 425 MW of wind power electricity by 2002. Local governments, with the support of wind energy developers and advocates, persuaded the Legislature in 1995 to reinstitute a limited property tax on wind energy equipment to ensure that rural communities where wind farms are developed receive a direct financial benefit.

The September 24, 1998, *Star Tribune* article titled "Towering turbines mark alternative-energy milestones" described the completion of Phase II. The article reported:

> The newest wind farm will produce 107 megawatts of electricity and is owned and operated by Enron Wind Corp. of California, a subsidiary of Enron Corp., one of the world's largest electricity and natural-gas companies.
>
> The additional power, like the first 25 megawatts that started flowing in mid-1994, comes from turbines stretched along the Buffalo Ridge, which rises from the prairies like a backbone and extends about 60 miles from the eastern Dakotas through southwestern Minnesota and into Iowa.
>
> The generators sit atop 168-foot hollow steel towers that are spread across several miles of farmland northwest of Lake Benton. Landowners received lump-sum payments of $5,000 per machine, as well as payment for easements and buffer areas.
>
> Property taxes paid by the utility will benefit Lake Benton Township, the local school district and Lincoln County.

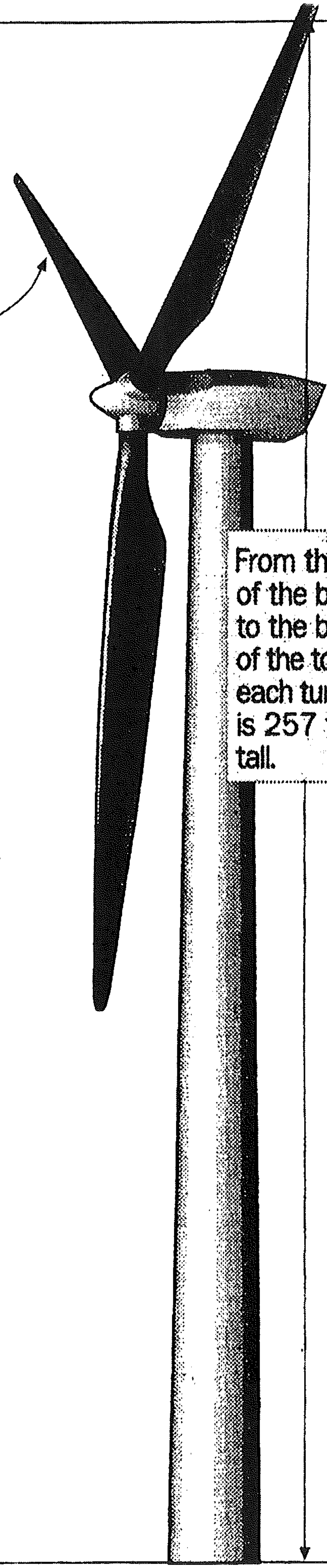
The *Star Tribune* graphic by Mike Godfrey and Greg Branson titled "Power from the wind" offers a visual illustration of wind energy development in southwestern Minnesota.

Power from the wind

A new wind farm in southwestern Minnesota is the largest single wind-farm project in the world. Each one of its 143 wind turbines can supply 750 kilowatts — enough electricity to service the needs of 250 average homes for a year. While the farm is spread out over 4,700 acres of land, it uses only 2 percent of the area, allowing the rest to be farmed.

The blades are 76.1 feet long and 2½ tons each. The distance from blade tip to blade tip is 157 feet — about the size of the wingspan of a DC-10 airplane.

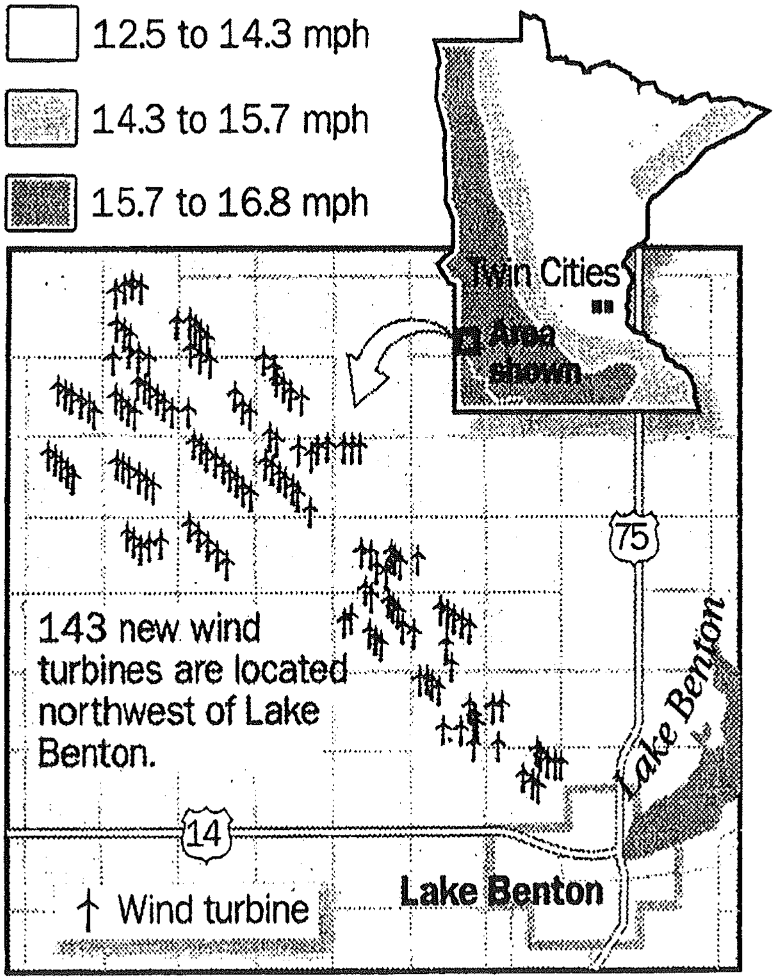
Enough concrete was used for foundations of the 143 towers to build an entire Washington Monument.



