Wind Integration Study
Introduction

MINNESOTA
DEPARTMENT OF
COMMERCE

Prepared by
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Department of Commerce
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Preface

The wind study performed by EnerNex Corporation on behalf of Xcel Energy and the Minnesota Department of Commerce is a significant advance in the science of understanding the impacts of the variability of wind power on power system operation in the Midwest. The application of sophisticated, science-based atmospheric models to accurately characterize the variability of Midwest wind generation is a vast improvement over previous methods.

This introduction to the wind integration study provides an overview of the study and its findings. For a more detailed examination of the study methodology and results, the reader is referred to the two-volume report found on the Minnesota Department of Commerce website.

Volume 1: Wind Integration Study - Final Report

Volume 2: Characterization of the Wind Resource in the Upper Midwest

Introduction

Reliable power system operation requires a precise balance between load and generation. That means that power production must be increased simultaneously with increases in customer demand and reduced simultaneously with decreases in customer demand.

Wind generation is variable, but how this variation combines with variations in load is a critical factor in determining the impacts. As the output of wind farms increases or decreases relative to the system load, the output of other sources of generation, such as coal or nuclear plants, must be adjusted.

Wind plants are becoming large enough to have measurable impact on system reliability and operating cost.

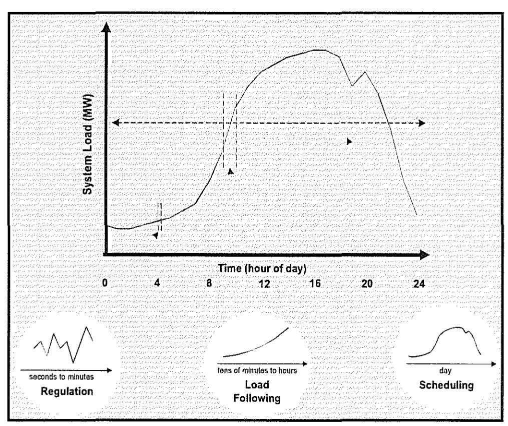
The purpose of this study was to evaluate the impacts on reliability and operating costs of 1500 megawatts of wind generation capacity on the Xcel Energy system with a projected 10,000 megawatts of peak customer load in the year 2010.

Overview of Utility System Operations

The Xcel Energy power system consists of a network of power plants and interconnecting power lines designed to deliver the output of the power plants, or generation, to customer loads. Within this system, generation and load must be matched on a real time basis. This is accomplished by system operators who constantly monitor system load and adjust the generation to changes in customer demand.

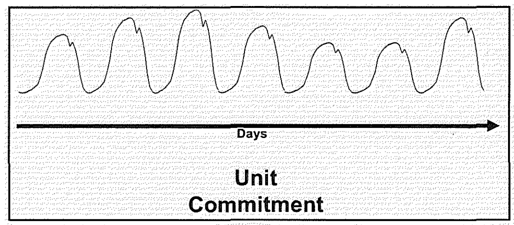
There are four time scales of interest in the monitoring operation of the power system: 1) regulation, 2) load following, 3) scheduling, and 4) unit commitment

Regulation is the process of maintaining system stability by adjusting certain generating units in response to fast fluctuations in the total system load. These fluctuations typically occur over a period of a few seconds to several minutes and are caused by customer actions as minor as turning on an air conditioning unit or as major as firing up a large industrial arc furnace.



Load following is the process of ramping generation up or down in response to daily load patterns. These patterns are typically predictable as load comes up in the morning and comes down in the evening.

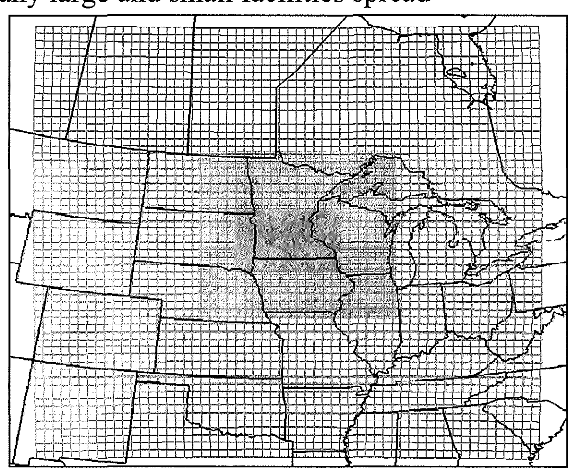
Scheduling is the practice of scheduling power plants for the next day based on short-term load forecasts and equipment availability.



Unit commitment is the practice of committing generation units several days in advance based on longer-term load forecasts, planned plant maintenance and other variables.

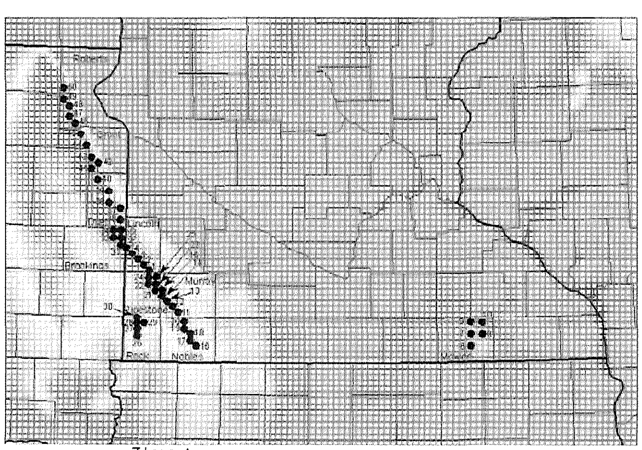
Wind Resource Characterization

Predicting how all the wind plants in the 1500-megawatt scenario appear in the aggregate to the Xcel system operators and planners is a critical aspect of the study. The total amount of wind generation will likely consist of many large and small facilities spread out over a large land area, with individual facilities separated by tens of miles over approximately two hundred miles.



The National Center for Environmental Prediction collects data and runs models to provide standard weather forecasts. A weather research company, WindLogics, archives that data. Sophisticated simulations utilized that archived weather data to "recreate" the weather for the years 2000, 2002, and 2003.

The figure on the right shows the grid used with the numerical model to simulate the actual meteorology occurring over the upper Midwest. The simulation featured three grids with two internal, nested grids of successively higher resolution. On the innermost grid, specific points that were either co-located with existing wind plants or likely prospects for future development were identified along Buffalo Ridge and in Mower county. See illustration on the left.



Wind speed data along with other key atmospheric variables from these selected points were saved at ten-minute intervals as the simulation progressed through three years of weather modeling. The results of the simulations were then applied to another set of data archived by WindLogics from the National Center for Atmospheric Research. This database represents 55 years of atmospheric data. This process "normalizes" the model data to better represent the historic character of the wind resource for the area of interest over 55 years.

The wind speed data was converted to wind generation data by applying power curves for existing and prospective commercial wind turbines at each of the selected locations.

Xcel System Model

A model of the projected Xcel system profile for 2010 was developed. The model included historical system load and plant performance data as well as projected load growth and generator additions. The geographic distribution of the individual wind plants comprising the 1500-megawatt scenario is depicted in the following table.

County	Nameplate Capacity
Lincoln	350 MW
Pipestone	250 MW
Nobles	250 MW
Murray	150 MW
Rock	50 MW
Mower	150 MW
Brookings (SD)	100 MW
Deuel (SD)	100 MW
Grant (SD)	50 MW
Roberts (SD)	50 MW
Total	**1,500 MW**

The wind generation scenario was derived from the numerical weather model data discussed in the previous section on Wind Resource Characterization. However, the 10-minute resolution of the WindLogic dataset is inadequate for fully characterizing the impacts of the 1500 megawatts of wind generation on the short time period of regulation control.

To estimate the short time period characteristics of the wind generation in the study scenario, one-second resolution monitoring data from the National Renewable Energy Laboratory for the Buffalo Ridge substation and Lake Benton II wind plant was included in the model.

The resulting model was then used to evaluate reliability impacts and operating cost impacts described in the following sections.

Reliability Impacts

The reliability impact of 1500 megawatts of wind power on the Xcel system was determined utilizing a concept called effective load carrying capability (ELCC). ELCC is a measure of the capacity value of any generator. This method of measuring reliability has been applied to traditional power plants for many years. However, it is a fairly new concept when applied to wind.

Each power plant contributes to system reliability based on its specific characteristics. Since no power plant is 100% reliable, this method takes unplanned outages into account. For example, a base load coal plant could experience an unplanned outage at any time. However, since the unplanned outage has a low probability of occurring, the ELCC for the coal plant is relatively high. Since the variability of the wind resource adds a level of uncertainty in addition to its turbine outage probability, its ELCC is expected to be lower.

This study used a reliability simulation software model to calculate the ELCC of wind in the study area. Three years of wind generation data was analyzed. That data was mapped on the proposed Xcel 2010 system and hourly generation and loads were calculated for three years. The results show that the ELCC of the system improves by 400 megawatts, or 27% of nameplate capacity, with the addition of 1500 megawatts of wind resource.

Thus, the addition of 1500 megawatts of wind turbine capacity on the Xcel system contributes 400 megawatts of reliability to the projected Xcel system peak load of 10,000 megawatts in the year 2010.

Operating Cost Impacts

The operating costs to serve the load are affected by the plans and procedures necessary to accommodate the variability of the wind generation and to maintain the reliability of the power system. These costs are called integration costs. The system is impacted over the time frames ranging from a few seconds to several days and are defined as regulation, load following, scheduling, and unit commitment. Refer to the previous section, Overview of Utility System Operations, for a graphic depiction of these time frames.

Regulation: The operating cost impact of wind on the ability to react to short term fluctuations in customer demand over a period of a few seconds to several minutes.

The study determined that the variability of 1500 megawatts of electricity on the Xcel system requires the reservation of an additional 7.8 megawatts of reserve capacity. A reserve capacity of 7.8 megawatts times the number of hours in a year would generate 68,328-megawatt hours of energy per year.

The cost of this incremental regulating requirement can be estimated by calculating the opportunity cost of the additional reserve capacity. The opportunity cost is computed as the revenue, less production cost, for energy that cannot be sold from the regulating capacity of 7.8 megawatts of electricity, or the cost of 68,328-megawatt hours of energy per year.

Xcel Energy currently employs large fossil fuel units for regulation so the production cost is approximately $10 per megawatt hour. The study assumed that this energy could be sold at $25 per megawatt hour, generating an opportunity cost of $15 per megawatt hour. Thus, the opportunity cost is just over $1,000,000 per year.

At an average capacity factor of 35%, the annual production from the 1500 megawatts of wind generation is 4.5 million-megawatt hours per year. One million dollars of opportunity cost spread over 4.5 million-megawatt hours produces a regulation cost, due to the variability of wind, of $0.23 per megawatt hour.

Load following: The fact that the wind resource sometimes fluctuates contrary to system load fluctuations creates an operating cost impact. For example, the wind may drop off as load picks up in the morning or the wind may pick up as load drops off in the evening.

It was determined through statistical analysis that the load exhibits significantly more variability than does wind generation over these short time frames. Therefore, the increase in operating cost due to load following is negligible. Thus, no monetary value was assigned.

Scheduling & Unit Commitment: Because wind plant output is not predictable and/or the wind forecast is not accurate, there is an operating cost impact for scheduling and committing units for the next day and several days ahead.

Because many generating units cannot be stopped and started at will, operating plans are developed to look at the expected demand over the coming days and commit generating units to meet this demand at the lowest possible production cost. These plans are developed by system schedulers, utilizing unit commitment and scheduling software.

The basis for the following simulations was a two-year history of hourly system load data and hourly wind generation data

The first step in this analysis was to build a reference system using the unit commitment and scheduling program. On the reference system it was assumed that the daily energy from wind generation was known precisely, and that it was delivered in equal amounts over the 24 hours of the day. These model runs produced a reference system production cost.

In the second step, projected load and wind generation forecasts were assumed. The program determined the lowest cost way to meet the load and accommodate the wind generation as it was forecast to be delivered. The forecast wind generation was then replaced by the actual wind generation to determine the lowest cost way to meet the load and accommodate the wind generation as it actually happened. The difference between the costs utilizing forecasted wind data and the costs utilizing actual wind data is the actual system production cost.

The difference between the reference system production cost from the first step and the actual system production cost from the second step is the scheduling and unit commitment integration cost due to the variability of wind.

This cost was determined to be $4.37 per megawatt hour of wind generation.

Summary

As we see greater levels of wind penetration into the Midwest power system, the question arises as to how much wind can be reliably integrated and the cost of absorbing that amount of wind.

The study concludes that 1500 megawatts of wind energy can be reliably integrated on the Xcel system. The study also concludes that 1500 megawatts of wind contributes 400 megawatts of effective load carrying capability, or 400 megawatts of reliability.

The analysis conducted in this study indicates the costs of integrating 1500 megawatts of wind generation into the Xcel control area in 2010 are no higher than $4.60 per megawatt hour of wind generation. This represents a wind penetration level of 15% on a projected peak load system of 10,000 megawatts.

The total costs include $0.23 per megawatt hour as the opportunity cost associated with an increase of 7.8-megawatts of reserve capacity to satisfy the regulation requirement; and $4.37 per megawatt hour of wind generation attributable to unit commitment and scheduling costs. The increase in production cost due to load following was determined by statistical analysis of the data to be negligible.

The study concludes that these costs are conservative, or worst case costs for a number of reasons. First of all, the emergence of wholesale energy markets could provide a less costly alternative to using internal resources to compensate for the variability of wind. Secondly, these costs are based on current state of the art forecasting and scheduling and unit commitment techniques. These techniques should improve as experience with wind integrating grows and the integration cost of wind should decrease for this level of wind penetration.

The production costs due to the variability of wind are unique to the characteristics of the system being studied and these findings cannot be assumed to apply to non-Xcel control areas or the aggregate of all control areas in Minnesota.

The study did not examine wind penetration beyond the 15% penetration level and did not indicate at which penetration level wind may become non-cost effective.

Wind Integration Study

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February 16, 2005

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Overview

- Study Background
- Key Issues
- Objectives & Scope
- Methods & Key Results
- Summary

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Background

- The Utility Wind Interest Group completed a study of the operating impacts of 280 MW of wind power on the Xcel (north) system in 2002
- The 2003 Minnesota Legislature adopted a requirement for an Independent Study of Intermittent Resources which evaluates the impacts of over 825 MW of wind power on the Xcel (north) system
- The Public Utilities Commission requested that the Department of Commerce take responsibility for oversight of the study

Background

- Commerce assembled a broad stakeholder group (IOUs, Coops, Munis, Chamber of Commerce, Environmental Orgs, AWEA, DOE/NREL, etc) to develop the study scope based upon an extensive literature search, insights from the first study, and stakeholder input.
- Study was competitively bid to qualified consultants; Xcel & DOC selected EnerNex/WindLogics to perform the study
- A Technical Review Committee of national experts was assembled to guide and review the study
- An aggressive schedule for the study began in January 2004; the study was completed in September 2004

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Key Issues

- Reliable power system operation requires precise balance between load and generation
- Capacity value of power plants depends on their contribution to system reliability
- Output of wind plants cannot be controlled and scheduled with a high degree of accuracy
- Wind plants are becoming large enough to have measurable impact on system operating cost

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Objectives

- Evaluate reliability and operating impacts of a projected 1500 MW of wind power serving Xcel (north) in 2010.
- Build upon the 2002 UWIG / Xcel study, as well as other recent relevant wind integration research.
- Produce meaningful, broadly supported results through a technically rigorous, inclusive study process.
- Not included in the study:
  - Transmission capacity (deliverability) for new wind power
  - Results for levels of wind power above 1500 MW (15% for Xcel)
  - Results for non-Xcel systems or for the whole state

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Study Scope

- Characterize the Nature of Wind Power Variability in the Midwest
- Assemble Data, Develop System Model, and Evaluate Interaction of the Wind Generation with System Load
- Evaluate Wind Integration Reliability Impacts
- Evaluate Wind Integration Operating Cost Impacts

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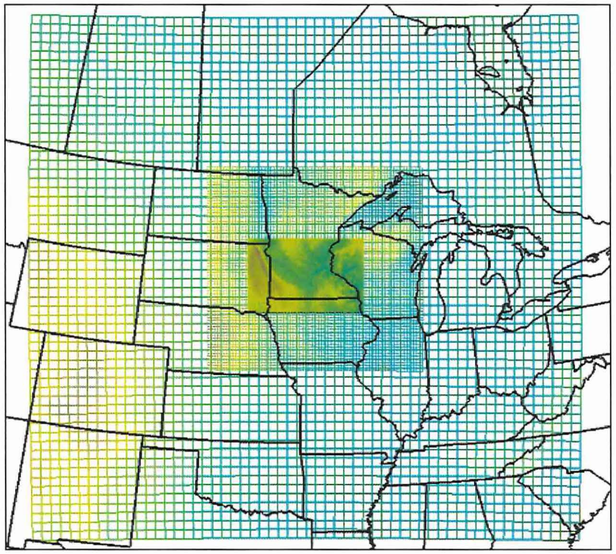
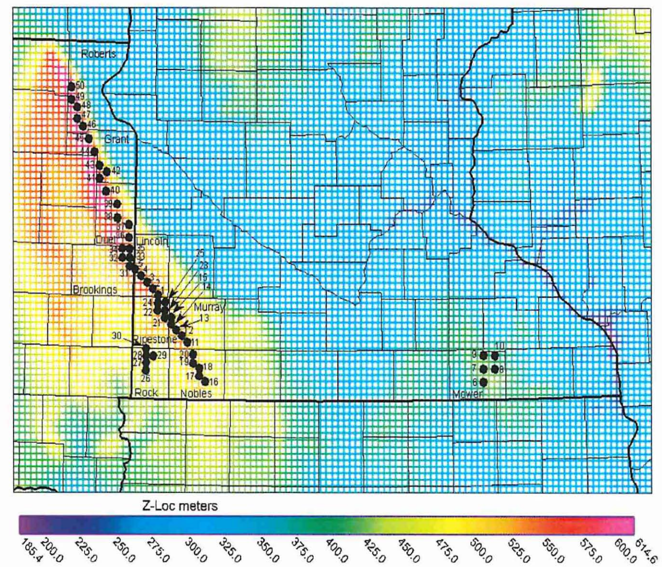
1. Characterize the Wind Power Variability



- WindLogics utilized a sophisticated, science-based atmospheric model
  (run for 3 full years, normalized to 55 year database, validated with actual historical data)
- Nested grid with innermost values extracted every 10 minutes

- 1500 MW of wind turbines modeled (approx. 900 MW existing/committed plus 600 MW projected)
- Model results demonstrated benefits of geographic diversity



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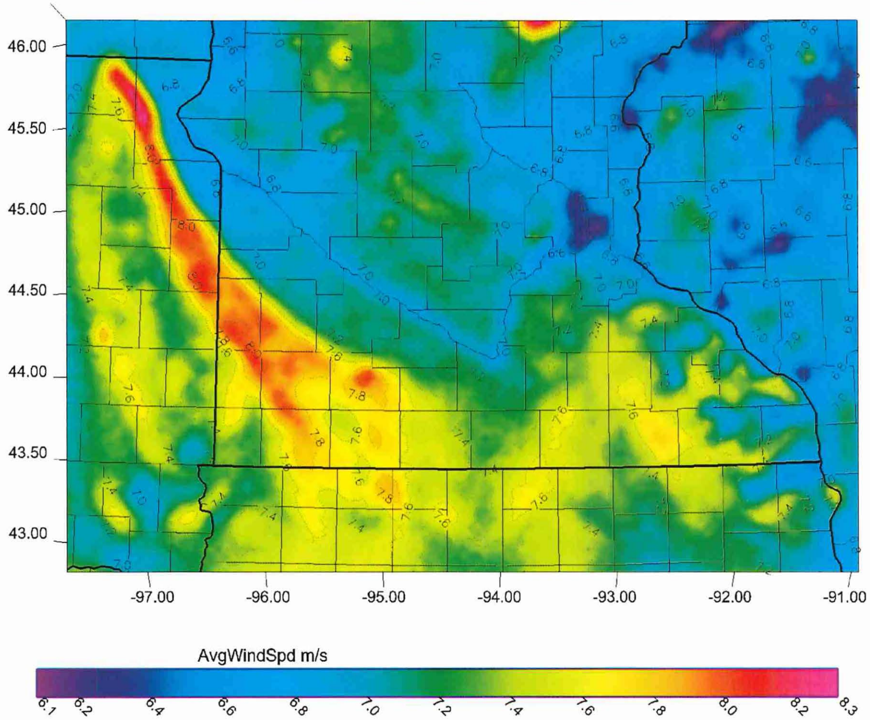
Characterize the Wind Power Variability (cont.)