From the tip of the blade to the base of the tower, each turbine is 257 feet tall.

Minnesota average wind speed

- 12.5 to 14.3 mph
- 14.3 to 15.7 mph
- 15.7 to 16.8 mph



Source: Enron Wind Corp.

Star Tribune graphic by Mike Godfrey and Greg Branson

CAPITAL COSTS FOR WIND ENERGY FACILITIES

The cost of energy associated with wind turbines designed for wind farms has been resolved into the components of capital, operations and maintenance costs, and the levelized costs of major subsystem replacement. These cost components are described in detail below.

State-of-the-art facilities are 600 to 750 kW generators at a cost of $1,000 to $1,100 per installed kW capacity. NEG Micon, the largest manufacturer of wind generators is building 750 kW to 1.5 MW facilities since they offer greater efficiencies. The expected production efficiency of current technology wind generators is in the range of 30 percent to 35 percent. However, that is dependent on wind resources. Table 1 provides a comparison of capital costs for selected wind generation facilities.

Table 1
Project Costs Utilizing 600 kW Turbine

	600 kW 1 Turbine	10 MW 17 Turbines	100 MW 166 Turbines
Concrete	$9,000	$150,000	$1,300,000
Rebar	$5,000	$77,000	$664,000
Backhoe	$1,250	$17,000	$120,000
Tower Imbed/Bolts	$8,000	$128,000	$1,250,000
Crane	$10,000	$150,000	$1,250,000
Support Crane	$1,000	$17,000	$125,000
Transformer	$8,500	$145,000	$1,250,000
Erection Labor	$3,000	$50,000	$500,000
Drop Cable	$250	$8,000	$66,000
Electrical Labor	$3,750	$55,000	$550,000
Wire	$3,750	$60,000	$500,000
Foundation Labor	$3,000	$50,000	$500,000
Roads and Site Prep	$2,500	$35,000	$330,000
QC Supervision	$2,500	$30,000	$250,000
HV Line Extension	$8,000	$125,000	$800,000
Construction Total:	**$69,250**	**$1,097,000**	**$9,555,000**
HV Sub/Intercon	$6,000	$400,000	$3,100,000
Turbines/600 kW	$445,000	$7,325,000	$68,890,000
Towers – 50m	$70,000	$1,150,000	$10,800,000
Land Easements	$1,000	$180,000	$5,000,000
Site Certificate	$1,500	$29,000	$250,000
Bid Process/PPA	$1,250	$27,000	$650,000
Project Total:	**$594,000**	**$10,208,000**	**$98,245,000**

*The cost figures in Table 1 are from the Southwest Regional Development Commission's *"WINDPOWER INFORMATION"* study completed in February, 1997.

OPERATIONS AND MAINTENANCE COSTS FOR WIND ENERGY FACILITIES

The costs of operation and maintenance (O&M) include all normally recurring costs associated with routine operation of the installed facility. The O&M costs do not include extraordinary or infrequently incurring costs, such as major overhauls of the wind turbines and other systems. These costs are included in the Levelized Replacement Costs (LCR) cost component.

The majority of the O&M costs are associated with maintenance. The **Wind Energy Costs Issue Paper,** by the National Wind Coordinating Committee, found that maintenance costs generally are grouped into three categories:

Unscheduled but statistically predictable routine maintenance visits to cure wind turbine malfunctions;

Scheduled preventive maintenance for the wind turbines and the power collection system; and

Major overhauls and subsystem replacements of the wind turbine.

The first two categories, unscheduled and scheduled maintenance, occur during the course of a year and are included in the O&M cost section. The third occurs at intervals of five, 10 or 15 years and is included in the LRC cost component (discussed below in the section on levelized replacement costs).

The maintenance costs for modern wind farm turbines are 1 cent/kWh or less. The major component of the total maintenance cost is the unscheduled maintenance, followed as a distant second by the preventive maintenance and a still more distant third by the cost of the major overhaul and replacements. Assuming 0.9 cent/kWh, the total cost of maintenance thus might be broken down as follows:

unscheduled maintenance visits	75%	0.68 cents/kWh
Preventive maintenance visits	20%	0.18 cents/kWh
Major overhaul	5%	0.04 cents/kWh
Total cost of maintenance	100%	0.90 cents/kWh

**Wind Energy Series, Issue Paper 11, January 1997, National Wind Coordinating Committee.*

These maintenance cost elements according to the **Wind Energy Costs Issue Paper** by the National Wind Coordinating Committee are discussed in more detail below.

Unscheduled maintenance: Wind turbines designed for use in wind farm arrays will have a small number of malfunctions each year. Typically a two-person maintenance crew using a small truck equipped with tools, spares and diagnostic equipment addresses these malfunctions. Often the repair is finished quickly, typically in one to four hours.