- Model results included wind speed, air density, power density, annual average energy production
- Temporal and geographic variations are characterized

- Benefits shown for a sophisticated method of forecasting wind power production which uses artificial intelligence applied to numerical weather models

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2. Develop System Model

- Xcel system model based upon projected load and resources in 2010
- Xcel provided a number of detailed data sets (including several yrs of 5-min and hourly load data, several years of hourly generation data, several weeks of 5-min load/generation/ACE data, unit commitment data set, forced outage data set, etc)
- Wind generation scenarios based upon WindLogics numerical modeling (10 min.) and high resolution (1 sec.) data sets for Buffalo Ridge wind plants

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3. Evaluate Reliability Impacts

- Wind generators capacity contribution is based on its influence on overall system reliability
- Effective Load Carrying Capability (ELCC), a common reliability measure, is evaluated to determine wind generation reliability impacts
- The system's hourly loads and generation are modeled with and without the wind generators while maintaining a fixed reliability level (one day in ten years)
- Results show the ELCC improves by 400 MW for the 1500 MW of modeled wind power (27% of nameplate)

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4. Evaluate Operating Cost Impacts

- Determine how the costs to serve load are affected by the plans and procedures necessary to accommodate the wind generation and to maintain the reliability and the security of the power system
- Impacts result from the variability and predictability of wind generation for the time frames:
  - Regulation
  - Load Following
  - Scheduling / Unit Commitment

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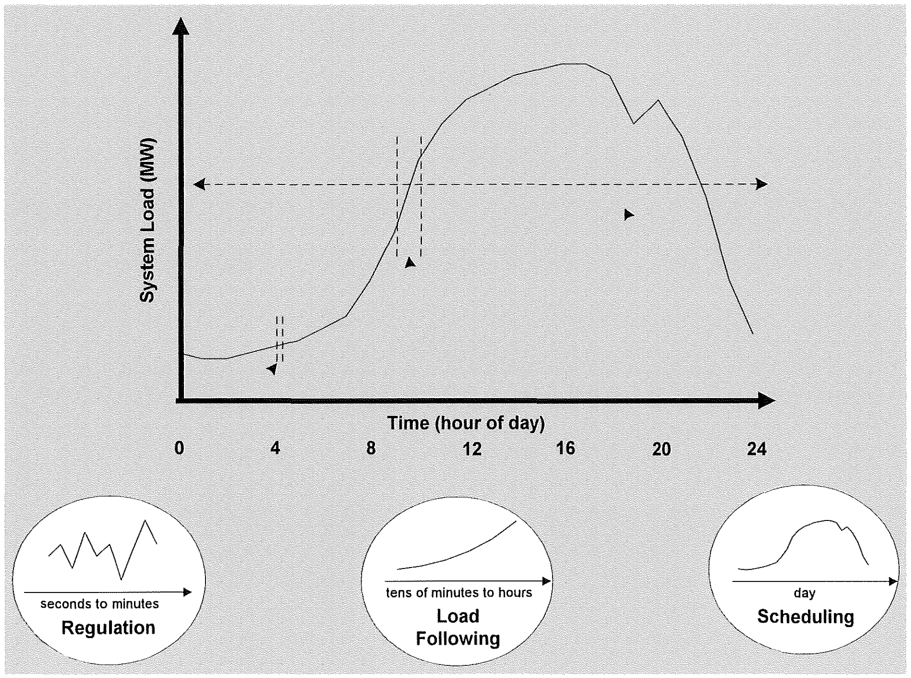
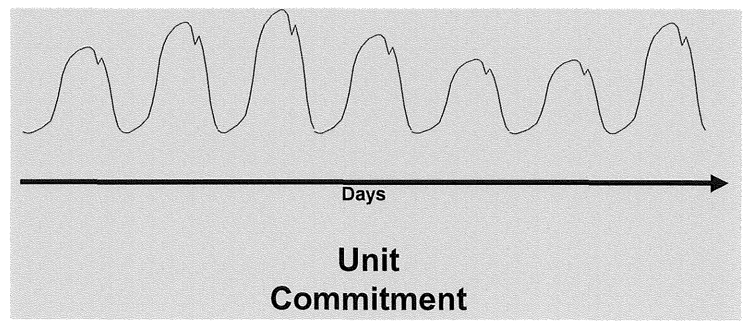
Power System Operation Impacts

Time Scales of Interest:



- Regulation -- seconds to a few minutes -- similar to variations in customer demand
- Load-following -- tens of minutes to a few hours -- usage follows predictable patterns



- Scheduling and commitment of generating units -- one to several days

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Power System Operation Impacts

- **Regulation**: *Can wind plants affect or increase the area control error (ACE)?*
- **Load following**: *What happens if wind plant output decreases in the morning when the load is increasing?*
- **Scheduling**: *How can committed units be scheduled for the day if wind plant output is not predicted? What happens if the wind forecast is inaccurate?*
- **Committing generating units**: *Over several days, how should wind plant production be factored into planning what generation units need to be available?*

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Operating Impacts

- 1500 MW of wind can be reliably integrated into the Xcel system in 2010 (on a projected peak system load of 10,000 MW)
- Impacts of integrating 1500 MW of wind generation are dominated by costs incurred to accommodate the wind generation variability and uncertainty in the day-ahead time frame.
- The integration cost of 1500 MW of wind is no higher than $4.60/MWh of wind generation. Includes:
  - An increase of 7.8 MW of regulation requirement at a cost of $0.23 per MWh of wind generation;
  - A negligible increase in production cost due to load following within the hour;
  - An increase in scheduling and unit commitment costs, under a conservative application of current operation practice and current markets, of $4.37/MWh of wind generation.

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Summary

- Costs impacts could be substantially reduced with improved strategies and practices for unit commitment and scheduling, improved forecasting, and improved markets.
- 1500 MW of wind generation was found to contribute 400 MW to system reliability (Effective Load Carrying Capability of about 27% of nameplate rating of the wind generation).
- Wind generation variability declines (as a percentage) as the number of wind turbines increases; the variability also declines with increasing geographic dispersion.

The full study is posted on the Department of Commerce web site.

www.commerce.state.mn.us

(Industry Info and Services / Energy Utilities / Energy Policy / Wind Integration Study)

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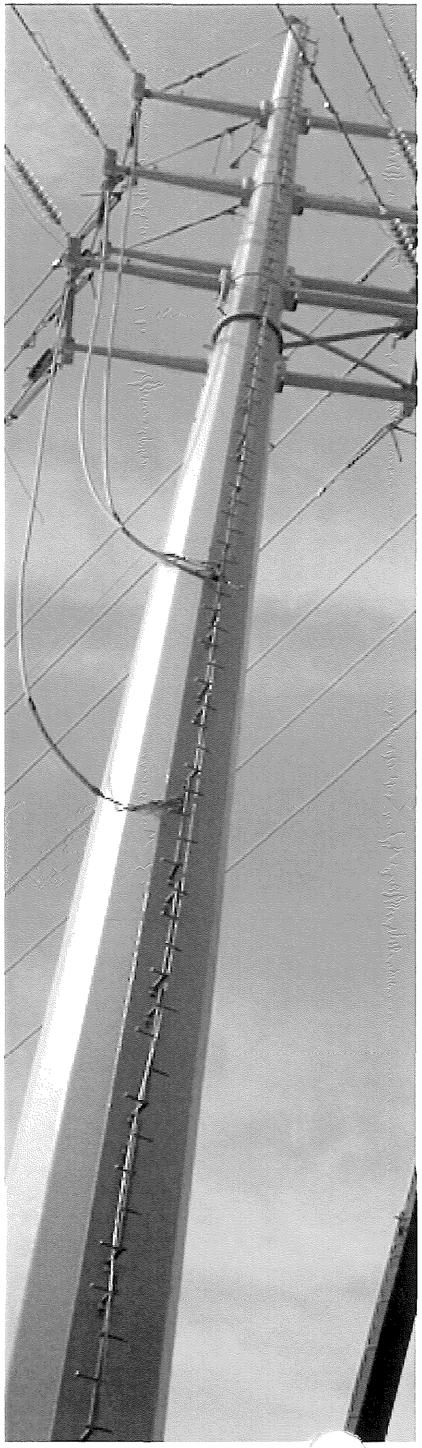
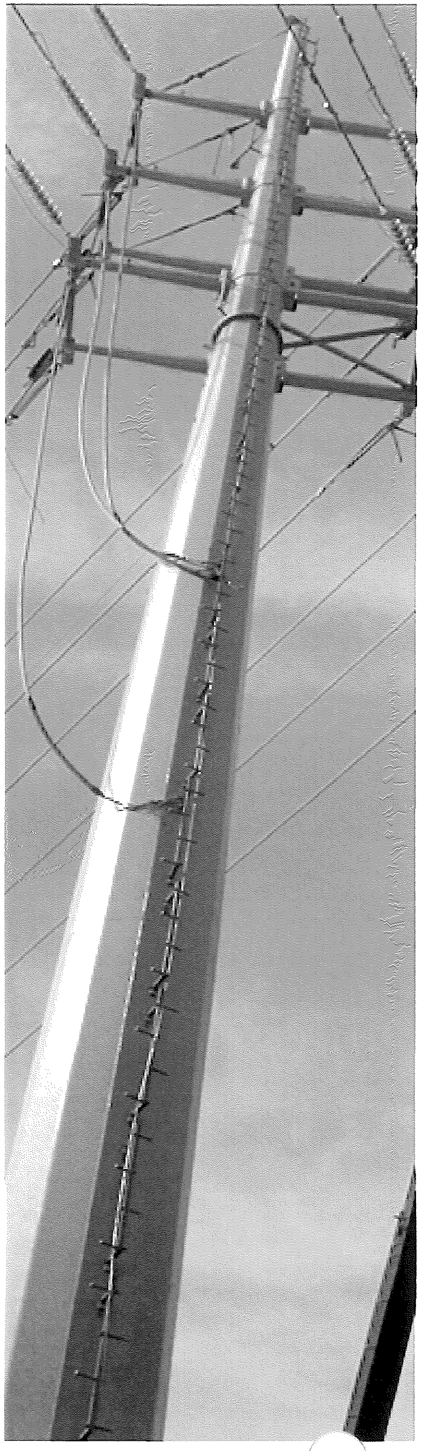


CapX 2020

A Vision for Transmission Infrastructure Investments for Minnesota



Who We Are

CapX 2020 is a joint effort by Minnesota transmission utilities to look at future transmission needs in a global, coordinated way

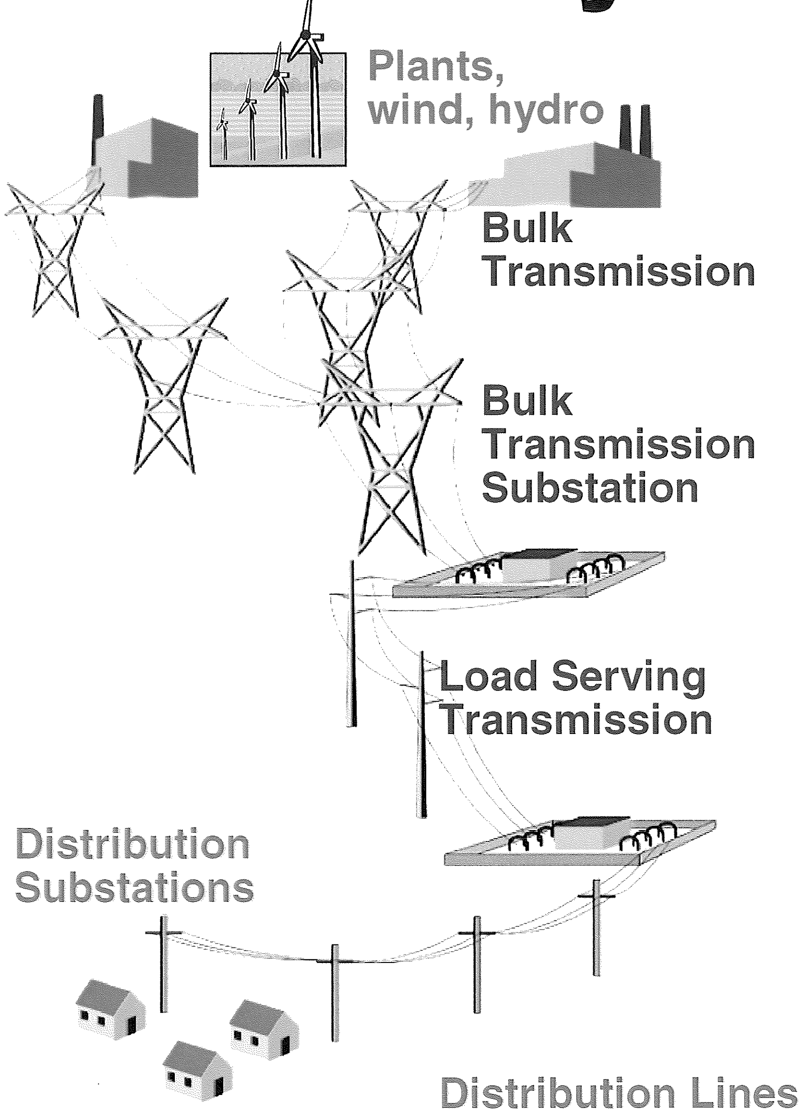
GREAT RIVER ENERGY®
A Touchstone Energy® Cooperative

minnesota power
AN ALLETE COMPANY

OTTER TAIL POWER COMPANY

Xcel Energy℠

How The System Works



Power is generated or purchased

Bulk transmission (>115kv) moves the power to transmission substations

These substations drop the voltage down

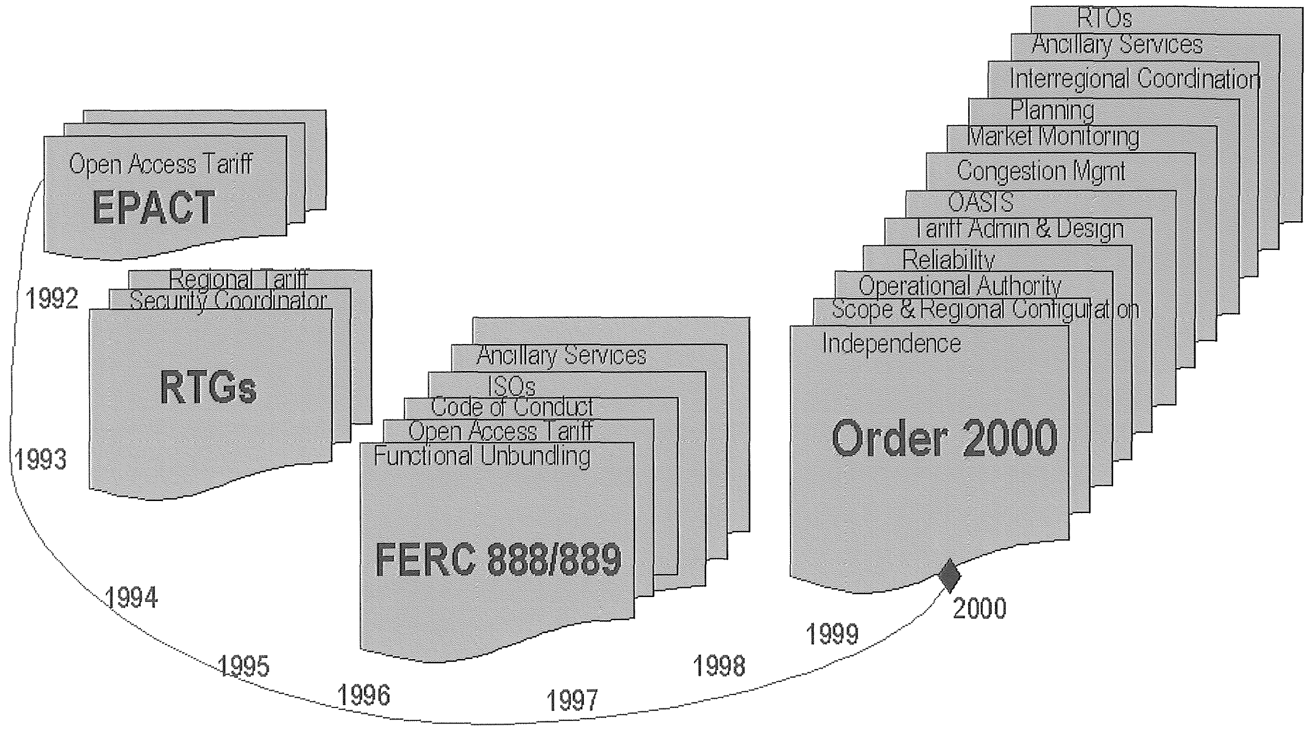
Load serving transmission (<115kv) moves the power to the distribution substation

Distribution substations drop the voltage down

Distribution lines move the power to business, industrial and residential customers