While malfunctions are not predictable for a given wind turbine, their numbers are predictable over the course of a year. Usually, the wind turbine manufacturer, through a combination of operating experience and analysis, is able to provide estimates for each major subsystem of the wind turbine. In addition, the average repair time also can be estimated.

Scheduled preventive maintenance: Preventive maintenance visits typically occur once per year for each wind turbine. If the wind has a seasonal profile, then the preventive maintenance visits may be planned for the low-wind part of the year. Depending on the design, the preventive maintenance visit typically may take a two-person crew about two hours per wind turbine. This minimizes lost energy production. Substation and power collection system maintenance may have more of an impact on energy production since all or part of the wind farm power delivery system is affected.

Major overhaul. Depending on the details of the design, major overhaul of a wind turbine occurs every five, 10, or 15 years. The major overhaul addresses the gears, bearings, seals, and other moving parts. Usually the generator and the enclosed tower top machinery are removed from the tower and transported to a nearby depot maintenance facility. Often the removed nacelle and equipment are replaced immediately with a rebuilt assembly.

Short of a major overhaul, there may be subsystems that require infrequent replacement, which can be replaced with the generator still mounted atop the tower. Replacement of the wind turbine blades is an example of this category of infrequent subsystem replacement.

Because these costs are incurred at intervals of several years and not routinely during each year, correct accounting for their costs requires an annual accrual of funds. The objective of this accrual is to have the funds available when the need for overhaul or replacement occurs. The accrual involves a net present value calculation to level or apportion the overhaul and replacement costs to an annualized basis consistent with the other cost elements.

Other cost elements

In addition to the costs of the maintenance staff, replacement parts and other maintenance items, the O&M cost element typically includes other routine costs. The National Wind Coordinating Committee listed the following as annually-recurring operating costs:

1. Property and other taxes

2. Land-use payments

3. Insurance

4. Transmission access and wheeling fees

5. Management fees and general and administrative costs

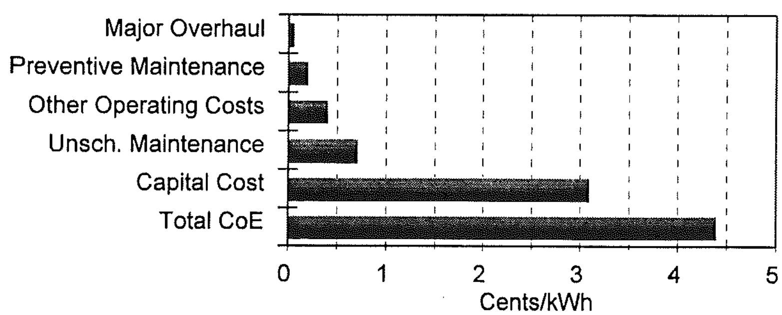
The values of these operating cost elements vary depending on the situation. The local property tax structure, the land-use agreement, insurance rates and remaining fees vary from locale to locale and from one wind farm installation to another. Most are the result of specifically negotiated arrangements. However, the range of variability is not as important as the typical values. Compared with the maintenance costs, these operating cost elements typically are small and in total contribute less than a half cent to the overall cost of energy.

Total cost of energy

The cost of energy associated with wind turbines designed for wind farms has been resolved into the components of capital cost (via the Fixed Charge Rate), operations and maintenance costs, and the levelized costs of overhaul and major subsystem replacement. In summary, the estimated values of the costs of energy are portrayed in Figure 1 and summarized in table 2.

Figure 1

Comparison of Cost of Energy Component



The relative magnitudes of these estimated values provide insight into where the overall economics of these systems may be impacted. From figure 1 and table 2, we see that the leading component of Cost of Energy is the capital cost, followed next by the costs of unscheduled maintenance. Together, these two leading components represent 86 percent of the total Cost of Energy for this illustrative example. These values underscore the importance of reducing capital cost and of increasing reliability. These often-contradictory goals represent one of the leading economic tradeoff issues faced by wind turbine designers.

TABLE 2**

Comparison of Estimated Cost of Energy (CoE) Components

CoE Component	Value (cents/kWh)	Basis for a Estimate a	Percent of Total CoE
Capital cost (ICC*FCR)	3.08	Used FCR=7.5%/year and Specific Capital Cost=41 cents/(kWh/yr.)	70%
Unscheduled Maintenance	0.68	75% of 0.9 cents/kWh total maintenance cost	16%
Preventive maintenance	0.18	20% of 0.9 cents/kWh total maintenance cost	4.1%
Major overhaul (LCR)	0.04	5% of 0.9 cents/kWh total maintenance cost	0.92%
Other operating cost elements	0.39	Estimated values*	8.9%
Total CoE	4.37	Total of CoE components	100%

*All estimated proceed form a hypothetical wind turbine and wind resource characterized by the values:

Power rating	500kW
Installed capital cost	$1,000/kW
Capacity factor	28%
Energy Production	1.226 million kWh/Yr.

** *Wind Energy Series, Issue Paper 11, January 1997, National Wind Coordinating Committee*

DEVELOPMENT MODELS FOR WIND ENERGY OWNERSHIP

According to the **Landowner's Guide to Wind Energy**, Minnesota farmers have a variety of options for developing wind resources on their property: first, a royalty or annual installment payment; second, a lump-sum lease payment; third, individual ownership; and fourth, shared ownership through an investment pool. The guide makes the following comparison of the farmer's options:

- The **royalty or annual installment payment** is usually based on a percentage of gross revenues from the energy sales, such as 2 percent over the first 15 years of production, escalating to 4 percent over the second 15 years. Landowners with the royalty payment provisions accept a higher level of risk since compensation will vary with performance of the wind generator.

- The **lease payment option** is a one-time, lump-sum payment per turbine installed on a landowner's property, for example, $5,000 per turbine. The landowner assumes no financial or management responsibility for the project. The developer assumes full responsibility for all aspects of the wind project: site selection and installation; financial and legal matters; operations and maintenance. One-time payments minimize project performance risk.

- The **individual owner/developer** assumes full responsibility for finding and measuring the best site, financing, permitting, purchasing and installation of equipment, operation and maintenance of the turbine(s), and negotiations of energy contracts.

- The **shared ownership or investment pool** raise the necessary capital for a wind project, which is planned, constructed, and operated by an independent developer. The farmer-investor takes on the risk and responsibility for acquiring project financing and has some control over the management of the wind plant.

The Wind Energy Ownership Models are discussed in more detail below.

Royalty or Annual Installment Payment

Landowners who lease their land to wind developers for wind energy projects may be offered a variety of payment options, ranging from a one time, lump-sum payment to annual royalty payments.

The **Landowner's Guide to Wind Energy,** by the Izaak Walton League advises that the terms of the payment must be carefully defined. For example, the basis of a royalty payment can greatly affect payment amounts and risks. Royalties may be based on a percentage of the net of gross energy production, energy deliveries to the customer, sales revenues, or profits. Royalty payments may also be affected by the power purchase agreement between the developer and the utility. For example, if the agreement specifies that the price will decrease after a period of years, the royalty payments will also decrease. Unfortunately, there is no way for the landowner to know the terms of the power purchase agreement when approached by the developer.

Lease Options for Wind Energy Facilities

In addition to payments for energy production and turbine placement, wind projects also occupy land for turbine pads, power lines, roads, substations, and anemometer towers. This equipment takes land out of production and the developer compensates the landowner for these impacts.

The **Landowner's Guide to Wind Energy** listed the following as necessary parts of an optimal contract.

- Whether there will be one payment or a series of payments;
- When each payment will be made;
- What each payment is for;
- How the payments are to be calculated;
- Whether there are minimum guaranteed payments;
- Whether the minimum payments are in addition to or subtracted from other payments;
- That the landowner has the right to verify with the utility any data used to calculate the payments;
- That the landowner has the right to energy production records for each turbine on the property;
- That the landowner has the right to an independent audit of the developer's books at specified intervals to verify payment computations;
- How and to whom the payment is to be made; and,
- The developer will keep discrete records for the portion of the project on the landowner's property, according to the terms of the royalty.

Individual Owner/Developer

As part of this report, 400 farmers - a statistical representation of the 2,900 farmers in the Buffalo Ridge area of Southwestern Minnesota - were mailed a Wind Energy Survey. Nobles, Rock, Lincoln, and ~~Lyon~~ Pipestone counties were included in the survey.

The survey was conducted by Hamline University student, JoLynn Sovell, as part of her senior honors project, in cooperation with Minnesota Agricultural Statistics Service, and personnel from the Rural Finance Authority. More than 40 percent, or 162 surveys, were returned. According to the Minnesota Agricultural Statistics, 20 percent response rate would be statistically accurate.

Questions focused on the farmer's comfort level with, knowledge of and willingness toward investing in wind energy. Of the responses received, one farmer had invested in a wind energy development project as a member of a corporation and eight farmers had signed a contract to sell their wind rights.

Farmers appear most comfortable with the large-scale wind farms (20 + Turbines) and the small-scale wind farms (3 to 20 Turbines). Respondents prefer to either sell or lease wind rights to a developer when given a choice of participation level in the development of wind energy. Only 12 percent of the farmers indicated they would, if given the opportunity, individually own and operate a wind turbine.

Shared Ownership or Investment Pool

Since the costs are often too much for a single investor, the idea of farmer - or other local investor - owned wind energy cooperative is often discussed. The **Locally Owned Wind Energy Feasibility Project,** published in May, 1997 by the Cooperative Development Services of Madison and the Minnesota Project, found that an agricultural cooperative is unlikely. Farmers and other investors would presumably pool their money, build a wind turbine, and sell power to NSP. However, since farmers do not buy power from NSP there are no directly traceable goods or services bought from or sold to the wind business by members. This creates difficulty in accurately measuring patronage in wind businesses.

It may be helpful to briefly comment on the organizational structure of cooperatives to further explain this impediment. Cooperatives have been used to address a wide variety of economic conditions and meet diverse challenges. Rural Electric Cooperatives (RECs) were started by farmers in the 1930s to obtain electric services when rural areas were unable to obtain service from privately held companies. A cooperative is a business that is owned and controlled by the people who use it. Its primary purpose is to provide goods and services to its members for mutual benefit.