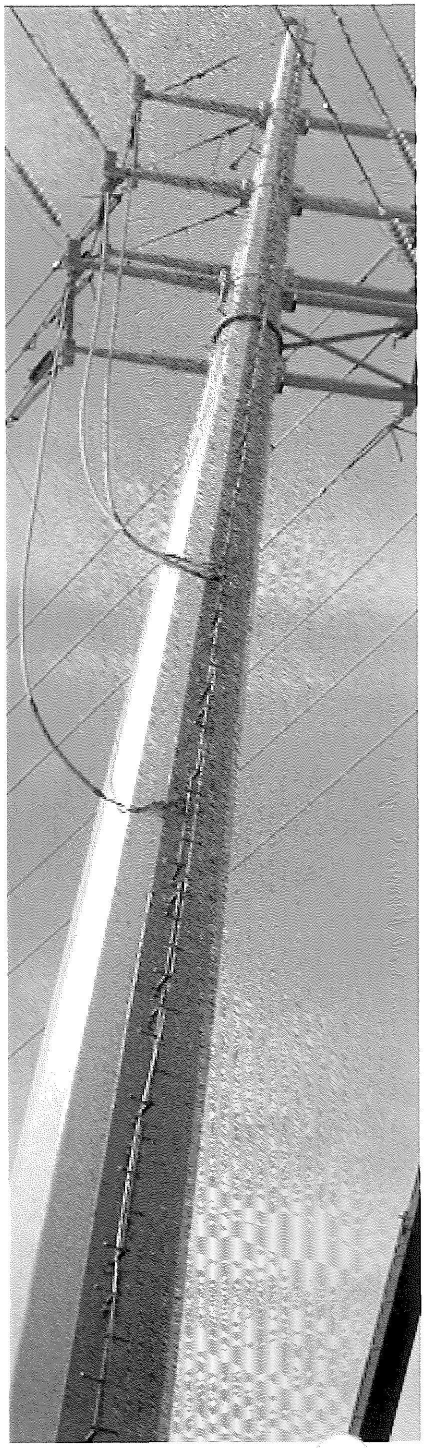
Open Access Transmission

FERC regulates access to the transmission grid



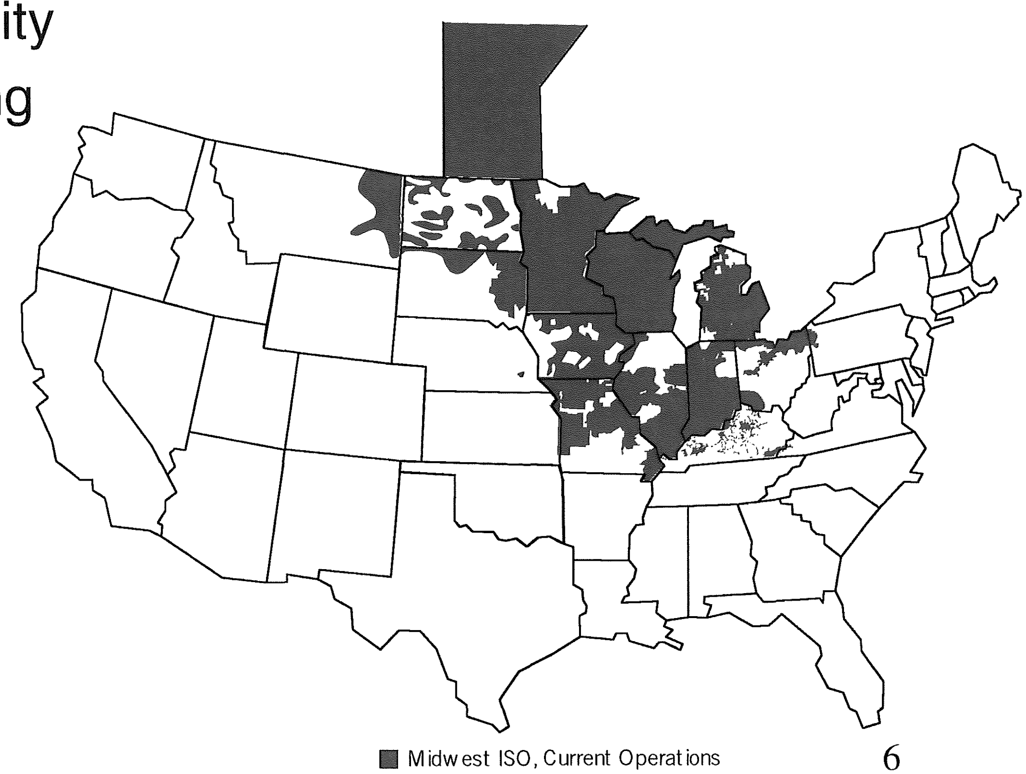
The World Has Changed

Before Open Access (60s, 70s)	After Open Access (Now)
Each utility was more of an island: Utilities owned and controlled transmission, primarily for themselves	Competitive wholesale markets with transmission as the vehicle
Utilities conducted integrated planning for generation and transmission	Utility transmission planners must plan for all generation projects in a non-discriminatory manner
Coordination was through MAPP for some functions	MAPP is replaced by MISO and MRO



MISO and Open Access

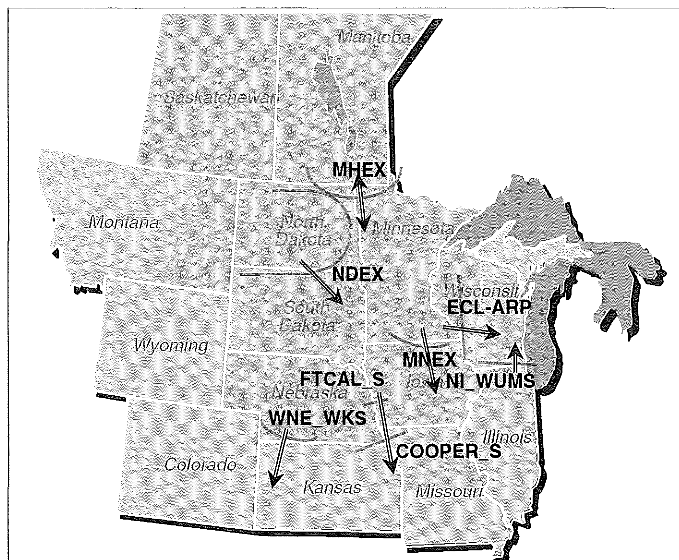
- Functions
  - Grid access
  - Congestion management
  - Reliability
  - Planning
  - Market



Transmission Congestion

Months	1998	2002
Jan-Mar	**30**	**205**
Apr-Jun	**95**	**365**
Jul-Sep	**125**	**605**
Oct-Dec	**35**	**345**

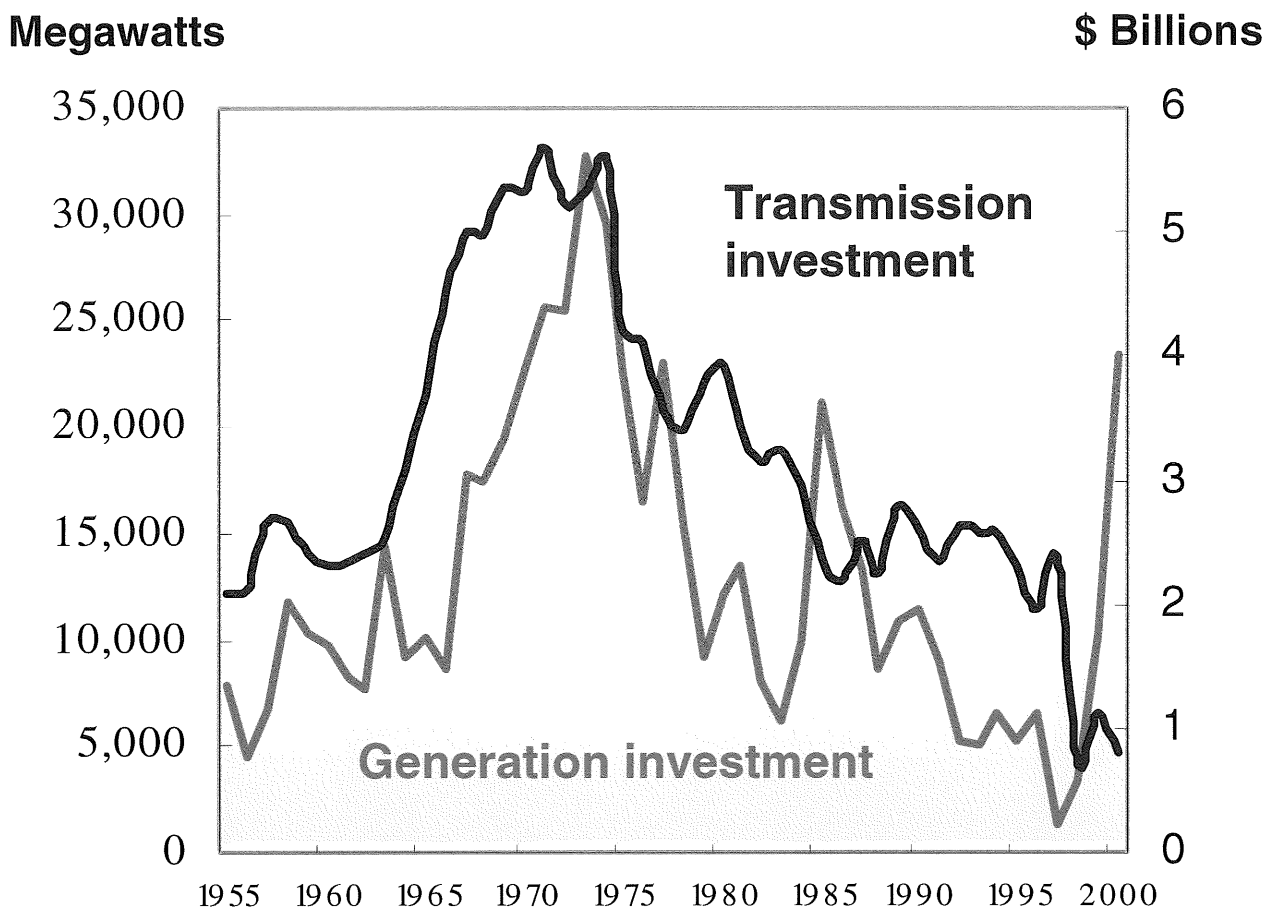
Source: ICF Consulting – data from April 2003 report

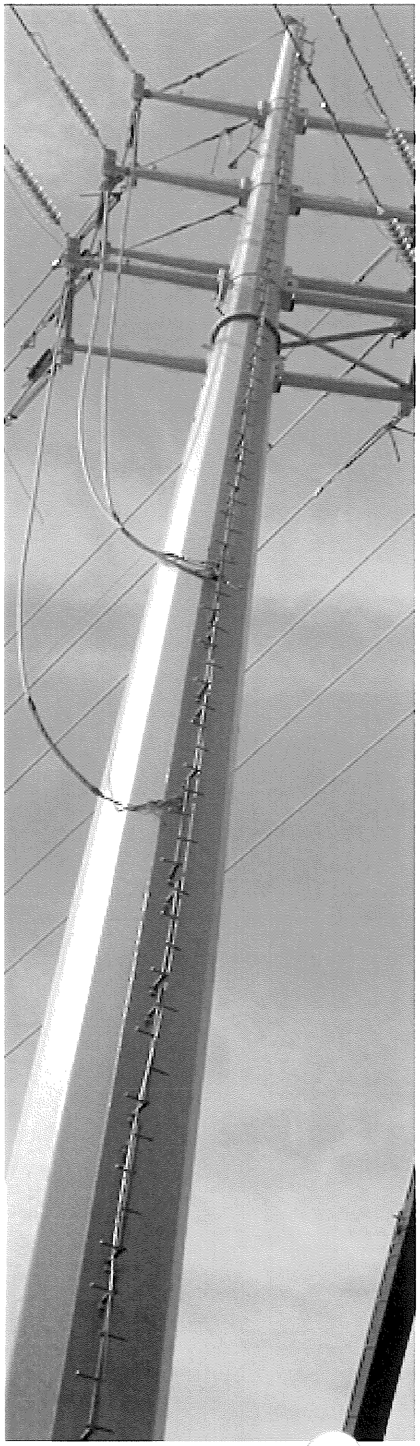


Transmission reliability curtailments (Midwest Market)

Source: FERC presentation at Midwest Energy Infrastructure Conference, November 2002

Transmission Investment

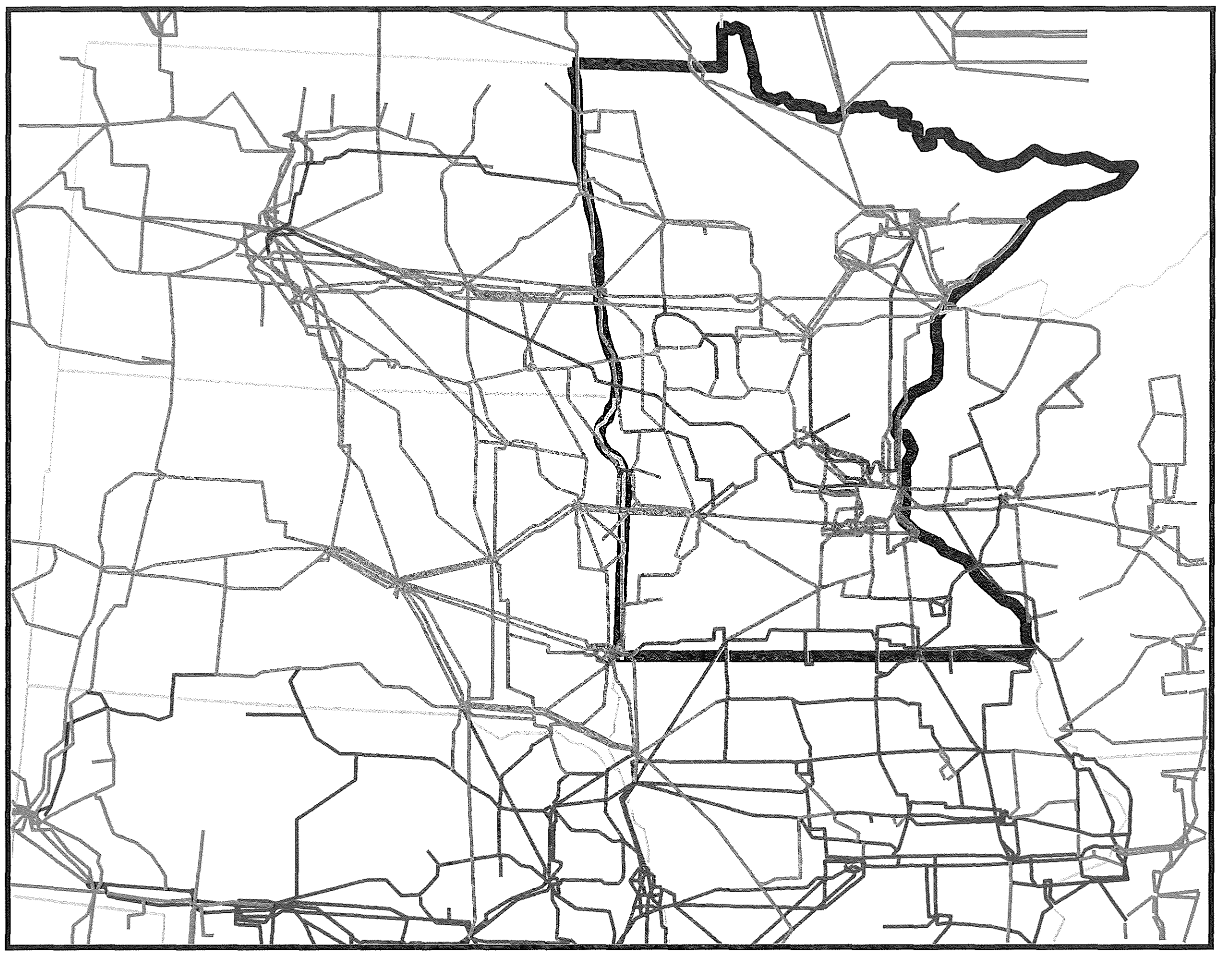




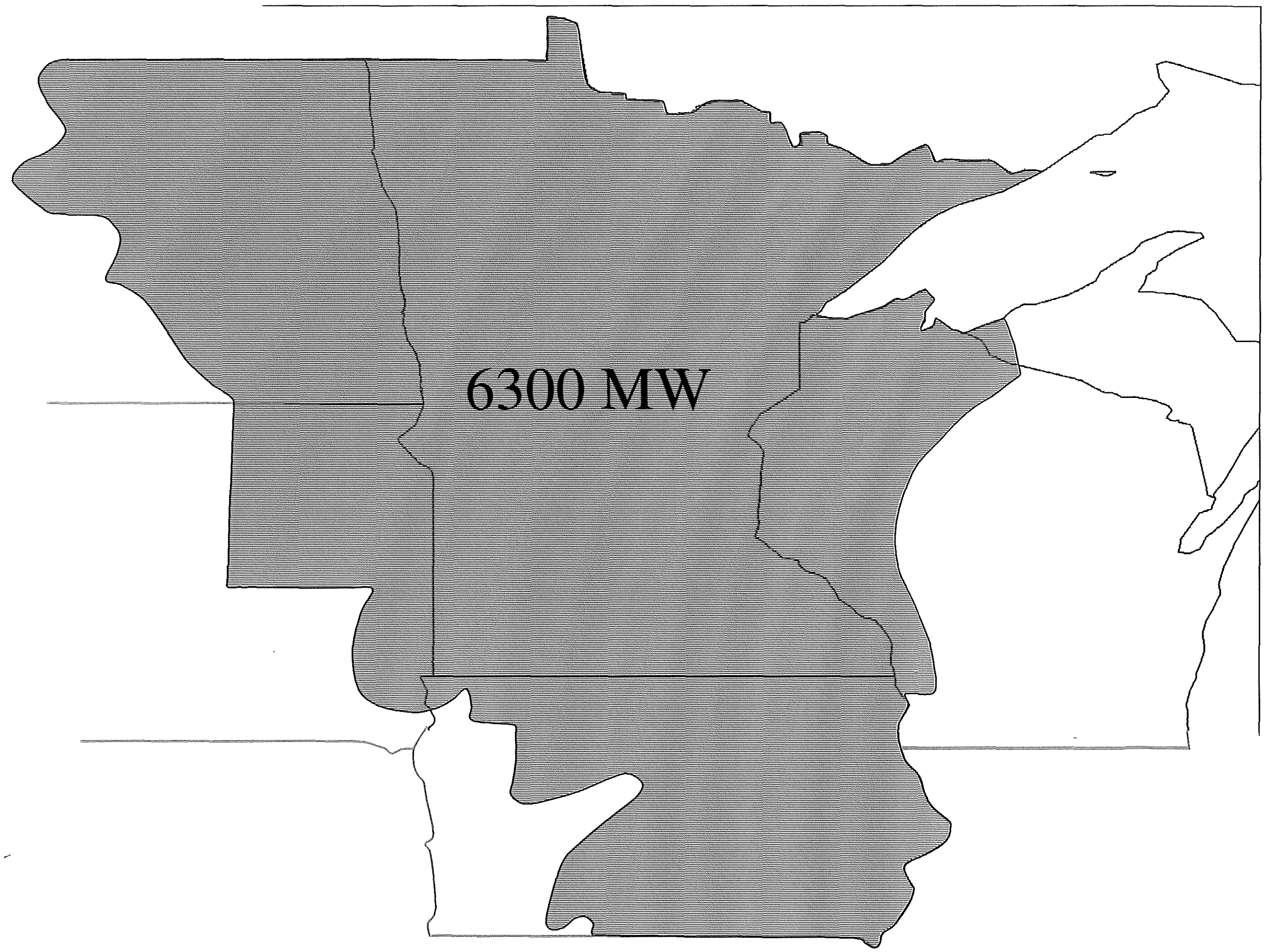
Why We Came Together

- To facilitate expansion of the transmission grid
  - To relieve congestion
  - To provide market access
  - To maintain reliability into the future
- What is at stake
  - Reliable power
  - Access to renewable energy
  - Low-cost energy and economic vitality in the state
- To request policy changes to help make this happen

Our Interconnectedness

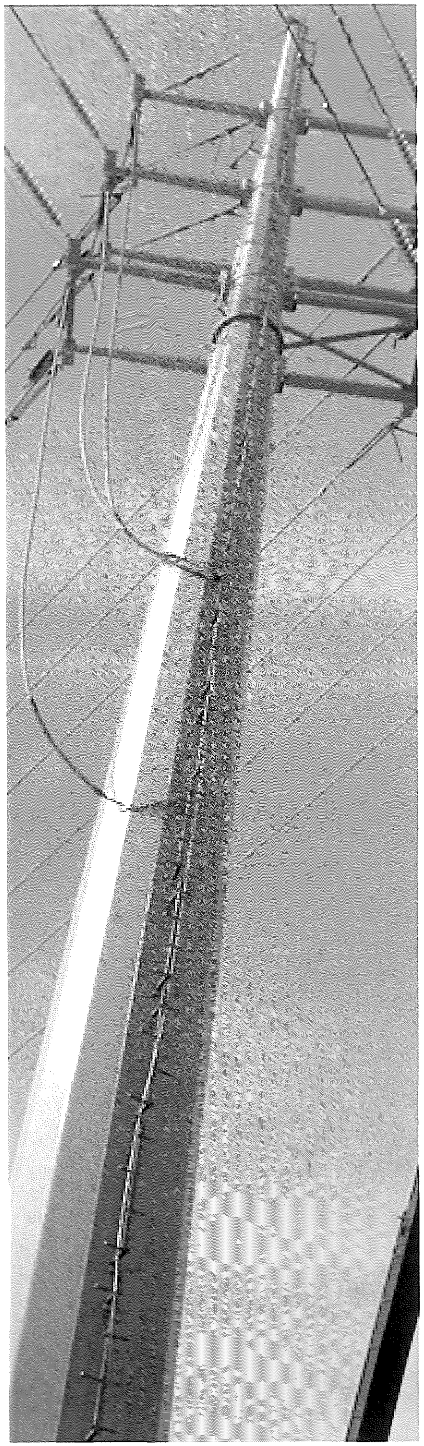


Study Load Area



Load Zones

Control Area	2009 Load Level (MW)	Yearly growth rate (%)	Calculated 2020 Load Level (MW)
Alliant Energy (W)	3265.3	1.60	3888.2
Xcel Energy (N)	9632.6	2.68	12885.1
MN Power	1507.3	1.70	1814.4
SMMPA/RPU	330.0	2.70	442.4
Great River Energy	2833.5	3.05	3894.0
Otter Tail Power	1677.2	2.70	2248.3
Dairyland Power Coop	954.7	2.60	1266.2
Total	20,200.6	Ave.=2.49	26487.8



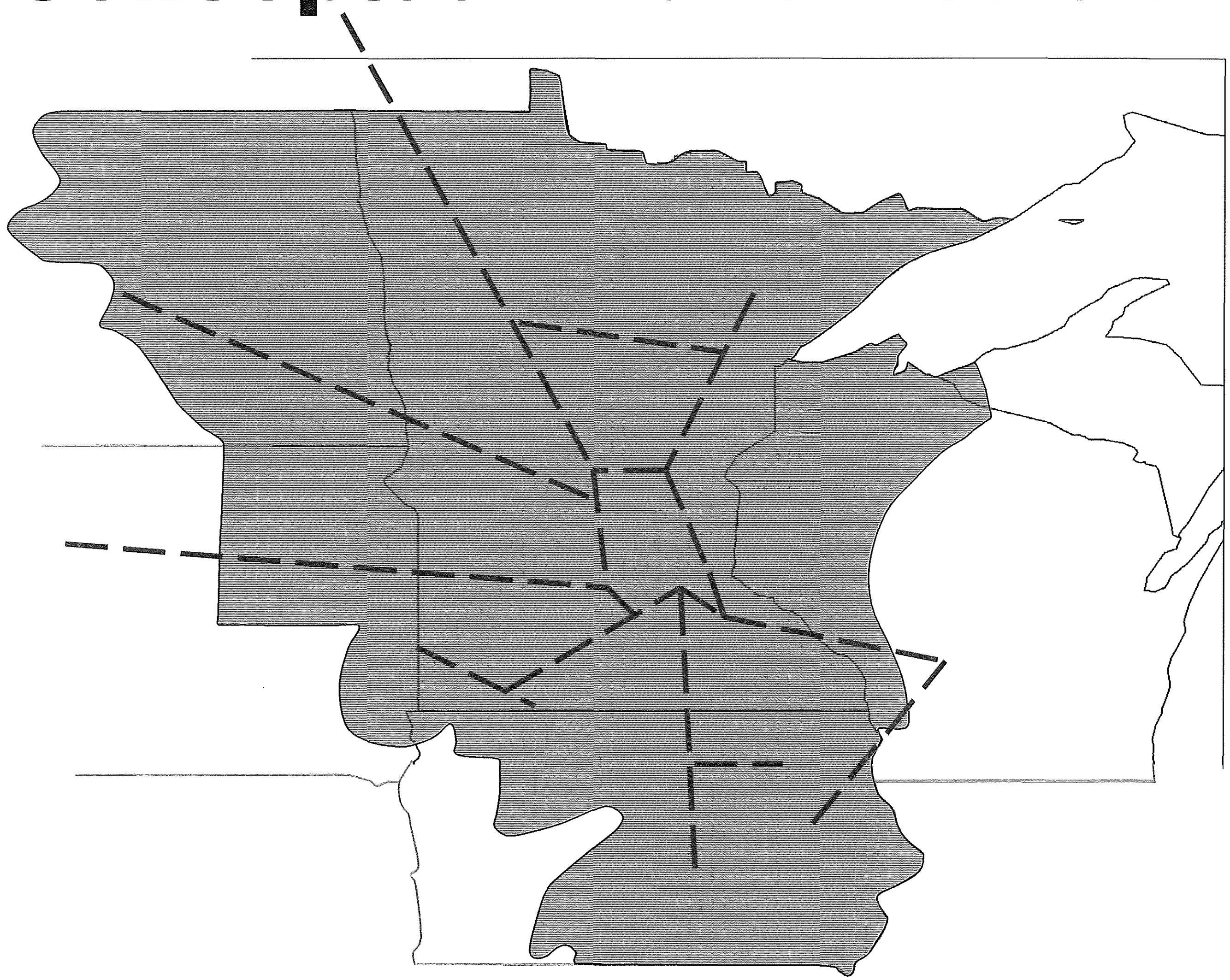
What We Are Finding

Scenario	System Intact Overloads	Prior Outage Overloads	Voltage Violations
North/ West	42	142	45
MN	42	187	14
East	42	197	33

What We Are Doing

- Establishing a vision of transmission expansion needed over the next 15 years to serve the projected 4,500 to 6,300 MWs of increased customer demand
- Identifying, through detailed studies, reliability issues in the Red River Valley
- Assessing and identifying impediments to building needed infrastructure in a timely manner
- Informing and educating decision makers and stakeholders on the above
- Gearing up for a major grid expansion – being proactive

Conceptual Transmission



What Minnesota Needs

- Improved Certificate of Need criteria
- Timely, efficient and certain cost-recovery mechanism
- Focused siting and routing procedures

At Stake: Reliability

- Our current transmission system is strong but reaching its limit, and it's at its limit more frequently as time goes on
- As the demand for electricity increases and the projected generation is built – including significant amounts of wind power – the robustness of the grid will deteriorate

At Stake: Renewables

- Renewable Energy Objective: 2400 MW of renewable generation
- No such thing as "green" transmission: Transmission is resource "neutral"

At Stake: Access

- Access to low-cost power serving future energy needs of the consumers of Minnesota
- Translates into the economic vitality of the state

Our Conclusions

- We need to expand the grid to meet growing customer demand
- Future reliability, renewable energy and access to low-cost power are all at stake
- We have time to do this right – if we start now
- The world has changed and we need to change with it to address this critical need

LEGISLATIVE ELECTRIC ENERGY TASK FORCE

(LEETF)

REPORT TO THE LEGISLATURE

JANUARY 15, 2005

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INTRODUCTION

The Legislative Electric Energy Task Force (LEETF) adopted a work plan for the 2004-2005 legislative interim. The work plan was focused on wind energy development with a specific emphasis on local economic benefits from wind generation investments. (Work Plan is contained in Appendix 1).

The work plan was adopted to satisfy the obligation of the LEETF under Minnesota Statutes, section 216C.051, subdivision 4a, which requires:

"By January 15, 2005, and every two years thereafter, the task force shall submit a report to the chairs of the committees in the house of representatives and the senate that have responsibility for energy and for environmental and natural resources issues that contains an overview of information gathered and analyses that have been prepared, and specific recommendations, if any, for legislative action that will ensure development and implementation of electric energy policy that will provide the state with adequate, renewable, and economic electric power for the long term. The report shall also identify issues that must be addressed to provide Minnesotans with adequate electricity from in-state, renewable energy sources for the long term and export to adjacent states."

This report is prepared and submitted to satisfy the requirements of subdivision 4a. The report is the result of 2004 interim activities that included three public meetings at which public testimony was received, including one held in Pipestone, Minnesota,

The interim activities were assisted by a working group whose members are listed in Appendix 2.

The report was prepared with the understanding that a charge to the LEETF is to make recommendations to achieve the maximum renewable energy generation in Minnesota that is consistent with a reliable, economic, and environmentally friendly electric system [Minnesota Statutes, section 216C.051, subdivision 3, paragraphs (2) and (3)]. Thus, the report does not provide an instant road map to an electric industry in Minnesota that generates electricity solely from renewable resources. Rather, the report is based on the view that there is a path to an optimal level of renewable generation resources that balances these factors. This report focuses on some recommendations to move along that path.

In the course of focusing on wind energy development and its ability to provide local economic benefits, the working group uncovered several larger issues. They relate to the need for additional transmission capacity and the lack of a clearly defined statutory policy concerning the role that local economic development benefits should play with respect to selecting wind energy generation projects.

Issues related to wind generation and local economic development are discussed in Chapter 1.

Chapter 2 discusses transmission issues.

Chapter 3 discusses the deliverables specified in the work plan. With respect to those deliverables that related to recommendations concerning local economic benefits, the lack of a current clear policy concerning local benefits makes it untimely to make specific recommendations other than to move to develop a clear policy.

Chapter 4 contains the recommendations.

The interim activities involved the free exchange of thoughts from many members of the public and stakeholders that was greatly appreciated and thanks are extended to all participants. A critical recommendation is to continue this process of discussion so that issues may be addressed outside of the stresses of the administrative and legislative processes that are the usual forum for discussion. Hopefully, these casual and open discussions will provide information to help the Legislature develop a coordinated and integrated state energy policy with the appropriate tools to implement it. Appendix 3 contains a selected summary of issues raised by various participants in the interim work activities. The significance of these issues and the fact that they are not resolved emphasizes the need for a long range, legislatively focused forum to address them.

The work group was not presented with a specific proposal to address so the discussions were general. This leads to some frustration. However, the work group did clarify two areas of concern related to community-based wind and transmission issues. Specific legislative proposals are being developed by others regarding these issues. These proposals would benefit from being discussed in the working group format.

A special thanks is due to Mr. John Lampe who moderated the three public meetings.

CHAPTER 1

LOCAL ECONOMIC BENEFIT AND CONSTRUCTION AND OPERATION OF WIND GENERATION FACILITIES

No clear policy in Minnesota law specifies that the amount of local economic benefits derived from the construction and operation of wind generation facilities plays a role in determining which wind generation facilities should be built.

These local economic benefits include wages earned by workers employed in constructing and operating a facility, payments of land rentals to local property owners, profits from owning a facility, increases in tax revenue, and payments to suppliers.

While Minnesota is perceived to have an implicit policy to promote wind projects that produce local benefits, that policy is not explicitly stated in law. As a result, it is likely that the substantial wind energy capacity already constructed as a result of state mandates has not optimized local economic benefits.

Obviously, maximizing local economic development cannot be the only consideration when crafting a strategy to promote the development of wind generation facilities. The cost of the electricity produced by a project and its system reliability impacts must also be considered. However, state policy is not clear on how to measure a project's local economic benefit value nor on how to weigh local economic benefit value against other factors such as the project's impact on electricity costs and system reliability.

What might be referred to as Minnesota's de facto wind energy economic development policy is contained in four major provisions of Minnesota law that mandate or facilitate the construction of wind generation facilities: (1) the 1994 Prairie Island law required Xcel to construct or purchase 825 MW of wind generation; (2) the Renewable Energy Production Incentive Program (REPI) provides a state funded incentive payment of 1.5 cents a kilowatt hour for 100 MW of wind capacity; (3) the Renewable Energy Objective (REO) law passed in 2001 requires a good-faith effort on the part of utilities to provide ten percent of their retail sales from renewable energy by 2015, including an obligation imposed on Xcel to provide an additional 300 MW of wind generation; and (4) the Renewable Development Fund (to which Xcel makes payments as part of its authorization to store nuclear casks in dry storage at Prairie Island) provides funding for, among other things, incentive payments for 100 MW of wind energy generation. [See Appendix 4 for the particular statutes.]

Although the legislature intended wind development to result in economic benefits to rural landowners and communities, this intention was expressed indirectly. None of these statutes directly mentions local economic development benefits. Instead, to a limited and inconsistent extent, the statutes contain restrictions – on location, size, and ownership – designed to produce local economic benefits.

Specifically, the Prairie Island legislation required 225 of its required 825 MW of wind energy to be built within Minnesota. No ownership or size limitations were specified. The REO law had no size, ownership, nor location limitations as it passed in 2001. The REO law was amended in 2003 to obligate Xcel to develop an additional 300 MW of wind energy. Of the 300 MW, 100 MW had to be provided by facilities under 2 MW, none of which could be owned by Xcel. To the extent technically feasible and economic, the 300 MW had to be distributed across Minnesota. The REPI program has limitations based on location, size, and ownership of projects. The Renewable Development Fund obligations are tied into the REPI program and subject to the same limitations.

Under these statutes, the wind projects constructed in Minnesota to date display a wide variety: large projects owned by out-of-state corporations, large projects owned by large local corporations, small projects owned by nonlocal investors, medium size projected owned by nonlocal investors, small projects developed by local individuals, and large projects proposed by local residents in which the locals have a revenue participation as well as a rental interest. None of these projects was evaluated on the basis of local economic impact although it is clear that all have a variable local economic impact. It is intuitive to judge that this array of projects has not garnered the maximum local benefit possible. If it is a goal of the state to provide local economic benefit from wind energy projects, it is appropriate to have a policy in place to measure and evaluate that local benefit. There is no clear evidence that size, ownership, or location limitations are the proper tools to achieve maximum local economic benefit.

Without a clear policy designed to provide local economic benefits from wind power mandates, it is likely that maximum local economic benefits will not be achieved. The lack of a policy also means a lack of measurement of benefits so it is not even possible to report how much local economic benefit has been achieved because projects have not been evaluated nor measured on that basis.

If the state of Minnesota wants to achieve local economic benefits from wind energy generation projects, particularly those it mandates, it should develop a clear policy in that regard. That policy should enumerate the sorts of local economic benefits to be considered. The policy should include directions on how to measure and evaluate whether and how much local economic benefits a project will produce.

A policy on local economic benefit must be fit within a larger energy policy that relates to how much wind should be developed, when it should be built, where it should be built and other issues that integrates wind energy planning with the total generation and transmission system that the state plans to have.

The use of a project size limitation as a tool to achieve maximum local economic benefit is particularly problematic. There is evidence that larger projects have economies of scale that would indicate a preference for larger projects. Moreover, state tax laws impose a much lower tax rate on smaller projects, thus reducing one of the major local economic benefits derived from wind generation projects. The focus should not be on the size of the project but rather on the amount of local economic benefits flowing from a project. Local ownership may be a key factor in producing maximum local benefits. Policymakers must also be careful not to be overly prescriptive, so that flexibility is available to construct projects maximizing local economic benefit using ownership models and technology that were not foreseeable at the time the policy was adopted.

Since there is a near term need to construct wind generation facilities to meet statutory mandates or objectives, it is imperative that the state act quickly to articulate a policy concerning local economic benefit.

CHAPTER 2

BARRIERS TO THE CONSTRUCTION OF ADDITIONAL ELECTRICITY TRANSMISSION CAPACITY IN MINNESOTA

I. The Need for Additional Transmission Capacity

Over the past 10 years, the Minnesota Legislature has passed a series of laws designed to foster the growth of wind energy generation in the state. These include establishing goals for the proportion of electric generation to be met by renewable resources; mandating the development of 1,125 MW of wind by the state's largest utility; providing production incentives per kilowatt-hour produced to owners of wind generation systems for a period of ten years; instituting net metering, small power purchase requirements, and "green pricing" programs to support demand for wind energy; and exempting wind systems from sales and property taxes.

These efforts have been eminently successful, as demonstrated by the fact that total wind generation capacity in Minnesota is exceeded by that of only two other states. That leadership, however, is at risk for several reasons, few of which could be foreseen when the Legislature began supporting wind generation. The challenge the state now faces is making sure that additional wind resources developed in Minnesota's wind-friendly environment are able to get to market. To preserve its leadership role, the state must become as adept at stimulating the development of adequate transmission capacity as it has proven to be with respect to generation.

The fact is that transmission capacity has become a bottleneck to the further development of wind in Minnesota. The transmission lines in southwestern Minnesota that will transport wind energy from Buffalo Ridge are already fully subscribed, even though they have not yet been constructed. Xcel Energy testified that, on occasion, the company pays wind producers for electricity that it cannot transport over a constrained transmission network.

Conventional electric generating sources as well as wind will need additional transmission capacity as well. This issue will have to be addressed soon: Minnesota utilities project the need for an additional 4,000 MW of baseload and intermediate capacity over the next ten years,[1] and an additional 6,300 MW by 2020.[2]

In one sense, the reason for this problem is simply that electricity demand growth has exceeded growth in transmission capacity. That has certainly been the case nationally: since the 1970s, new transmission line miles have grown at half the rate of electricity demand.

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[1]Minnesota Department of Commerce, *Energy policy and conservation report – draft,* July 2004, p.i.

[2]CAPX2020, *Identifying Minnesota's transmission infrastructure needs – interim report,* November 2004, p. 2.

In Minnesota, the last major transmission line built, before the lines in southwestern Minnesota from Buffalo Ridge, was in 1979, 25 years ago. Local opposition to that line is one factor that inhibited the development of new transmission. Since then, non-transmission alternatives have been utilized to meet demand growth, through a combination of conservation efforts, deploying natural gas peaking plants and purchasing electricity from the grid.

The solution, of course, is to expand transmission capacity. But in the last dozen years, the electricity system has changed so significantly that uncertainty with respect to basic issues – Who will own and operate transmission lines? How will those entities recover their investment? – makes that simple solution a complex one to realize.

II. Barriers to Transmission Posed by the New Electricity System

In the past, transmission decisions were straightforward. They were made by the same vertically-integrated utilities that owned the generation plants to which transmission lines connected. Utilities financed transmission investments and coordinated their timing with the deployment of new generation facilities. The Federal Energy Regulatory Commission (FERC) affirmed that the project benefited ratepayers and increased grid reliability. The transmission investment was repaid from rates on the sale of electricity, usually in 5 years. This system governed the vast expansion of the transmission grid during the 20th century.