Cooperatives operate much like other businesses. However, they are unique in certain aspects, including:

> Members own their own cooperative. As owners, members provide the capital necessary for start-up and growth of the business.
>
> Members control their cooperative. Each member usually gets one vote, regardless of the amount of equity they have invested in the coop. A board of directors is elected by the cooperative membership.
>
> Members benefit from their cooperative. Profits are distributed to the members in proportion to each member's use of the coop through patronage.

A patronage refund is an amount paid by a cooperative to a patron based on the quantity or value of business done with or for the patron and derived from the cooperative's earnings. For example, if 2 percent of a cooperative's business is with Mr. Jones, and the cooperative has a total net margin for the year of $100,000, then Mr. Jones receives a patronage dividend of $2,000 (100,000 x 2%)

The Cooperative Wind Report, written in May, 1998 by the Renewable Energy Policy Project, argues that Rural Electric Cooperatives (RECs) appear to offer a natural home for wind energy development. They are frequently located in areas rich in renewable resources and often serve geographically dispersed populations that are well matched to small-scale or distributed power systems.

The organizational structure of RECs is an important determinant of the opportunities they offer for wind energy. First and foremost, RECs are owned and governed by the farms, homes, and businesses that pay the electric bills. Co-op "members" also receive "patronage rebates" if the revenue raised exceeds the costs of operation.

RECs are usually set up in two functional groups: distribution cooperatives and generation and transmission (G&T) cooperatives (henceforth "co-ops"). Distribution co-ops own and operate the distribution system and customers' meters and are directly responsible for serving and billing members. They generally buy the energy and capacity they need, often under exclusive or "all-requirements" contracts with a G&T co-op. Distribution co-ops are run by professional managers and governed by a board of directors consisting of co-op members.

G&T co-ops are owned by the distribution co-ops and serve to aggregate rural customer loads in order to take advantage of economies of scale. They own and operate transmission lines and generations or enter into wholesale power purchase contracts with other generators. G&T co-ops are staffed by utility professionals and are governed by a Board that contains the managers and directors from the distribution co-ops of the system.

This structure theoretically means that co-ops have the incentive, the power, and the mechanisms to make decisions to invest in options that would benefit their members, including wind energy. The Fall 1998 issue of ***Sustainable Minnesota*** reported that four wind projects totaling 35 megawatts (MW) are under construction in southwestern Minnesota. The fourth wind project is a 2 MW, three-turbine project being developed as part of a green pricing program of three generation and transmission cooperatives: Cooperative Power (CP), United Power Association (UPA) and Dairyland Power (DP).

There are other situations in which a cooperative could work. For instance, a number of farmers who each owned a wind turbine could form a cooperative to market the power. If the power from the wind turbines is sold to the same utility from which the members buy power, then patronage could be assigned based on each member's electrical usage. This model is similar to that used in Denmark. According to **the Cooperative Wind Report**, wind turbine cooperatives have had a profound effect on the development of wind energy in Denmark. Some 100,000 Danish households, about 5 percent of the population, own a stake in a windmill guild or cooperative.

Danish wind cooperatives receive 85 percent of the retail rate in gross revenue from the sale of wind-generated energy to the local utility at a rate between 10 to 12 cents/kWh; a rate established by the Danish government. Danish law limits participation in a cooperative to those living within the district or an adjoining district to where the turbine is located. Income earned by the cooperative members is tax-free up to 1.5 times the member's domestic electricity consumption. **The Cooperative Wind Report** identified one particularly successful cooperative of 508 families that owns 35 turbines on the west coast of Jutland, Denmark. The cooperative's turbines adjoin 65 turbines installed by the local utility.

One overlooked aspect of Danish success with small cooperatives and single turbine installations is the backing of Danish financial institutions. Like buying a house, wind investors seldom pay cash for the entire cost of the system, choosing to finance a portion of the cost. Danish banks are willing to provide 10-12-year loans at attractive rates for 60 percent to 80 percent of the installed cost. Danish lending institutions are comfortable with financing wind energy for several reasons, most notably the length of a Power Purchase Agreement is longer than the length of the loan and the price paid for electricity is set at the government-established rate.

Minnesota communities have taken initiatives to "municipalize" wind energy with community support and ownership. An example of this ownership model is Moorhead Municipal Public Service. The January 7, 1999 issue of *Agri News* reported that:

> Moorhead has broken ground in preparation for the construction of a 750-kilowatt wind turbine, bringing this city one step closer to providing wind-generated electricity.
>
> Construction has already started on the first phase of the project, a 44-square foot concrete pad that will anchor the turbine and tower. The turbine will be manufactured and shipped in pieces to Moorhead for assembly next spring.
>
> More than 400 Public Service customers have signed up as charter members of the Capture the Wind Program.
>
> "Wind power is renewable and affordable," said Bill Schwandt, general manager of the utility. "No need to mine, burn or dispose of anything."
>
> Wind power subscribers will pay a half-cent more per kilo-watt hour for the power.
>
> The $677,000 turbine is scheduled to begin producing electricity by June 1999.

RISK FACTORS AND IMPEDIMENTS

Farmers responding to the Wind Energy Survey indicated that there were a number of factors that deterred them from individually owning and operating a wind turbine. Foremost was the capital costs of a wind energy facility. Farmers also cited a lack of understanding of wind energy economics, lack of operating knowledge, difficulty selling electricity, and low profits as barriers to individual ownership.