That model of utility finance no longer operates. The joint ownership link between generation and transmission has been weakened. Electricity restructuring – the move towards a more market-based approach to electricity service -- has transformed the system. FERC has pushed utilities to separate their transmission and generation operations. In 1999, FERC required utilities to transfer operational control of transmission to regional transmission organizations such as MISO (Midwest Independent System Operator). Minnesota utilities have done so. In order to create a free-flowing market in wholesale electricity, all transmission lines are now common carriers with access equally available to all generators. A utility that owns transmission cannot favor its own generation. That also means that transmission cannot be developed solely for one type of energy – wind or coal – but must be open to all generators.

With respect to transmission, the thought behind the market model was this: Since transmission is a relatively small proportion of total energy costs, under 10 percent, paying for additional transmission lines will be offset by the lower-priced resources to which those lines will provide access. In fact, MISO's first 5-year transmission plan, published in June 2003, confirmed this hypothesis. Under a "high-wind" scenario that called for developing 10,000 MW of wind in the Midwest, access to lower-cost wind offset the cost of transmission additions, resulting in lower overall energy costs to consumers.[3]

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[3]Midwest Independent System Operator, *MTEP-03: Midwest ISO Transmission Expansion Plan 2003*, June 19, 2003, p. 21.

Having different entities conduct separate planning processes and make separate decisions with respect to generation and transmission has more serious implications for wind than for other electric generating technologies. A transmission bottleneck negates one of wind's advantages over conventional electric generation, the ability to build projects quickly, over 18-months to two years. In contrast, transmission projects can take 6 or more years to complete. So unless transmission projects are planned in advance of additional wind generation, that generation will not be able to get to market.

That type of coordination is now more difficult, producing a classic chicken-and-egg problem: Developers can't build wind turbines and have them sit idle for years while the transmission lines are being planned and constructed. And transmission lines won't be built unless there is enough generating capacity available to make the line economically viable. The process is not made any easier by the entrepreneurial nature of small wind development: we don't know exactly when or where wind generation will occur, or who the developer may be.

The question the new system hasn't yet answered is this: Who pays for constructing the transmission lines? As a U.S. Department of Energy Report to Congress issued in May 2004 stated:

> The question of who pays for transmission expansions will be a major barrier to large-scale exploitation of the abundant wind (and coal) resources in the upper Midwest. Until the question of who pays (which includes issues of cost recovery and cost allocation) is answered, there likely will be no major expansion of transmission capacity to support wind energy development in the upper Midwest.[4]

The new market-based system does not match up very well with wind generation projects. Many wind projects are small, as is the financial capacity of their developers. They cannot contribute a substantial up-front transmission investment. Will the utility buying the power step in and make the investment? Again, the small size of wind projects – and the fact that several projects in a given area are developed over a period of years -- means that the initial wind development may not justify such a substantial transmission investment.

Another obstacle to transmission investment produced by the new open access regime illustrates what economists call the free-rider problem. Since capacity on the line must be open to all, where is the incentive to be the one to build the line that others will use? The entity that does assumes all of the risk, but others will benefit. As the California Public Utilities Commission stated in a December 2003 Report to the Legislature: "The fact that some developers in a given renewable resource area would bear disproportionate financial responsibility for required transmission upgrades, while other developers would escape such costs, creates a serious obstacle to the planned

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[4]U.S. Department of Energy, Office of Electric Transmission and Distribution, Office of Energy Efficiency and Renewable Energy, *Report to Congress on Analysis of wind resource locations and transmission requirements in the upper midwest,* May 2004, p. 3.

development of renewable resources. . . ."[5]

An additional source of uncertainty surrounding transmission investments is the issue of recovering those investments in retail electric rates. A major problem is how to allocate rates among beneficiaries of transmission service when the flows over a line contain both power destined for customers of a particular Minnesota utility (called "native load") and some that is only passing through to customers in a different state ("wholesale electricity"). How the Minnesota Public Utilities Commission will set those rates is as yet unknown. That makes potential transmission investors cautious.

MISO's Regional Expansion Criteria and Benefits Task Force is currently working to determine how to allocate the benefits and costs of transmission across MISO's 14-state membership. It will file a rate-setting protocol with FERC, at which point Minnesota may intervene if it feels the interests of Minnesota consumers are not served by the tariff. FERC can, of course, accept or reject the proposed rate framework.

III. Actions Minnesota Can Take

The state still retains authority to influence the new decision-making system, and the legislature has acted to do so in recent years.

- In 2001 and 2002, legislation was passed allowing utilities to automatically recover the costs of transmission for energy generated to meet the state's renewable energy objectives for wind and biomass, without the need for a rate case. This reduces some of the risk and uncertainty surrounding transmission. The Commission established a process to review costs proposed for this automatic rate recovery, and the first case consisting of 8 Xcel projects is currently awaiting a Commission decision. (Minnesota Statutes 2004, Section 216B.1645)

- In 2001, the legislature explicitly gave the Public Utilities Commission the authority to order public utilities to make "adequate infrastructure investments" in transmission facilities. MISO also has such authority; neither organization has made use of it yet. (Minn. Stat. 2004, sec. 216B.79)

- In 2001, the legislature ordered utilities owning or operating transmission lines to submit a report to the Public Utilities Commission every two years identifying present and foreseeable inadequacies in the state's transmission system and alternative means to address them. This statute was amended in 2003 to include the specific requirement that such reports "determine necessary transmission upgrades to support development of renewable energy resources required to meet" the state's renewable energy objectives. (Minn. Stat. 2004 sec.

[5] California Public Utilities Commission, Energy Division, *Report to the Legislature, SB 1038/Public Utilities Code Section 383.6: Electric transmission plan for renewable resources in California*, December 1, 2003, p. 11.

216B.2425) Next November's filings may provide the state with a valuable planning tool.

Minnesota also has authority to address another factor many have pointed to as inhibiting the speedy construction of new transmission lines: the length and complexity of the Public Utilities Commission's Certificate of Need process and the subsequent environmental review of such projects conducted by the Environmental Quality Board. This is an area the legislature may want to examine to see if the timeline can be shortened.

As described above, decision-making with respect to planning, building and operating transmission systems is organizationally fragmented and geographically dispersed. Some authority with respect to electric transmission has been removed from the hands of Minnesota companies and state regulators and relocated in entities operating from a regional and national perspective.

Thus, in order to protect the state's interests in electricity reliability and the growth of electric generation from renewable sources, including wind, Minnesota must operate simultaneously on two tracks. First, it must closely monitor planning processes that take place outside the state, and participate when there is opportunity to advocate for the state's position. At the same time, Minnesota must insure that the planning process within the state adequately considers all the options available.

For example, utilities are currently required to submit to the Commission both resource plans and transmission plans for all generation sources and specifically for renewables. But no entity is charged with integrating these separate plans for the state as a whole, and examining options from a statewide perspective, either with respect to resources, transmission, or, more importantly, both together.

MISO studies take place at the regional level. The Biennial Transmission Reports aggregate Minnesota utility perspectives on transmission for renewables. What may be missing is a Minnesota-wide plan to insure that the legislature's commitment to developing sources of renewable energy is matched by a commitment that those energy sources get to market. If the legislature thinks that more comprehensive planning needs to be done, it may want to examine options to insure that that occurs.

CHAPTER 3

INTERIM WORK PLAN DELIVERABLES

The LEETF 2004 interim work plan lists five deliverables. As discussed earlier, the list of deliverables was partially based on the assumptions that there was good information available on what wind projects provided the most local economic benefit and that a state policy based on that information was being implemented. As discussed in Chapter 1, those assumptions are clearly false. Thus, with respect to deliverables numbered 3, 4, and 5, it is premature to discuss in detail answers to those issues until a better knowledge base is acquired about wind energy's local economic development potential.

1. An inventory of current wind projects in Minnesota and the surrounding states by size, service date, ownership, customers, and location.

See attached Appendix 5. Xcel Energy alone is mandated to construct a minimum of 1125 MW. The Renewable Energy Objective (REO) law will probably be met by substantially more wind than any other renewable energy source.

2. An inventory of current Minnesota, federal, and neighboring state policies, which seek to facilitate wind energy development.

See attached Appendix 6.

3. Identify policy alternatives, which minimize consumer cost while maximizing the economic development potential for both small and large developers.

It is premature to provide answers to this issue until it is known what types of projects provide what levels of local economic development benefits. What is clear with respect to economic development benefits is that the issue of small versus large wind generators is a false dichotomy: the appropriate issue is level of local benefit, which may be more appropriately characterized as level of local ownership versus level of non-local ownership.

4. Identify ways to ensure that the costs of wind-related economic development are borne by the communities where the economic development is likely to occur.

It is premature to identify ways. There is not sufficient information to ensure that the lowest cost/highest benefit projects are being constructed. There are also wide differences of opinion concerning the benefits that should be counted and how they should be valued with respect to utilizing wind generation versus fossil fuel and other generation alternatives. What is clear is that a policy should be developed that strives to construct projects that have the least cost and most benefit to consumers under whatever sets of values are embedded in the policy.

5. Identify opportunities for investment or ownership of wind projects on the part of local landowners, cooperative investors, or utilities and their customers.

There are a multitude of opportunities and perhaps the best way to discuss this issue is to focus on barriers to investment. Those barriers include lack of capital, lending limits for small local banks, lack of expertise, risk aversion, and a lack of economies of scale.

It is premature to discuss the solution to these barriers until better information is available as to what are the projects that should be built to achieve maximum local economic development benefit. For example, it may be that the best plan for wind development is four 100 MW wind farms. If that is the case, the barriers for local investment would be different if the model was 100 four MW wind farms. Thus, it is not profitable to discuss the proper tools to enhance local investment opportunities except in such general terms that it would not be of much value. Local investors would need capital, expertise, understanding of risks, and a good project in any instance.

CHAPTER 4

RECOMMENDATIONS

1. The task force should authorize the continuation of the working group activities involving meetings of the public and stakeholders. These activities provide a forum that is more informal than the usual administrative or legislative forum allowing for more comfortable sharing of information. The activities should have a short-term and long term focus and continue year around. The short-term focus should involve issues ripe for legislation and occur prior to and during a legislative session. During the 2005 session, such issues would include local economic benefit from wind projects and electricity transmission. These two issues are a matter of some urgency and it is recommended that the legislative committees with jurisdiction address them, taking advantage of the information gathered by the work group. The long-term issues would be addressed in the interims between legislative sessions and would focus on structures and processes designed to foster development of an integrated and comprehensive state energy policy. (See Appendix 3 for a selected list of topics suggested by participants in the interim meetings.)

2. The efforts of several utilities to work on transmission issues in a project commonly known as CAPX2020 illustrates the need for an industry-wide approach to some issues. There is a need for more coordinated work between industry members. It is recommended that the legislative committees with jurisdiction address whether there is a need for statutory amendment to mandate this coordination.

3. The task force should consider using its financial resources (assessment authority of $250,000 per fiscal year) to commission work of a technical nature. This could include expanding on the wind integration study commissioned by the Department of Commerce that analyzed the cost of integrating 1500 MW of wind on the Xcel energy system. An analysis of the cost of integrating additional wind and its reliability impacts would be crucial in assessing the role of wind generation. An examination of the maximum reliable wind additions should be a part of the study along with the location and time frame of adding wind. Another example of work that the task force could commission is an analysis of the types of projects that maximize local economic benefit.

4. Task force members should be encouraged to become legislative members on the several national organizations that focus on energy issues and/or to attend conferences on energy issues so as to serve as a resource to fellow members. There is some complexity to energy issues and developing a knowledge base among legislators is a crucial predicate to formulating energy policy.

5. The task force (and the legislature in general) should utilize the expertise of the executive branch in developing energy policy. In particular, the task force should invite the Public Utilities Commission to communicate with (preferably in person) the task force shortly before and after each legislative session to receive advice on concerns over existing policy and the need for new policy. In general, strong working relationships should be forged between the executive branch and the legislature on energy issues and the executive branch agencies should be a vital part of the working

group process.

6. The work group should examine the various Minnesota laws that address wind generation such as the property tax, agricultural and economic loan programs, and generation mandates to assess whether there is a need to amend these laws so that a coordinated approach to wind energy is in place that is consonant with state wind policy. The need for a state agency to be directly involved in the development aspect of wind should also be explored.

APPENDIX 1

Project Summary: Wind Energy policy issues evaluation

Project Sponsor: EETF **Project Managers: EETF Steering Committee**

Policy Issue	Objectives	Scope
• As wind energy develops as a resource large wind developers appear to dominate development causing the potential for a large vs. small conflict to develop. There appear to be barriers to entry for small developers which frustrate small wind development. Policy questions and options to facilitate the continued development of wind energy should be explored.	• Review current policy and linkages to regional electric infrastructure issues and development incentives. Compare and contrast the customer cost, economic development attributes, barriers to entry and electric infrastructure policy implications of large Commercial and small or community based wind energy project development.	• EETF will use a working group and public meeting format which will seek stakeholder perspectives on these issues. These public meetings will be held in locations to facilitate a wide range of analysis and public policy input.

Workplan Overview	Deliverables
• Develop a compendium of existing projects and policies related to wind energy development • Hold public information gathering meetings to learn: 1. Relative consumer cost impact of large and small wind energy development. 2. Relative economic development potential of large and small wind energy development. 3. Barriers to entry for wind development: a. Relative barriers for small and large projects b. FERC queuing issues c. Infrastructure capacity issues d. Interdependence on neighboring states infrastructure	• An inventory of current wind projects in Minnesota and the surrounding states by size, in-service date, ownership, customers and location. • An inventory of current Minnesota, Federal and neighboring state policies which seek to facilitate wind energy development. • Identify policy alternatives which minimize consumer cost while maximizing the economic development potential for both small and large developers. • Identify ways to ensure that the costs of wind-related economic development are borne by the communities where the economic development is likely to occur. • Identify opportunities for investment or ownership of wind projects on the part of local landowners, cooperative investors, or utilities and their customers.

APPENDIX 2

ELECTRIC ENERGY TASK FORCE STEERING COMMITTEE
2004 WORK PLAN

1. Bob Ambrose, Great River Energy (Representing Co-ops)
2. Mrg Simon, Missouri River Energy (Representing municipals)
3. Carl Lehmann, Xcel Energy (Representing investor-owned utilities)
4. Bill Grant, Izaak Walton League (Representing environmental groups)
5. Dan Juhl (Representing small wind developers)
6. Paul White, EnXco (Representing large wind developers)
7. Laura Bordelon, Minnesota Chamber of Commerce
8. Clair Moeller, Midwest Independent System Operator (MISO)
9. Jack Keers, Pipestone County Commissioner (Representing Local Governments)
10. Dick Hemmingsen, University of Minnesota

APPENDIX 3

SELECTED SUMMARY OF PUBLIC COMMENT

Wind on the Wires

1. Who is responsible for planning for new transmission for wind power?

2. Who is responsible for building new transmission for wind power?

3. Who gets to use the new capacity on the lines?

4. Who pays for new transmission?

5. What criteria will determine whether transmission system upgrades are paid by the generator (participant funded) and which are not (rolled in)?

Sarofolean and Associates, L.L.C.

1. Why is the state of Minnesota allowing non-utility interests to build, own and operate, unregulated wind generating facilities without requiring an affected regulated utility to submit a similar, competing proposal?

2. Considering the state's regulatory compact with its utilities, why aren't the utilities required to build, own, and operate these wind assets?

3. Does the state need multiple owners of wind generating assets? If so, what economic benefits accrue to ratepayers or what other requirements are met?

4. Should not regulated utilities be given the bidding and investment opportunities their regulatory compact with the State of Minnesota seems to allow?

5. Has Minnesota subtly changed its regulatory compact between utility providers and ratepayers to focus on and allow non-utility ownership of certain generation?

Citizens Comment–Laura and John Reinhardt-September 19, 2004

Various comments on transmission issues to federal DOE. Present the issue of whether federal open access transmission regulations impede investment in transmission infrastructure and the ability of a state to plan for and serve the needs of its citizen. Raises the issue of federal policy jurisdiction and need to be alert to protection of state's interests.

The Minnesota Project

Commented that ownership structures do matter to the prosperity of local communities. The local benefits also impact the extent to which the development and supporting infrastructure, namely transmission lines, are supported locally. It is a critical time to establish long-term state policies to allow entrepreneurs to persist and to thrive. Four distinct action steps need to be taken

1. Define and articulate the policy objectives that are being sought.

2. Document the principal barriers to the desired outcomes in the marketplace and assess their relative importance.

3. Identify and develop a variety of policy tools or mechanisms that can be used to achieve those outcomes.

4. Evaluate those tools and mechanisms relative to their effectiveness, cost, and impact.

Kristen Eide-Tollefson for Communities United for Responsible Energy

1. Suggested that the large versus small wind energy project distinction is not relevant for assessing local economic benefit.

2. What are the range of funding options and models that would enhance the economic development potential of wind/renewable energy?

2. How does the potential for financial and project aggregation (of MWs) change the potential and terms of "small wind energy" development?

3. What role does MISO have that affects wind energy development in Minnesota, and what policies does it embrace?

4. How would dispersed and distributed renewable projects across the state affect reliability, security, and constraint issues for Minnesota load and/or market export? What kind of transmission/distribution system support would maximize potential benefits and minimize problems associated with distributed and dispersed generation?

Mike Michaud-representing North American Water Office, Citizens United for Responsible Energy, and Lake City Wind Energy Task Force

Identified lack of transmission infrastructure and front end capital costs as two barriers to wind generation community-based economic development. Suggested:

1. Use dispersed generation on the distribution side of the grid, thus, not requiring transmission capacity.

2. Explore options to encourage distribution side interconnection agreements.

3. To address the problem of lack of transmission reservation access, encourage partnering of renewable/nonrenewable projects for transmission reservation purposes.

4. Suggested a variety of options that would provide better market access for renewable energy.

5. Suggested that small wind projects can be quickly built and, thus, be a quick relief to transmission issues if strategically utilized.

Minnesota Municipal Power Association

1. Stressed that the renewable energy production incentive should have increased funding and that its limitations on size and ownership be changed so that economies of scale and the participation of public power entities can be facilitated.

2. Suggested a system of tradable tax credits so that public power entities can participate in the program since they are tax exempt.

3. Need transmission capacity and wind projects pose special challenges since the best wind resources are generally distant from loads and wind is not always dispatchable to support transmission. Anticipates supporting an industry-wide initiative designed to address transmission planning and construction.

Minnesota Department of Commerce

While citing Minnesota's leadership in renewable energy production, the department declared that the state must address inadequate transmission infrastructure and barriers to community-based energy development.

Minnesota Project on behalf of Minnesotans for an Energy Efficient Economy, the North American Water Office, and Windustry

These suggestions all relate to proposals to assist community based wind projects.

1. Consider extending the Renewable Energy Program Incentive with various funding sources suggested.

2. Provide a wind tariff for all Minnesota utilities (not just Xcel) and make it bankable in the sense the tariff would be enough and paid in a manner to make the project financially viable.

3. Reserve an annual amount of new energy generation to community-based projects that would be competitively bid.

4. Create a Minnesota tradable renewable energy tax credit that would allow those who cannot benefit from tax credits to trade them.

5. Provide state loan guarantees for community based wind projects.

6. Experiment with piggybacking or joining large developments with small projects.

<u>Metropolitan Counties Energy Task Force</u>

1. Large government purchasers of electricity need an effective means to purchase renewable energy.

2. The CIP program needs a mechanism to provide adequate funding for conservation recommissioning studies of public buildings.

3. The LEETF work group activities provide a forum for persons to discuss energy issues and should continue with a goal of achieving a coordinated and integrated energy policy.

APPENDIX 4

MINNESOTA WIND ENERGY MANDATES AND SUBSIDIES

116C.779 Funding for renewable development.

Subdivision 1. Renewable development account. (a) The public utility that owns the Prairie Island nuclear generating plant must transfer to a renewable development account $16,000,000 annually each year the plant is in operation, and $7,500,000 each year the plant is not in operation if ordered by the commission pursuant to paragraph (c). The fund transfer must be made if nuclear waste is stored in a dry cask at the independent spent-fuel storage facility at Prairie Island for any part of a year. Funds in the account may be expended only for development of renewable energy sources. Preference must be given to development of renewable energy source projects located within the state.

(b) Expenditures from the account may only be made after approval by order of the Public Utilities Commission upon a petition by the public utility.

(c) After discontinuation of operation of the Prairie Island nuclear plant and each year spent nuclear fuel is stored in dry cask at the Prairie Island facility, the commission shall require the public utility to pay $7,500,000 for any year in which the commission finds, by the preponderance of the evidence, that the public utility did not make a good faith effort to remove the spent nuclear fuel stored at Prairie Island to a permanent or interim storage site out of the state. This determination shall be made at least every two years.

Subd. 2. Renewable energy production incentive. (a) Until January 1, 2018, up to $6,000,000 annually must be allocated from available funds in the account to fund renewable energy production incentives. $4,500,000 of this annual amount is for incentives for up to 100 megawatts of electricity generated by wind energy conversion systems that are eligible for the incentives under section 216C.41. The balance of this amount, up to $1,500,000 annually, may be used for production incentives for on-farm biogas recovery facilities that are eligible for the incentive under section 216C.41 or for production incentives for other renewables, to be provided in the same manner as under section 216C.41. Any portion of the $6,000,000 not expended in any calendar year for the incentive is available for other spending purposes under this section. This subdivision does not create an obligation to contribute funds to the account.

(b) The Department of Commerce shall determine eligibility of projects under section 216C.41 for the purposes of this subdivision. At least quarterly, the Department of Commerce shall notify the public utility of the name and address of each eligible project owner and the amount due to each project under section 216C.41. The public utility shall make payments within 15 working days after receipt of notification of payments due.

216B.1691 Renewable energy objectives.

Subdivision 1. Definitions. (a) Unless otherwise specified in law, "eligible energy technology" means an energy technology that:

(1) generates electricity from the following renewable energy sources: solar; wind; hydroelectric with a capacity of less than 60 megawatts; hydrogen, provided that after January 1, 2010, the hydrogen must be generated from the resources listed in this clause; or biomass, which includes an energy recovery facility used to capture the heat value of mixed municipal solid waste or refuse-derived fuel from mixed municipal solid waste as a primary fuel; and

(2) was not mandated by Laws 1994, chapter 641, or by commission order issued pursuant to that chapter prior to August 1, 2001.

(b) "Electric utility" means a public utility providing electric service, a generation and transmission cooperative electric association, or a municipal power agency.

(c) "Total retail electric sales" means the kilowatt-hours of electricity sold in a year by an electric utility to retail customers of the electric utility or to a distribution utility for distribution to the retail customers of the distribution utility.

Subd. 2. Eligible energy objectives. (a) Each electric utility shall make a good faith effort to generate or procure sufficient electricity generated by an eligible energy technology to provide its retail consumers, or the retail customers of a distribution utility to which the electric utility provides wholesale electric service, so that:

(1) commencing in 2005, at least one percent of the electric utility's total retail electric sales is generated by eligible energy technologies;

(2) the amount provided under clause (1) is increased by one percent of the utility's total retail electric sales each year until 2015; and

(3) ten percent of the electric energy provided to retail customers in Minnesota is generated by eligible energy technologies.

(b) Of the eligible energy technology generation required under paragraph (a), clauses (1) and (2), not less than 0.5 percent of the energy must be generated by biomass energy technologies, including an energy recovery facility used to capture the heat value of mixed municipal solid waste or refuse-derived fuel from mixed municipal solid waste as a primary fuel, by 2005. By 2010, one percent of the eligible technology generation required under paragraph (a), clauses (1) and (2), shall be generated by biomass energy technologies. An energy recovery facility used to capture the heat value of mixed municipal solid waste or refuse-derived fuel from mixed municipal solid waste, with a power sales agreement in effect as of May 29, 2003, that terminates after December 31, 2010, does not qualify as an eligible energy technology unless the agreement provides for rate adjustment in the event the facility qualifies as a renewable energy source.

(c) By June 1, 2004, and as needed thereafter, the commission shall issue an order detailing the criteria and standards by which it will measure an electric utility's efforts to meet the renewable energy objectives of this section to determine whether the utility is making the required good faith effort. In this order, the commission shall include criteria and standards that protect against undesirable impacts on the reliability of the utility's system and economic impacts on the utility's ratepayers and that consider technical feasibility.

(d) In its order under paragraph (c), the commission shall provide for a weighted scale of how energy produced by various eligible energy technologies shall count toward a utility's objective. In establishing this scale, the commission shall consider the attributes of various technologies and fuels, and shall establish a system that grants multiple credits toward the objectives for those technologies and fuels the commission determines is in the public interest to encourage.

Subd. 3. Utility plans filed with commission. (a) Each electric utility shall report on its plans, activities, and progress with regard to these objectives in its filings under section 216B.2422 or in a separate report submitted to the commission every two years, whichever is more frequent, demonstrating to the commission that the utility is making the required good faith effort. In its resource plan or a separate report, each electric utility shall provide a description of:

(1) the status of the utility's renewable energy mix relative to the good faith objective;

(2) efforts taken to meet the objective;

(3) any obstacles encountered or anticipated in meeting the objective; and

(4) potential solutions to the obstacles.

(b) The commissioner shall compile the information provided to the commission under paragraph (a), and report to the chairs of the house of representatives and senate committees with jurisdiction over energy and environment policy issues as to the progress of utilities in the state in increasing the amount of renewable energy provided to retail customers, with any recommendations for regulatory or legislative action, by January 15 of each odd-numbered year.

Subd. 4. Renewable energy credits. (a) To facilitate compliance with this section, the commission, by rule or order, may establish a program for tradable credits for electricity generated by an eligible energy technology. In doing so, the commission shall implement a system that constrains or limits the cost of credits, taking care to ensure that such a system does not undermine the market for those credits.

(b) In lieu of generating or procuring energy directly to satisfy the renewable energy objective of this section, an electric utility may purchase sufficient renewable energy credits, issued pursuant to this subdivision, to meet its objective.

(c) Upon the passage of a renewable energy standard, portfolio, or objective in a bordering state that includes a similar definition of eligible energy technology or renewable energy, the commission may facilitate the trading of renewable energy credits between states.

Subd. 5. Technology based on fuel combustion. (a) Electricity produced by fuel combustion may only count toward a utility's objectives if the generation facility:

(1) was constructed in compliance with new source performance standards promulgated under the federal Clean Air Act for a generation facility of that type; or

(2) employs the maximum achievable or best available control technology available for a generation facility of that type.

(b) An eligible energy technology may blend or co-fire a fuel listed in subdivision 1, paragraph (a), clause (1), with other fuels in the generation facility, but only the percentage of electricity that is attributable to a fuel listed in that clause can be counted toward an electric utility's renewable energy objectives.

Subd. 6. Electric utility that owns nuclear generation facility. (a) An electric utility that owns a nuclear generation facility, as part of its good faith effort under this subdivision and subdivision 2, shall deploy an additional 300 megawatts of nameplate capacity of wind energy conversion systems by 2010, beyond the amount of wind energy capacity to which the utility is required by law or commission order as of May 1, 2003. At least 100 megawatts of this capacity are to be wind energy conversion systems of two megawatts or less, which shall not be eligible for the production incentive under section 216C.41. To the greatest extent technically feasible and economic, these 300 megawatts of wind energy capacity are to be distributed geographically throughout the state. The utility may opt to own, construct, and operate up to 100 megawatts of this wind energy capacity, except that the utility may not own, construct, or operate any of the facilities that are under two megawatts of nameplate capacity. The deployment of the wind energy capacity under this subdivision must be consistent with the outcome of the engineering study required under Laws 2003, First Special Session chapter 11, article 2, section 21.

(b) The renewable energy objective set forth in subdivision 2 shall be a requirement for the public utility that owns the Prairie Island nuclear generation plant. The objective is a requirement subject to resource planning and least-cost planning requirements in section 216B.2422, unless implementation of the objective can reasonably be shown to jeopardize the reliability of the electric system. The least-cost planning analysis must include the costs of ancillary services and other necessary generation and transmission upgrades.

(c) Also as part of its good faith effort under this section, the utility that owns a nuclear generation facility is to enter into a power purchase agreement by January 1, 2004, for ten to 20 megawatts of biomass energy and capacity at an all-inclusive price not to exceed $55 per megawatt-hour, for a project described in section 216B.2424, subdivision 5, paragraph (e), clause (2). The project must be operational and producing energy by June 30, 2005.

216B.2423 Wind power mandate.

Subdivision 1. Mandate. A public utility, as defined in section 216B.02, subdivision 4, that operates a nuclear-powered electric generating plant within this state must construct and operate, purchase, or contract to construct and operate: (1) 225 megawatts of electric energy installed capacity generated by wind energy conversion systems within the state by December 31, 1998; and (2) an additional 200 megawatts of installed capacity so generated by December 31, 2002.

For the purpose of this section, "wind energy conversion system" has the meaning given it in section 216C.06, subdivision 19.

Subd. 2. Resource planning mandate. The Public Utilities Commission shall order a public utility subject to subdivision 1, to construct and operate, purchase, or contract to purchase an additional 400 megawatts of electric energy installed capacity generated by wind energy conversion systems by December 31, 2002, subject to resource planning and least cost planning requirements in section 216B.2422.

Subd. 2a. Site preference. The Public Utilities Commission shall ensure that a utility subject to the requirements of subdivision 1, clause (2), shall implement that clause with a preference for wind energy conversion systems within the state. This preference shall not prevent the utility from constructing or contracting to construct wind energy conversion systems outside the state, if the Public Utilities Commission determines that selection of a facility within the state conflicts with the requirements of section 216B.03.

Subd. 3. Standard contract for wind energy conversion systems. The Public Utilities Commission shall require a public utility subject to subdivision 1 to develop and file in a form acceptable to the commission by October 1, 1997, a standard form contract for the purchase of electricity from wind conversion systems with installed capacity of two megawatts and less. For purposes of applying the two megawatts limit, the installed capacity sold to the public utility from a single seller or affiliated group of sellers shall be cumulated. The standard contract shall include all the terms and conditions for purchasing wind-generated power by the utility, except for price and any other specific terms necessary to ensure system reliability and safety, which shall be separately negotiable.

216C.41 Renewable energy production incentive.

Subdivision 1. Definitions. (a) The definitions in this subdivision apply to this section.

(b) "Qualified hydroelectric facility" means a hydroelectric generating facility in this state that:

(1) is located at the site of a dam, if the dam was in existence as of March 31, 1994; and

(2) begins generating electricity after July 1, 1994, or generates electricity after substantial refurbishing of a facility that begins after July 1, 2001.

(c) "Qualified wind energy conversion facility" means a wind energy conversion system in this state that:

(1) produces two megawatts or less of electricity as measured by nameplate rating and begins generating electricity after December 31, 1996, and before July 1, 1999;

(2) begins generating electricity after June 30, 1999, produces two megawatts or less of electricity as measured by nameplate rating, and is:

(i) owned by a resident of Minnesota or an entity that is organized under the laws of this state, is not prohibited from owning agricultural land under section 500.24, and owns the land where the facility is sited;

(ii) owned by a Minnesota small business as defined in section 645.445;

(iii) owned by a Minnesota nonprofit organization;

(iv) owned by a tribal council if the facility is located within the boundaries of the reservation;

(v) owned by a Minnesota municipal utility or a Minnesota cooperative electric association; or

(vi) owned by a Minnesota political subdivision or local government, including, but not limited to, a county, statutory or home rule charter city, town, school district, or any other local or regional governmental organization such as a board, commission, or association; or

(3) begins generating electricity after June 30, 1999, produces seven megawatts or less of electricity as measured by nameplate rating, and:

(i) is owned by a cooperative organized under chapter 308A other than a Minnesota cooperative electric association; and

(ii) all shares and membership in the cooperative are held by an entity that is not prohibited from owning agricultural land under section 500.24.

(d) "Qualified on-farm biogas recovery facility" means an anaerobic digester system that:

(1) is located at the site of an agricultural operation;

(2) is owned by an entity that is not prohibited from owning agricultural land under section 500.24 and that owns or rents the land where the facility is located; and

(3) begins generating electricity after July 1, 2001.

(e) "Anaerobic digester system" means a system of components that processes animal waste based on the absence of oxygen and produces gas used to generate electricity.

Subd. 2. Incentive payment; appropriation. (a) Incentive payments must be made according to this section to (1) a qualified on-farm biogas recovery facility, (2) the owner or operator of a qualified hydropower facility or qualified wind energy conversion facility for electric energy generated and sold by the facility, (3) a publicly owned hydropower facility for electric energy that is generated by the facility and used by the owner of the facility outside the facility, or (4) the owner of a publicly owned dam that is in need of substantial repair, for electric energy that is generated by a hydropower facility at the dam and the annual incentive payments will be used to fund the structural repairs and replacement of structural components of the dam, or to retire debt incurred to fund those repairs.

(b) Payment may only be made upon receipt by the commissioner of finance of an incentive payment application that establishes that the applicant is eligible to receive an incentive payment and that satisfies other requirements the commissioner deems necessary. The application must be in a form and submitted at a time the commissioner establishes.

(c) There is annually appropriated from the general fund to the commissioner of commerce sums sufficient to make the payments required under this section, other than the amounts funded by the renewable development account as specified in subdivision 5a.

Subd. 3. Eligibility window. Payments may be made under this section only for electricity generated:

(1) from a qualified hydroelectric facility that is operational and generating electricity before December 31, 2005;

(2) from a qualified wind energy conversion facility that is operational and generating electricity before January 1, 2007; or

(3) from a qualified on-farm biogas recovery facility from July 1, 2001, through December 31, 2017.

Subd. 4. Payment period. (a) A facility may receive payments under this section for a ten-year period. No payment under this section may be made for electricity generated:

(1) by a qualified hydroelectric facility after December 31, 2017;

(2) by a qualified wind energy conversion facility after December 31, 2017; or

(3) by a qualified on-farm biogas recovery facility after December 31, 2015.

(b) The payment period begins and runs consecutively from the date the facility begins generating electricity or, in the case of refurbishment of a hydropower facility, after substantial repairs to the hydropower facility dam funded by the incentive payments are initiated.

Subd. 5. Amount of payment; wind facilities limit. (a) An incentive payment is based on the number of kilowatt hours of electricity generated. The amount of the payment is:

(1) for a facility described under subdivision 2, paragraph (a), clause (4), 1.0 cent per kilowatt hour; and

(2) for all other facilities, 1.5 cents per kilowatt hour.

For electricity generated by qualified wind energy conversion facilities, the incentive payment under this section is limited to no more than 100 megawatts of nameplate capacity.

(b) For wind energy conversion systems installed and contracted for after January 1, 2002, the total size of a wind energy conversion system under this section must be determined according to this paragraph. Unless the systems are interconnected with different distribution systems, the nameplate capacity of one wind energy conversion system must be combined with the nameplate capacity of any other wind energy conversion system that is:

(1) located within five miles of the wind energy conversion system;

(2) constructed within the same calendar year as the wind energy conversion system; and

(3) under common ownership.

In the case of a dispute, the commissioner of commerce shall determine the total size of the system, and shall draw all reasonable inferences in favor of combining the systems.

(c) In making a determination under paragraph (b), the commissioner of commerce may determine that two wind energy conversion systems are under common ownership when the underlying ownership structure contains similar persons or entities, even if the ownership shares differ between the two systems. Wind energy conversion systems are not under common ownership solely because the same person or entity provided equity financing for the systems.

Subd. 5a. Renewable development account. The Department of Commerce shall authorize payment of the renewable energy production incentive to wind energy conversion systems for 100 megawatts of nameplate capacity in addition to the capacity authorized under subdivision 5 and to on-farm biogas recovery facilities. Payment of the incentive shall be made from the renewable energy development account as provided under section 116C.779, subdivision 2.

Subd. 6. Ownership; financing; cure. (a) For the purposes of subdivision 1, paragraph (c), clause (2), a wind energy conversion facility qualifies if it is owned at least 51 percent by one or more of any combination of the entities listed in that clause.

(b) A subsequent owner of a qualified facility may continue to receive the incentive payment for the duration of the original payment period if the subsequent owner qualifies for the incentive under subdivision 1.

(c) Nothing in this section may be construed to deny incentive payment to an otherwise qualified facility that has obtained debt or equity financing for construction or operation as long as the ownership requirements of subdivision 1 and this subdivision are met. If, during the incentive payment period for a qualified facility, the owner of the facility is in default of a lending agreement and the lender takes possession of and operates the facility and makes reasonable efforts to transfer ownership of the facility to an entity other than the lender, the lender may continue to receive the incentive payment for electricity generated and sold by the facility for a period not to exceed 18 months. A lender who takes possession of a facility shall notify the commissioner immediately on taking possession and, at least quarterly, document efforts to transfer ownership of the facility.

(d) If, during the incentive payment period, a qualified facility loses the right to receive the incentive because of changes in ownership, the facility may regain the right to receive the incentive upon cure of the ownership structure that resulted in the loss of eligibility and may reapply for the incentive, but in no case may the payment period be extended beyond the original ten-year limit.

(e) A subsequent or requalifying owner under paragraph (b) or (d) retains the facility's original priority order for incentive payments as long as the ownership structure requalifies within two years from the date the facility became unqualified or two years from the date a lender takes possession.

Subd. 7. Eligibility process. (a) A qualifying project is eligible for the incentive on the date the commissioner receives:

(1) an application for payment of the incentive;

(2) one of the following:

(i) a copy of a signed power purchase agreement;

(ii) a copy of a binding agreement other than a power purchase agreement to sell electricity generated by the project to a third person; or

(iii) if the project developer or owner will sell electricity to its own members or customers, a copy of the purchase order for equipment to construct the project with a delivery date and a copy of a signed receipt for a nonrefundable deposit; and

(3) any other information the commissioner deems necessary to determine whether the proposed project qualifies for the incentive under this section.