Farmers responding to the survey were asked to rank six intrinsic risk factors when financing a wind energy conversion facility. Respondents ranked the intrinsic risk factors in the following order from highest risk to lowest risk by the mean average: Political, Market, Technology, Operating, Construction, Supply, and other.

The risk factors and a definition are listed below in that order:

- **Political** - The extent the project relies on government policy, direct government support or other regulator factors.
- **Market** - The risk that wind-generated electricity cannot be marketed competitively.
- **Technology** - The risk that the technology is not viable or competitive with alternative energy sources.
- **Operating** - The risk that the facility is not efficiently operated.
- **Construction**- The risk that the project cannot be built or operated in accordance with the business plan.
- **Supply** - The risk that supply of wind energy is not sufficient.

FINANCING REQUIREMENTS FOR WIND ENERGY FACILITIES

A survey was mailed to RFA participating agricultural lenders in Lincoln, Lyon, Pipestone, Murry, Rock and Nobles county in southwestern Minnesota. The survey was conducted by JoLynn Sovell, a Hamline University student, as part of her senior honors project, and personnel from the Rural Finance Authority. The survey showed that RFA participating lenders in southwestern Minnesota had little or no loan activity for wind generation facilities. One bank had advanced money to a borrower for the purpose of financing, improving, or adding to a wind energy project. The size of the loan was between $25,000 to $50,000.

Lenders indicated that the most important supporting documentation needed to make a credit decision on a wind energy facility is a business plan, power purchase agreement, feasibility analysis, performance bond, and financial statements, respectively.

Rural lenders viewed individual ownership of wind energy projects as unproven and indicated that they would rely on applicants' other financial resources unrelated to the project in order to make a credit decision. Lenders commonly require supporting documentation in completing a credit analysis and expect to see profit history, three years of balance sheets, earnings, and income tax returns, and a record of existing debt.

Risk is an important factor in the financing of a wind energy conversion facility. Lenders generally agreed that the assumed risk of a wind energy conversion facility with RFA participation up to 45 percent of the principal of the loan would lower the credit risk.

Rural Lenders responding to a Wind Energy Survey were asked to rank six intrinsic risk factors when financing a wind energy conversion facility. Respondents ranked the intrinsic risk factors in the following order from highest risk to lowest risk by the mean average:

- **Construction-** The risk that the project cannot be built or operated in accordance with the business plan.
- **Market** - The risk that wind-generated electricity cannot be marketed competitively.
- **Technology** - The risk that the technology is not viable or competitive with alternative energy sources.
- **Operating** - The risk that the facility is not efficiently operated.
- **Political** - The extent the project relies on government policy, direct government support or other regulator factors.
- **Supply** - The risk that supply of wind energy is not sufficient.

MINNESOTA WIND ENERGY INCENTIVES

Corporate Renewable Energy Equipment Accelerated Depreciation Allowance
Grant Wind Energy Generation Grants
Loan Value - Added Stock Loan Participation Program
Loan Agricultural Improvement Loan Program for Wind Energy Systems
Property Wind Systems Exemption
Sales Wind Energy Equipment Exemption

Renewable Energy Equipment Accelerated Depreciation Allowance

Minnesota offers an accelerated depreciation provision for renewable energy systems. Minnesota's incentive mirrors the federal modified accelerated cost recovery (MACRS) schedule for renewables. That is, a five-year, 200 percent declining balance accounting method. The federal code it mirrors is titled Accelerated Cost Recovery System and is located in the U.S. tax code in Title 26, Subtitle A, Chapter 1, Subchapter B, Part VI, Section 168.

Wind Energy Generation Grants

Minnesota offers a 1.5 cent per kilowatt-hour payment for electricity generated from new wind energy projects less than 2 MW in capacity. Qualifying projects will receive payments for ten years. From July 1997 to June 30, 1999, this program will be available to new projects up to a statewide capacity ceiling of 7.5 MW. That is, the payments will be made available on a first-come, first-serve basis until new wind capacity statewide totals 7.5 MW. From July 1, 1999, to January 1, 2005, the statewide ceiling will be raised to 100 MW. The ten-year payment period extends beyond the current expiration date of January 1, 2005. For example, a project implemented as late as December, 2004 (assuming the statewide capacity limit of 100 MW has not yet been met) will still be able to receive payments for 10 years beyond that date, but projects that commence in 2005 and thereafter will not qualify.

Value Added Stock Loan Participation Program

This low-interest loan program, which is administered by the Minnesota Department of Agriculture through the Rural Finance Authority, was created in 1994 and is designed to assist farmers wishing to buy into wind generation cooperatives. Under current rules, the maximum size of an individual project supported by a wind energy cooperative is 1 MW. Like Minnesota's Agricultural Improvement Loan Program, this is a participation loan whereby the loans are made by individual financial institutions working with the Rural Finance Authority. Rates under this program average 4 percent. The program is funded through a revolving account.

Agricultural Improvement Loan Program for Wind Energy Systems

This low-interest loan program, which is administered by the Department of Agriculture through the Rural Finance Authority, provides loans to farmers for improvements to or additions to permanent facilities. In 1995, wind energy conversion equipment was added to the definition of agricultural improvements. Like Minnesota's Stock Loan Program, this is a participation loan, whereby the loans are made by individual financial institutions working with the Rural Finance Authority.

Property Tax Exemption

Laws of Minnesota for 1997, Chapter 231, Article 2, Section 7 outlines the tax exemptions for certain wind energy systems.