(b) The commissioner shall determine whether a project qualifies for the incentive and respond in writing to the applicant approving or denying the application within 15 working days of receipt of the information required in paragraph (a). A project that is not operational within 18 months of receipt of a letter of approval is no longer approved for the incentive. The commissioner shall notify an applicant of potential loss of approval not less than 60 days prior to the end of the 18-month period. Eligibility for a project that loses approval may be reestablished as of the date the commissioner receives a new completed application.

Wind Projects in Selected States

State	Project	Owner	Date Online	MW	Power Purchaser/User
Illinois	Mendota Hills	Navitas Energy	4th Qtr 2003	50.4	ComEd
Iowa	Adair	Shafer Systems	Dec 1994	0.225	Alliant/IES Utilities
	Akron-Westfield School District	Akron-Westfield Comm. Schools	Jan 1999	0.6	Alliant
	Iowa Dist. Wind Energy Project	Consortium/Cedar Falls is lead with 2/3 ownership	Sept 1998	2.25	Consortium
	Sibley Wind Farm	Northern Alternative Energy	Oct 1997	1.2	Alliant/IES Utilities
	Forest City High School	Forest City Comm School District	May 1999	0.6	Forest City Community
	Windway Technologies	Northwood-Kensett School	Dec 1998	0.25	Alliant/IES Utilities
	Nevada High School	Nevada High School	Dec 1998	0.5	Alliant/IES Utilities
	Nevada	Story County Hospital	Dec 1993	0.225	Alliant/IES Utilities
	Spirit Lake	Community School District	Dec 1992	0.25	Alliant/IES Utilities
	Storm Lake I Buena Vista & Cherokee Coutnies	Edison Capital	June 1999	112.50	MidAmerican
	Storm Lake II Buena Vista & Cherokee Counties	GE Wind	May 1999	80.25	Alliant/IES Utilities
	Clear Lake	FPL Energy	April 1999	42.0	Alliant/FORAS/FPL Energy

Wind Projects in Selected States

State	Project	Owner	Date Online	MW	Power Purchaser/User
Iowa – Cont.	Buena Vista County	GE Wind	June 1999	1.5	Waverly Light & Power
	Sentral School		Nov 1995	0.07	
	Worth County	Entergy (with Zilkha & Midwest Renewable)	Dec 2001	80.1	Alliant/IPC
	Waverly	Waverly Light & Power	2001	0.90	Waverly Light & Power
	Spirit Lake	Spirit Lake School Dist	Dec 2001	0.75	Alliant
	Clarion-Goldfield School	Clarion-Goldfield High School	June 2002	0.05	Clarion-Goldfield High School
	Eldora – New Providence Schools	Hardin County	2002	0.75	Eldora – New Providence Schools
	Hancock County Wind Farm	FPL Energy	2002	97.68	Alliant Energy (44 MW)
	Wall Lake	Wall Lake Municipal Utilities	2003	0.66	Wall Lake Municipal Utilities
	Flying Cloud (Near Spirit Lake)	PPM Energy	4^{th} Qtr 2003	43.5	Alliant
	Henry Hills	NAE	4^{th} Qtr 2003	3.6	Alliant
	Lenox	Lenox Municipal	4^{th} Qtr 2003	0.75	Lenox
	Wall Lake	Wall Lake Municipal	2003	0.66	Wall Lake
	Sibley Hills Project	NAE	2003	0.66	Alliant
Michigan	Traverse City	Traverse City Light & Power	May 1996	0.6	Traverse City Light & Power

Wind Projects in Selected States

State	Project	Owner	Date Online	MW	Power Purchaser/User
	Mackinaw City		2001	1.8	Consumers Energy
Montana	Blackfeet Reservation	Blackfeet Nation	1996	0.1	Glacier Electric Cooperative
Nebraska	Lincoln		1999	1.32	Lincoln Electric System
	Springview	Nebraska Public Power District	Oct 1998	1.5	Nebraska Public Power District
	Near Valley	Omaha Public Power District	Dec 2001	0.66	Omaha Public Power District
	Kimball	Municipal Energy Agency of Nebraska	Nov 2002	10.5	Municipal Energy Agency of Nebraska
North Dakota	Fort Totten	Spirit Lake Sioux	Jan 1997	0.1	Spirit Lake Sioux
	Belcourt	Turtle Mt. Chippewa	Jan 1997	0.1	Turtle Mt. Chippewa
	Grafton	Grafton Tech. College	Jan 1997	0.065	
	Richardton	Richardton Abbey	Jan 1997	0.125	Richardton Abbey
	Valley City, Oriska Hills		Jan 2002	0.9	Minnkota Power Coop
	East of Petersburg	Minnkota Power Cooperative	Jul 2002	0.9	Minnkota Power Cooperative
	Prairie Winds, near Minot		Nov 2002	2.6	Basin Elec. Power Coop & Central Power Elec. Coop
North Dakota – Cont.	Edgeley	FPL Energy	2003	40.5	Basin Electric
	Kulm	FPL Energy	2003	21	Otter Tail Power Company

Wind Projects in Selected States

State	Project	Owner	Date Online	MW	Power Purchaser/User
South Dakota	Chamberlain	Basin Electric	Aug 2001	2.6	Basin Electric, East River Coop
	Howard County	City of Howard	Oct 2001	0.216	City of Howard
	Gary	EMS-DES	June 2002	0.09	EMS-DES
	Canova	City of Howard	2002	0.108	City of Howard
	Miner County	City of Howard	2003	0.216	City of Howard
	Rosebud Sioux	Rosebud	2003	0.75	Rosebud Tribe
	Highmore	FPL Energy	2003	40.5	Basin Electric
Wisconsin	De Pere	4 WI Utilities	Jan 1998	1.2	Consortium of 4 WI Utilities
	Rosiere/Kewaunee County	Madison Gas & Electric	June 1999	11.22	Madison Gas & Electric
	Lincoln/Kewaunee County	Wisconsin Public Service	June 1999	9.24	Wisconsin Public Service
	Byron, Fond du Lac County	Alliant Energy	June 1999	1.32	Wisconsin Electric
	Monfort Wind Farm	Enron Wind Corp.	July 2001	30.0	Wisconsin Electric; Alliant Energy

Source: American Wind Energy Association, *Wind Project Database*. Updated August-December 2004. Online at: www.awea.org/projects

WIND TURBINES

	NUMBER OF TURBINES	NUMBER OF MEGAWATTS
PERMITTED		
BY EQB	588	546
LOCALLY	244	259
TOTAL PERMITTED	832	805
IN OPERATION		
EQB PERMIT	495	406
LOCAL	204	195
TOTAL	699	601

Based on current information at EQB and Department of Commerce Incentive database, received 11/4/2004.

11/17/2004

Wind Project Data Base

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MN Wind Resource Assessment Report

State Summary:

Total MW = 594.58
Planned MW = 135.1

Wind Energy Potential:
Average Power Output (MW): 75,000
Annual KWh: 657B
Rank in US: 9th

Follow the links for more information

Updated: Jan 24, 2005

Minnesota

Wind Energy Development

Existing Project or Area	Owner	Date Online	MW Installed	Power Purchaser/ User	Turbine/ Units
Crookston	Phoenix Industries	1987	0.075	Otter Tail Power Co.	NA
1. Buffalo Ridge	Kenetech Windpower	1994	25.0	Xcel Energy	Kenetech (73)
4. Chandler Hills	Great River Energy	Dec 1998	1.98	Great River Energy	Vestas (3)
1. Lake Benton - I	GE Wind	Fall 1998	107.25	Xcel Energy	Enron Z-48 (143)
2. Woodstock	Edison Capital	May 1999	10.2	Xcel Energy	Vestas V44 (17)
5. Moorhead	Moorhead Public Service	May 1999	0.75	Moorhead Public Service	NEG Micon Project Info NEG Micon (1)
Lakota Ridge NEG Micon Project Info	NAE/Edison	May 1999	11.25	Xcel Energy	Micon M1800 (15)
Lake Benton II 2. Pipestone County	FPL Energy	May 1999	103.5	Xcel Energy	Enron Z-50 (138)
Shaokatan Hills	NAE/Edison	June 1999	11.88	Xcel Energy	Vestas V-47 (18)
Lac qui Parle Valley School		1997	0.225	Lac qui Parle Valley School	Micon 225 (1)
Dispersed Project		Dec 2000	5.94	Xcel Energy	Vestas V-47 (9)
North Shaokatan Wind Farm	NAE/Enel North America	Dec 2000	11.88	Xcel Energy	Vestas V-47 (16)
Ruthton Wind Farm	NAE/Enel North America	Jan 2001	15.84	Xcel Energy	Vestas V-47 (24)
Agassiz Beach	NAE/Enel North America	Jan 2001	1.98	Xcel Energy	Vestas V-47 (3)
Metro Wind LLC	NAE/Enel North America	Feb 2001	0.66	Xcel Energy	Vestas V-47 (1)
Chandler Champepaden, Chandler Hills Phase II	Great River Energy	Dec 2001	1.98	Great River Energy	Vestas V-47 (3)
Chandler Moulton Chandler Hills Phase II	Great River Energy	Dec 2001	1.98	Great River Energy	Vestas V-47 (3)
Pipestone County, Kas Farms	Kas Brothers	Dec 2001	1.5	Xcel Energy	NEG Micon (2)
Hendricks/ Lincoln County (Lakeview Ridge)	Otter Tail Power/EMS	Dec 2001	0.9	Otter Tail Power	NEG Micon (1)
Pipestone, Olsen Wind Farm	Olsen Farm	2001	1.5	Xcel Energy	NEG Micon (2)
Wilmont Hills	NAE	Dec 2001	1.5	Alliant Energy	NEG Micon (1)

Moorhead	Moorhead Public Service	Aug 2001	0.75	Moorhead Public Service	NEG Micon (1)
Missouri River Energy Services (MRES) Worthington	MRES	Aug 2002	3.6	MRES/ Worthington Public Utilities	NEG Micon NM 52 (4)
Dodge Center McNeilus	McNeilus	2002	9.0	Xcel Energy	NEG Micon NM53 (10)
MinWind I & II	Farmer's Cooperative	Oct 2002	3.8	Alliant Energy	NEG Micon 950 (4)
Don Sneve Coop	Farmer's Cooperative	Dec 2002	0.95	Alliant Energy	NEG Micon 950 (1)
McNeilus	Garwin McNeilus	2003	22.8	Xcel Energy	NEG Micon 950 (24)
McNeilus	Garwin McNeilus	2003	6.0	NA	NEG Micon 1500 (4)
McNeilus	Garwin McNeilus	2003	1.65	NA	NEG Micon 1650 (1)
McNeilus	Garwin McNeilus	2003	16.5	NA	NEG Micon 1650 (11)
McNeilus (Dodge County)	Garwin McNeilus	2004	3.0	NA	Vestas 1500 kW (2)
McNeilus (Mower, Adams)	Garwin McNeilus	2004	9.9	NA	Vestas 1650 kW (6)
Fairmont	SMMPA	2003	1.9	SMMPA	NEG Micon 950 (2)
Farmers' Coops		2003	22.8	Xcel/GRE	Suzlon Energy 950 (8)
Pipestone School District	Pipestone School District	2003	0.75	Pipestone School District	NEG Micon 750 (1)
Chanarambie (Murray County)	enXco	4th Q 2003	85.5	XCel	GE Wind 1.5 MW (57)
Moraine Wind Power Project	PPM Energy	4th Q 2003	51.0	XCel	GE Wind 1.5 MW (34)
Viking (Murray County)	Project Resources Corp.	4th Q 2003	12.0	XCel	GE Wind 1500 (8)
Worthington	Missouri River Energy Systems	2003	1.9	Missouri River Energy Systems	NEG Micon 950 (2)
Fairmont	SMMPA	2003	1.9	SMMPA	NEG Micon 950 (2)
Shaokatan Power Partners	NAE	2003	1.6	XCel	Gamesa Eolica 800 (2)
Don Sieve Wind Farm	Diversified Energy Solutions	2003	.95	Alliant	NEG Micon 950 (1)
Lincoln County	Diversified Energy Solutions	2003	.9	Otter Tail Power	NEG Micon 900 (1)
Farmer's Coops (Jackson County)	DanMar Associates	2004	5.7	Xcel/ Great River Energy	950 kW (6)
Minn Wind III-IX (Luverne)	Xcel Energy	2004	11.55	Xcel Energy	Vestas (7)
SMMPA (Fairmont, Redwood Falls, and Wells)	SMMPA	2004	3.3	SMMPA	Vestas (2)

New Wind Projects in Minnesota

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Xcel Energy and Carlton College (Carleton College)	Northfield	Proposed	1.65	2004/ 1650 kW (1)
SMMPA	Fairmont, Redwood Falls, and Wells	Proposed	3.3	2005/ Vestas (2)
Xcel Energy/ Dan Juhl/Edison Capital (Maiden Winds)	West Pipestone		8.25	2004/ Vestas (5)
JJNWind Farm	Buffalo Ridge		1.5	2004/ Vestas (1)
Xcel/ Project Resources/ enXco (Minnesota Wind Share)	Murray and Pipestone Counties	Proposed	5.4	2005/ 1800 kW (3)
Xcel/ Northern Alternative Energy (Shaokatan Power Partners)	Lincoln County, Hendricks	Proposed	1.8	2005/ Vestas 1800 kW (1)
Great River Energy/ Trimont Wind, LLC (Trimont Area Wind Farm)	Martin & Jackson Counties	NA	100.0	2005/ NA

Sources:
*Installed & Projected MW - AWEA
**Wind Energy Potential - *An Assessment of the Available Windy Land Area and Wind Energy Potential in the Contiguous United States*, Pacific Northwest Laboratory 1991, ("Potential" is stated in terms of average Megawatts of Capacity (MWa), or megawatts of capacity at 100% capacity factor. 1 MWa is roughly equal to about 3 MW of nameplate wind turbine capacity.)

WIND PROJECT DATA BASE | AWEA HOME PAGE

APPENDIX 6

Federal and State Economic Incentives Promoting Wind Energy Systems												
	Income Tax Credit			Property Tax			Sales Tax					
	Production	Capital Cost	Production Payment	Permanent Exemption	Temporary Exemption	Reduced Valuation	Exemption	Reduction	Production Tax Exemption	Net Metering	Grants	Loans
Federal	X		X (expired)								X	
Illinois										X	X	
Indiana				X								
Iowa					X	X			X	X		X
Michigan												
Minnesota			X[1]	X			X		X[2]	X	X	X
Montana		X			X					X	X	X
Nebraska												X
North Dakota		X			X	X[3]	X[4]			X		
Ohio				X			X			X		X
South Dakota					X[5]			X[6]				
Wisconsin				X						X	X	

[1] Applies only to wind energy systems below 2 MW capacity.

[2] Applies only to wind energy systems located in Job Opportunity Building Zones.

[3] Applies only to wind energy systems exceeding 100 kW capacity and owned by an IOU.

[4] Applies only to wind energy systems exceeding 100 kW capacity.

[5] Does not apply to wind energy systems producing energy for resale.

[6] Contractor's excise tax reduced by half for systems exceeding 10 kW capacity.

Economic Incentives Promoting Wind Energy Systems at the Federal Level and in Selected States

Federal Incentives

Federal Tax Incentives

Renewable Electricity Production Credit (Internal Revenue Code, Section 45)

The Renewable Electricity Production Credit, also known as the Production Tax Credit, is a per-killowatt-hour tax credit available to owners of wind energy systems during the first ten years of operation. Adjusted for inflation to a level of 1.8 cents per kwh in 2003, the credit expired at the end of that year. In September 2004, Congress reauthorized the credit, extending it retroactively to January 1, 2004 through the end of 2005.

Accelerated Depreciation (Internal Revenue Code, Sec. 168)

Under the Modified Accelerated Cost Recovery System, owners can recover their investment through equipment depreciation deductions from their federal tax liability. This provision allows wind energy systems to be depreciated over five years. Systems acquired and placed into service between May 5, 2003 and January 1, 2005 qualify for a 50% bonus depreciation in the first year of service.

Other economic incentives

Renewable Energy Production Incentive (42 United States Code, Section 13317) (Expired)

Public utilities, rural electric cooperatives, and local or state governments that sell energy generated by a wind energy system are eligible to receive a payment of 1.8 cents per kilowatt-hour generated in the first ten years of operation. This incentive expired on September 30, 2003, and has not yet been reauthorized by Congress.

Grants

- Renewable Energy Systems and Energy Efficiency Improvement Program

  This program, authorized for five years by the 2002 Farm Bill, provides grants of up to 25% of project costs, to a maximum of $500,000. In Fiscal Year 2004, $22.8 million was awarded.

- Value-Added Producer Grants

  Wind energy systems owned by farmers are eligible for grants of up to $500,000. Equal matching funds are required. In Fiscal Year 2004, the U.S. Department of Agriculture awarded $13.8 million under this program.

Incentives in Selected States

ILLINOIS

State Tax Incentives

None

Other economic incentives

Net Metering

Commonwealth Edison, the utility that serves the Chicago metropolitan area, has instituted a voluntary net metering program under which wind energy systems up to 40 kW are eligible to receive monthly payments at the utility's avoided cost. In addition, at year's end, the utility pays generators for the total excess power added to the utility's system (up to the amount of power purchased by the customer from the utility) at a rate equal to the difference between the average avoided cost paid to the customer and the average retail rate paid by the customer.

Grants (Illinois Statutes Chapter 20, Section 687/6-3)

The Illinois Department of Commerce and Community Affairs administers grants under the Renewable Energy Resources Program. Maximum awards for wind energy conversion projects with a capacity between 5 and 200kW are 50% of project costs, up to $2/watt or $50,000. For systems whose capacity is between 201 kW and 2 MW, the maximum award is 30% of project costs, up to $500,000.

INDIANA

State Tax Incentives

Property Tax Exemption (Indiana Code 6-1.1-12)

Wind energy systems and affiliated equipment, including equipment for energy storage and distribution, are exempt from the property tax.

Other economic incentives

Grants

- Wind energy systems developed by businesses, non-profit organizations, and local units of government, including schools, are eligible for grants administered under three programs by the Energy Policy Division of the Indiana Department of Commerce: the Alternate Energy System Grant Program, the Distributed Energy Grant Program, and the Energy Education and Demonstration Grant Program. The maximum award is $30,000.

- The Energy Efficiency and Renewable Energy Set-Aside program provides a financial incentive to utilities and industrial concerns that develop projects, including wind energy systems, that significantly reduce nitrogen oxide emissions. NO_x allowances, which have traded on the market at $2,500 to $6,000 per ton in recent year, are set aside for developers of such projects.

IOWA

State Tax Incentives

Property tax exemption (Iowa Code Sec. 441.21, subsection 8)

Wind energy systems installed on agricultural, residential, commercial, or industrial property is exempt from the property tax for five full assessment years.

Special valuation of wind system property (IC Sec. 427B.26)

A city or county may pass an ordinance requiring local assessors to value wind energy systems for property tax purposes at 0% of net acquisition cost in the first year, 5% of cost in the second year, and increasing by 5% each year until leveling off at 30% in the seventh and succeeding years.

Exemption from generation tax (IC Sec. 437A.6)

Wind energy systems are exempt from the replacement generation tax of .06 cents per kilowatt-hour generated.