Small scale wind systems installed after January 1, 1991, are completely exempt from property taxation -including the foundation or support pad - provided they are used as an electric power source, located within one county and owned by the same owner, and produce two megawatts or less of electricity as measured by nameplate ratings.

Medium scale wind energy conversion systems installed after January ·1, 1991, are treated as follows: the foundation and support pad are taxable, the associated supporting and protective structures are exempt for the first five assessment years after they have been constructed, and thereafter 30 percent of the market value of the associated supporting and protective structures are taxable. The turbines, blades, transformers, and related equipment are exempt. Medium scale wind energy systems are located within one county, owned by the same owner, and produce more than 2 but equal to or less than 12 MW of energy as measured by nameplate ratings.

Large scale wind energy conversion systems installed after January 1, 1991, are treated as follows: 25 percent of the market value of all property is taxable, including the foundation and support pad, the associated supporting and protective structures, the turbines, blades, transformers, and its related equipment. Large scale wind energy systems produce more than 12 MW as measured by nameplate ratings.

Sales Tax Exemption

Laws of Minnesota for 1997, Chapter 231, Article 7 exempts wind energy devices from the state sales tax. The exemption includes equipment and all materials used to manufacture, install, construct, repair or replace such systems if the systems are used as an electric power source.

Production Incentives

Minnesota law provides for production incentive payments of 1.5 cents per kWh of electricity generated and sold by wind energy generating facilities of 2 MW or smaller for a period of 10 years. Facilities that become operational between July 1, 1997, and January 1, 2005, are eligible for the payments. The bill is to be funded with a standing appropriation capped at 7.5 MW for the first biennium, and 100 MW overall, for an approximate total of $30 million in potential subsidies for small wind energy producers.

Another bill designed to pave the way for wind energy development in Minnesota exempted wind projects of 5 MW or smaller from all provisions of the state power plant siting process, instead giving local governments limited discretionary oversight. It also provided for a fast-track siting process for larger projects through the state Environmental Quality Board. The overall goal was to make it faster and easier to site wind energy projects, which previously had to go through the same approval process as larger, traditional-fuel power plants.

Appendix A - Definitions

Accelerated Depreciation - Allowing firms to write off depreciation faster than true economic depreciation. Tax depreciation is a non-cash expense meant to roughly represent the loss of asset value with time and is defined as the portion of an investment that can be deducted from taxable income in any given year.

Assessed Value - The value a jurisdiction assigns to a property for tax purposes. Reassessments are typically made on a periodic basis.

Assets - Anything an individual or business entity owns or is owed.

Balance Sheet - The part of a financial statement that shows the assets, liabilities, and capital of a company as of a certain date.

Collateral - Something of value provided to the lender to secure a loan and provide a secondary source of repayment.

Corporation - A state-chartered form of business organization usually with limited liability for shareholders (owners) and an independent legal status.

Dispersed Wind Generation - Wind energy harnessed at a relatively large number of generation sites, with some of the resulting electricity possibly consumed at the site of generation, but with the excess from each site routed to an electricity transmission network.

Deductions - Certain expenditures that may be subtracted from Adjusted Gross Income in the computation of taxable income.

Depreciation - An accounting framework for allocating the cost of an asset over the economic (useful) or accounting life of the asset. Depreciation does not represent a cash outlay, but is a charge to earnings.

Equity - The amount by which the value of a business' assets or property exceeds any claims or liens against it. The difference between total assets and total liabilities.

Exemption - When calculating taxable income, an amount of income that can be excluded from taxation or inclusion in the AGI.

General Obligation Bonds - Bonds issued through public entities to assist in activities that further economic development, education, housing initiatives or other qualified public purposes. These bonds may be tax-exempt or taxable and are backed by the general "faith and credit" of the issuing entity.

Income Statement - The portion of a financial statement that shows the commutative income and expenses of a company for a specific period, e.g., one year.

Intrinsic Risk - Risks inherent in certain industries or types of lending, e.g. commercial real estate, asset-based, and consumer.

Net Income - Net income or net loss refers to the change in equity (i.e., the change in net assets) of an entity during the period as a result of transactions that result in revenues, expenses, gains, and losses. Thus, net income or net loss includes all changes in equity during a period, except for investments by and distributions to owners, and certain other changes in net assets.

Revenue Bonds - Revenue bonds are not general obligations of the State.

Tax Credit - A subtraction from tax liability (as opposed to a subtraction from taxable income). A credit is more beneficial to the taxpayer as it directly reduces the amount of money due in taxes.

Utility Scale Wind Generation - wind energy harnessed at a central site comprised of many turbines.

Working Capital - The excess of current assets over current liabilities. It is the owner's and long-term lender's investment in the current working assets of the business, i.e., accounts receivable and inventory.

Appendix B - Lender Survey

LENDER SURVEY

Minnesota Department of Agriculture
and the
Rural Finance Authority (RFA)

Please take a few minutes to answer the following questions. If you require more space for your responses, please attach an additional sheet. If you wish to include more detailed information, feel free to supplement your responses.

The information being sought focuses on factors contributing to the financing of wind energy conversion facilities. This information will be used to complete a report to the Legislature on the status of the Wind Energy Conversion Facility Pilot Loan Program. These questions are directed to lenders who are eligible to participate in the RFA Wind Energy Conversion Facility Pilot Loan Program and investment bankers that have financed wind energy facilities.

Please return your survey response in the enclosed self-addressed envelope. Thank you.

1. Have you had any customers inquire about financing a wind energy project?

   __3__ Yes   __25__ No

2. Have you advanced money to a borrower for the purpose of financing, improving or adding to a wind energy project?

   __1__ Yes   __27__ No (Move to question 3)

   If yes, was the borrowing entity a (an): circle all that apply:

Individual	Farmer Co-op	Local Utility
Private Developer	Corporation	Other

   Average size of the loan request: **$25 - 50,000**

3. What minimum credit standards need to be met in order to finance a wind energy project. (Please indicate the minimum standards in the blanks below):

Equity Requirement	**40 - 50%**	Collateral	**1.5 - 2:1**
Liquidity	**1. 5 - 2. 0**	Return on Equity	______
Debt Service Capacity	**110 - 115%**	Return on Investment	______

   Comments:

4. What supporting documents are needed to make a credit decision on a wind energy project? (Feasibility analysis, business plan, power purchase agreement, performance bond or other.)

Feasibility analysis	11	Power purchase agreement	13
Business plan	14	Performance bond	8
Financial statements	7		

Other documentation required by area lenders included three years of financial statements, income statement, and tax returns, copies of permits, contracts and sworn construction statement, lease agreements or clear title to land where turbine is located, maintenance agreements and hazard insurance.

5. Rate the assumed risk in making a loan for a wind energy conversion facility.

(Low) _____1 _____2 _____3 __**2**__4 __**10**__5 __**7**__6 __**5**__7 (high)

6. Rate the assumed risk in making a loan for a wind energy conversion facility with an RFA participation up to 45 percent of the principal amount of the loan to a maximum of $500,000.

(Low) _____1 _____2 __**4**__3 __**3**__4 __**6**__5 __**9**__6 __**2**__7 (high)

7. **Rank the following intrinsic risk factors associated with a wind energy project.** Number 1 would represent the highest level of risk, number 2 is the next level of risk, etc., to number 7 as the lowest level.

__**3**__ Technology - The risk that the technology is not viable or competitive with alternative energy sources.

__**5**__ Political - The extent the project relies on government policy, direct government support or other regulator factors.

__**1**__ Construction - The risk that the project cannot be built or operated in accordance with the business plan.

__**4**__ Operating - The risk that the facility is not efficiently operated.

__**6**__ Supply - The risk that supply of wind energy is not sufficient.

__**2**__ Market - The risk that wind generated electricity cannot be marketed competitively.

_____ Other.

Thank you for your response

Appendix C - Farmer Survey

WIND ENERGY SURVEY

Minnesota Department of Agriculture
and the
Rural Finance Authority (RFA)

Please take a few minutes to answer the following questions. These questions are directed to farmers who may be eligible to participate in the RFA Wind Energy Conversion Facility Pilot Loan Program. This information will be used to complete a report to the Legislature on the status of the Wind Energy Conversion Facility Pilot Loan Program.

Please return your survey response in the enclosed self-addressed envelope. Thank you.

1. Have you made a loan request to finance a wind energy project?

   0 Yes **162** No

2. Have you borrowed money to finance, improve or add to a wind energy project?

   1 Yes **161** No (Move to question 3)

   If yes, was the borrowing entity a (an): circle all that apply:

   Individual Farmer Co-op Corporation Other

   Size of the loan request: **$25 - 50,000**

3. Have you signed a contract to sell your wind rights?

   8 Yes **153** No

   If yes, what payment option was chosen?

   One-time payment option **3** % Payment option **4**

   Other **3**

4. What do you see as the barriers to individual ownership?

   102 Lack of capital **63** Lack of operating knowledge

   39 Difficulty selling electricity **32** Low profits

   67 Lack of understanding of wind energy economics **6** Other

5. If you were to be involved in the development of wind energy, what participation level would you prefer?

   __39__ I would sell wind rights and have no further responsibilities.

   __58__ I would lease wind rights and make money as a percentage of the sale of electricity.

   __29__ I would be part of an investment pool or cooperative.

   __20__ I would own and operate the equipment myself.

   __21__ No involvement.

6. Which do you believe is the best way to develop wind energy?

   __59__ Large Scale Wind Farms (20 + Turbines) __25__ On Farm Use (1-2 Turbines)

   __56__ Small Scale Wind Farms (3-20 Turbines) __10__ Don't Support Development

7. Are you interested in the idea of joining with other local investors in the formation of a wind energy cooperative to build turbines?

   __19__ Yes __73__ No __70__ Maybe

8. Rank the following intrinsic risk factors associated with a wind energy project. Number 1 would represent the highest level of risk, number 2 is the next level of risk, etc., to number 7 as the lowest level.

   __3__ Technology - The risk that the technology is not viable or competitive with alternative energy sources.

   / ~~5~~ Political - The extent the project relies on government policy, direct government support or other regulator factors.

   5 ~~1~~ Construction- The risk that the project cannot be built or operated in accordance with the business plan.

   __4__ Operating - The risk that the facility is not efficiently operated.

   __6__ Supply - The risk that the supply of wind energy is not sufficient.

   __2__ Market - The risk that wind generated electricity cannot be marketed competitively.

   _____ Other.

Thank you for your response

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