Other economic incentives

Net Metering (IC Sec. 476.43; Iowa Administrative Code Sec. 199-15.11(5))

Iowa's net metering rule specifies that generators shall be credited at the utility's avoided cost. A utility's net metering purchases are capped at its share of statewide peak demand. The state's investor-owned utilities may limit individual applicants to 500 kW, with the balance of the facility's capacity purchased under a standard contract or PURPA purchase agreement.

Loans

- Zero-Interest Loans (IC Sec. 476.46)

  The Alternative Energy Revolving Loan Program administered by the Iowa Energy Center is a competitive loan program available to residential, commercial and industrial customers. It offers zero-interest loans for up to 50% of project costs to a maximum of $250,000. Nineteen of the 34 loans made since 1996 have financed wind projects.

- Low-Interest Loans (IC Sec. 473.19)

  Provides low-interest financing to energy conservation and renewable energy projects developed by public and non-profit agencies.

MICHIGAN

State Tax Incentives

None

Other economic incentives

None

MINNESOTA

State Tax Incentives

Property Tax Exemption (Minnesota Statutes Section 272.02, subdivision 22)

Real and personal property of a wind energy system, except land, are exempt from the property tax.

Sales Tax Exemption (Minn. Stat. Sec. 297A.68, subd. 12)

Wind energy systems and the materials used to manufacture, install, construct, repair, and replace them are exempt from the sales tax.

Wind Energy Production Tax Exemption (Minn. Stat. Sec. 272.029, subd. 7)

Wind energy systems located in Job Opportunity Building Zones are exempt from the wind energy production tax.

Other economic incentives

Renewable Energy Production Incentives (Minn. Stat. Sec. 216C.41)

Owners of small wind energy systems (generally, under 2 MW) are eligible for payments of 1.5 cents per kilowatt-hour generated for a period of ten years. Payments are limited to 200 MW of capacity and have been fully allocated.

Net Metering (Minn. Stat. Sec. 216B.164)

Net metering applies to all generators whose capacity is below 40 kW. There is no statewide capacity limit. Generators may choose to be compensated at the utility's average retail rate; alternatively, the Public Utilities Commission is to set the compensation rate based on avoided costs, considering the utility's fixed distribution costs and other relevant factors.

Grants

- Renewable Development Fund Grants (Minn. Stat. Sec. 116C.779)

  At least $10 million annually is available to fund renewable energy projects approved by the Public Utilities Commission from funds contributed by Xcel Energy.

Loans

- Agricultural Improvement Loan Program (Minn. Stat. Sec. 41B.043)

  The Minnesota Department of Agriculture's Rural Finance Authority provides low-interest loans to help farmers purchase wind energy systems. The maximum award is 45% of the loan principal or $200,000, whichever is less.

- Value-Added Stock Loan Program (Minn. Stat. Sec. 41B.046)

  The Minnesota Department of Agriculture's Rural Finance Authority helps farmers become members of wind energy cooperatives whose wind energy system is 1MW or less. The Authority may purchase up to 45% of the loan at an interest rate of 4%.

MONTANA

State Tax Incentives

Individual/Corporate Tax Credit (Montana Code 15-32-401)

Income generated from investments in a wind energy system is eligible for a corporate or individual income tax credit of up to 35%. The credit may not be used in conjunction with any other state energy tax benefits or the property tax exemption.

Property tax exemption (MC 15-6-225)

New generation facilities with a nameplate capacity below 1 MW are exempt from the property tax for a period of 5 years after operations begin.

Residential tax credit (MC 15-32-201)

Installation of a residential non-fossil fuel energy system is eligible for a tax credit of up to $500.

Other economic incentives

Net Metering (MC 69-8-601 through 605; Montana Administrative Rules Sec. 38.5.1905)

Net metering is allowed for wind energy systems of 50 kW or less. There is no limit on enrollment or statewide capacity. These provisions do not apply to electric cooperatives, which drafted a separate net metering agreement in 2001 that most cooperatives have implemented.

Grants

NorthWestern Energy uses at least $1 million annually from its collection of the state Universal Service Benefits Charge to make grants of up to $150,000 for renewable energy systems.

Loans (MCA 75-25-101)

The Alternative Energy Revolving Loan Program provides loans of up to $10,000 under a five-year repayment schedule.

NEBRASKA

State Tax Incentives

None

Other economic incentives

Loans

Although wind energy projects are eligible to take advantage of the Nebraska Energy Office's loan program, it focuses mainly on residential and commercial energy efficiency investments; only a handful of renewable projects have been funded. Once a qualified borrower has obtained private financing, the state will "purchase" one-half of the loan at 0%, effectively cutting the interest rate in half. Maximum borrowing amounts are $100,000 for businesses and non-profits, and $175,000 for government projects.

NORTH DAKOTA

State Tax Incentives

Income Tax Credit (North Dakota Century Code Section 57-38-01-.8)

Any individual or corporate taxpayer may subtract from any income tax liability three percent of the cost of a wind energy system for a period of five years.

Sales and use tax exemption (NDCC Secs. 57-39.2-04.2 (2), (3) and 57-40.2-04 (2), (3))

Production equipment of wind energy systems and tangible personal property used in the construction of such facilities with a nameplate capacity greater than 100 kW are exempt from sales and use taxes.

Local property tax exemption (NDCC Sec. 57-02-08(27))

Machinery, equipment, and installation of wind energy systems are exempt from local property taxes for five years.

Reduction in valuation for centrally-assessed property tax (NDCC Sec. 57-02-27.3)

A wind energy system with a nameplate capacity of 100 kW or greater that is owned by an investor-owned utility is valued at three percent of its assessed value for property tax purposes, in contrast to 10 percent for other property.

Gross Receipts Deduction (NDCC Sec. 57-33-03)

A rural electric cooperative purchasing wind power for resale from a North Dakota wind energy system owned by an investor-owned utility may deduct the cost of that power from the cooperative's gross receipts before determining its income tax liability.

Other economic incentives

Net metering (North Dakota Administrative Code 69-09-07-09)

Net metering applies to all wind generators with a nameplate capacity of 100 kW or less. There is no statewide cap on enrollment or statewide capacity. Generators will be credited at the utility's avoided cost, unless the Public Utilities Commission determines that a lower rate is just and reasonable, non-discriminatory, and sufficient to encourage cogeneration and small power production. Payments can include avoided capacity costs if the utility projects capacity deficits within ten years and the contract extends into that deficit period.

OHIO

State Tax Incentives

Tax Exemptions (Ohio Revised Code Sec. 5709.50)

Tangible property used in a wind energy system is exempt from sales and use taxes, real and personal property taxes, and the state franchise tax.

Other economic incentives

Net Metering (ORC Sec. 4928.67)

Net metering applies to all customers of investor-owned utilities, up to a limit of 1% of peak demand for each utility. Generators are credited at the utility's unbundled generation rate.

Reduced-Interest Loans (ORC Sec. 4928.62)

Ohio's Renewable Energy Financial Assistance Program reduces loan rates by half for five years for projects in the service territories of the five participating utilities. The program is not available to projects generating electricity for resale. The maximum loan amount for residential projects is $25,000, and for commercial and industrial projects, $500,000.

SOUTH DAKOTA

Tax Exemptions

Property Tax Exemption (South Dakota Certified Laws Secs. 10-6-35.8 through 35.15)

The assessed value of renewable energy systems on residential property is fully exempt from property taxes for three years following installation; for systems installed on commercial property, 50% of the cost is exempt for three years. However, this exemption does not apply to systems that produce energy for resale.

Reduced contractor's excise tax (SDCL Sec. 10-46C-4)

For wind energy facilities above 10 MW, the contractor's excise tax on gross receipts for materials and services is reduced from 2% to 1% and may be spread over four years.

Other economic incentives

None

WISCONSIN

State Tax Incentives

Property Tax Exemption (Wisconsin Statutes Sec. 70.11)

Wind energy systems are exempt from the property tax.

Other economic incentives

Net Metering (Public Service Commission Order 6690-UR-107)

Net metering applies to all wind generators with a capacity of 20kW or less. There is no capacity limit on utility purchases of net-metered generation, which is purchased at the retail rate.

Grants

- Owners of wind energy systems with a capacity greater than 20kW are eligible for Focus on Energy Implementation Grants, which can award 35% of total project costs to a maximum of $45,000.

- Owners of wind energy systems with a capacity below 20kW are eligible for Focus on Energy Cash-Back Rewards of 25% of project costs, up to $35,000.

APPENDIX 7

OWNERSHIP/FINANCIAL MODELS OF WIND DEVELOPMENT IN MINNESOTA

The financial incentives available to wind developers in Minnesota – the state Renewable Energy Production Incentive, the federal production tax credit, and an accelerated depreciation schedule – have created the financial environment in which developers shape projects. Minnesota developers have been very creative in crafting successful projects within these constraints. Among successful ownership/financial models are the following:

Minnesota "Flip"

This structure allows for the participation of local owners who do not have sufficient passive income (which does not include interest and dividend income) to utilize the federal production tax credit (PTC), which amounts to 1.9 cents per kwh produced. A limited liability corporation (LLC) is created, comprised of a single local investor, typically the farmer on whose land the wind turbine is located, and a tax-motivated corporate investor, who provides most of the up-front capital. During the first 10 years of the project, the farmer may own as little as 1 percent of the project financially, while retaining at least 51 percent voting rights in order to allow the project to receive the Minnesota incentive payment of 1.5 cents per kwh produced.[1] The tax-motivated investor receives 99 percent of the cash flows and tax benefits of the project (PTC, Minnesota's production incentive, accelerated depreciation, revenue from electricity sales) during this time. The local investor may also be paid a "management fee," calculated as a percentage of the project's gross revenues, in addition to a fee for land rental.

Once the PTC is exhausted, ownership "flips" to the local Minnesota investor, leaving the investor with a debt-free wind project that should continue to operate for a decade or more. The corporate investor may maintain its one percent share or sell it to the local investor at fair market value.[2]

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[1]Mark Bolanger, *A survey of state support for community wind power development,* Case studies of state support for renewable energy, Lawrence Berkeley Laboratory and the Clean Energy States Alliance, March 2004, pp. 8-9 <http://eetd.lbl.gov/ea/ems/cases/community_wind.pdf>

[2]Mark Bolanger et. al., *A comparative analysis of community wind power development options in Oregon,* Prepared for the Energy Trust of Oregon, July 2004, p. 76 <www.energytrust.0rg/RR/wind/OR_CommunityWind_Report.pdf>

Multiple Local Investors

The Minwind projects in Rock County pioneered the formation of two LLCs owning two turbines each (totaling 1.9 MW) that maintain local ownership by pooling the passive tax income and associated tax liabilities of many local investors in order to take advantage of the PTC. These companies sold stock to 66 individuals at $5,000 per share, while 70 percent of project costs were financed through loans from a local bank. The rules, similar to those of a cooperative, require that farmers own 85 percent of the shares, with the remainder available to local residents and investors. No individual investor may own more than 15 percent of the shares. Seven more LLCs of this type are planned.[3]

Municipal Utility Ownership

While municipal utilities have the ability to sell tax-free bonds to finance wind systems, Moorhead Public Service, which installed two 750 kW wind turbines in 1999 and 2001, used cash reserves to purchase the equipment. Output from the turbines was fully subscribed quickly by more than 800 utility customers, giving the utility's "green pricing" program, Capture the Wind, the highest customer participation rate in the nation, at 5.8 percent.[4]

In early 2004 an analyst from Lawrence Berkeley Laboratory examined the ownership/financial structures of the projects (totaling 200 MW in capacity) that qualified for Minnesota's production incentive.[5] The distribution of ownership was as follows:

Ownership/Financial Structure	Percentage of Capacity
Conventional commercial projects	29
Individual personal wealth	17
Minnesota flip	39
Municipal utilities	4
Multiple local owners	8
Projects owned by schools	2

[3] *A survey of state support...*, p. 7.

[4] "MPS Capture the Wind Program Still #1," Moorhead Public Service press release, February 21, 2003. <www.mpsutility.com/02-21-03_ctw_program.htm>

[5] *A survey of state support...*, p. 7.

Summary of Wind Turbines not Geocoded at EQB
Turbines < 100 kW

Turbines not geocoded that appear in the Department of Commerce Incentive Database
Number of turbines estimated based on size and year.

County	Number of Turbines in County	Capacity MW	Year
Aitkin	1	0.0175	2002
Carlton	1	0.004	2002
Dodge	2	0.079	2002
Faribault	1	0.039	2003
Freeborn	7	0.273	2002
Freeborn	10	0.371	2003
Goodhue	1	0.03	2001
Grant	1	0.039	2001
Jackson	1	0.039	2002
Jackson	1	0.035	2003
Lake	1	0.032	2002
LeSueur	1	0.035	2003
Lincoln	2	0.075	2000
Lincoln	1	0.04	2001
McLeod	1	0.038	1997
Mcleod	1	0.039	2002
Nicollet	2	0.035	2002
Pope	1	0.035	2005
Rice	1	0.02	2000
Rice	1	0.039	2004
Sibley	1	0.039	2001
Sibley	3	0.098	2002
Stearns	1	0.039	2002
Steele	3	0.117	2002
Swift	1	0.0375	2002
Swift	1	0.035	2004
Waseca	1	0.039	2002
Washington	1	0.035	2001
Washington	1	0.0175	2002
Winona	1	0.01	2002
Total	52		

Turbines on the Windustry Internet Site - not geocoded or listed in Incentive Database.

Unknown	1	0.035	1992
Unknown	1	0.0125	1993
Dakota	1	0.02	Unknown
Lac Qui Parle	1	0.035	1993
Lac Qui Parle	1	0.225	1997
Lake	1	0.02	1995
Lincoln	3	0.04	1991
Ramsey	1	0.01	2003
Redwood	1	0.035	1993
Stevens	1	0.035	1992
Winona	1	0.001	1994
Total	13		

Data Sources: Department of Commerce, Windustry Internet Site

Prepared for the Minnesota Environmental Quality Board
by the Minnesota Department of Administration's
Land Management Information Center, November 2004.

Summary of Wind Turbines not Geocoded at EQB
Turbines > 100 kW

County	Number of Turbines in County	Capacity MW	Year
Turbines not geocoded that appear in the Department of Commerce Incentive Database			
Number of turbines estimated based on size and year.			
Blue Earth	2	3.3	2004
Cottonwood	12	19.8	2004
Dodge	2	1.9	2003
Faribault	2	3.3	2005
Lac qui Parle	1	0.225	1997
Lincoln	2	1.6	2003
Lincoln	9	13.35	2004
Lyon	1	1.65	2004
Lyon	1	1.65	2005
Martin	1	1.65	2004
Martin	2	1.9	2003
Mower	6	4.5	2003
Murray	10	13.5	2004
Nicollet	1	0.26	2003
Nobles	6	7.9	2004
Nobles	1	1.65	2005
Nobles	2	1.8	2002
Nobles	2	1.9	2003
Pipestone	20	30	2004
Rice	2	3.3	2004
Rock	4	3.8	2002
St Louis	1	1.65	2005
County Not Indicated	2	3.3	unknown
Total	92		

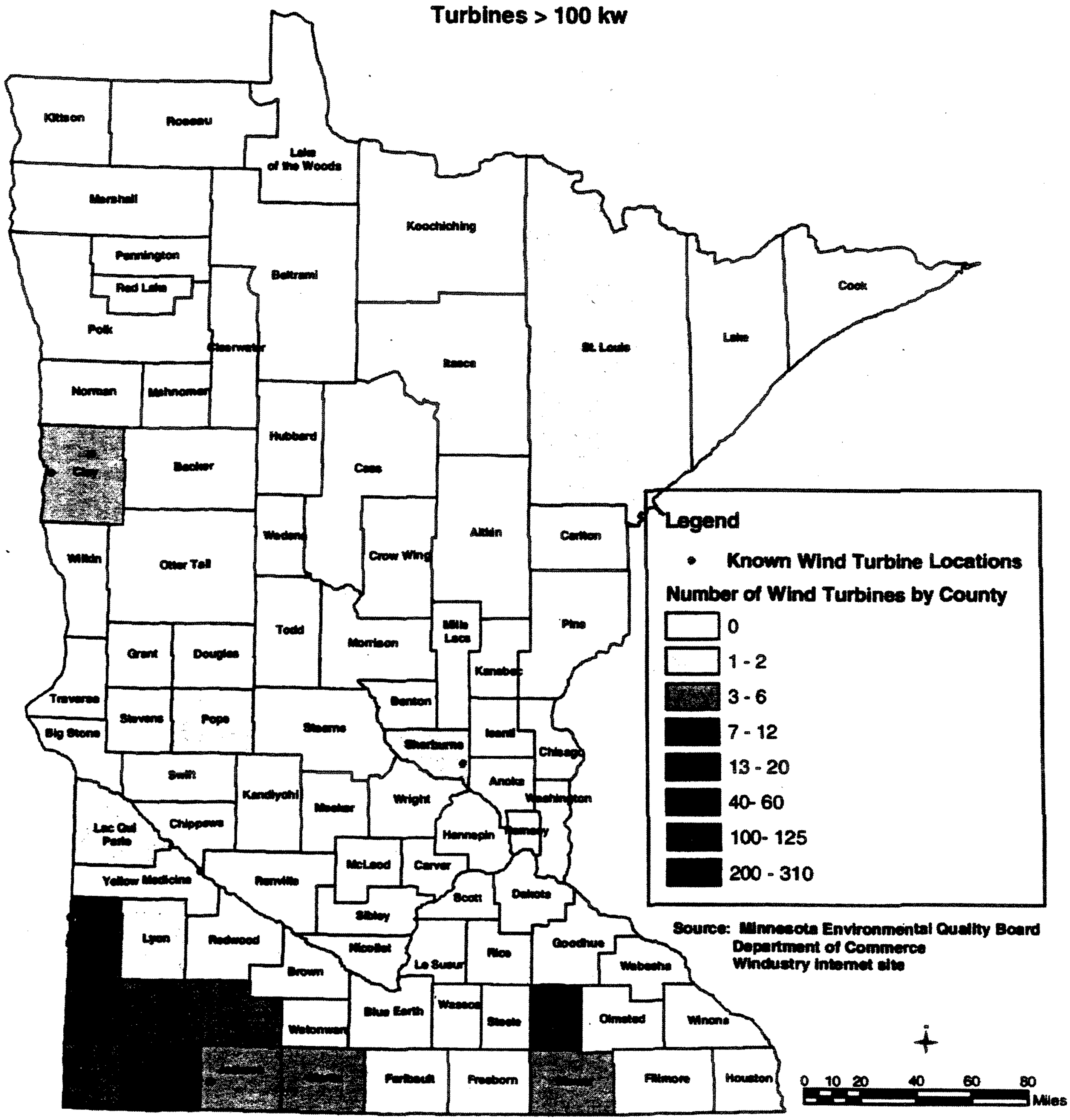
Turbines on the Windustry Internet Site - not geocoded or listed in Incentive Database.

Polk	1	0.75	1987
Total	1		

Data Sources: Department of Commerce, Windustry internet site

Prepared for the Minnesota Environmental Quality Board
by the Minnesota Department of Administration's
Land Management Information Center, November 2004.

Distribution of Wind Turbines in Minnesota



Based on location of known 660 wind turbines and 133 records in Department of Commerce's Wind Energy Incentive Database, received 11/4/04, that are not yet located.

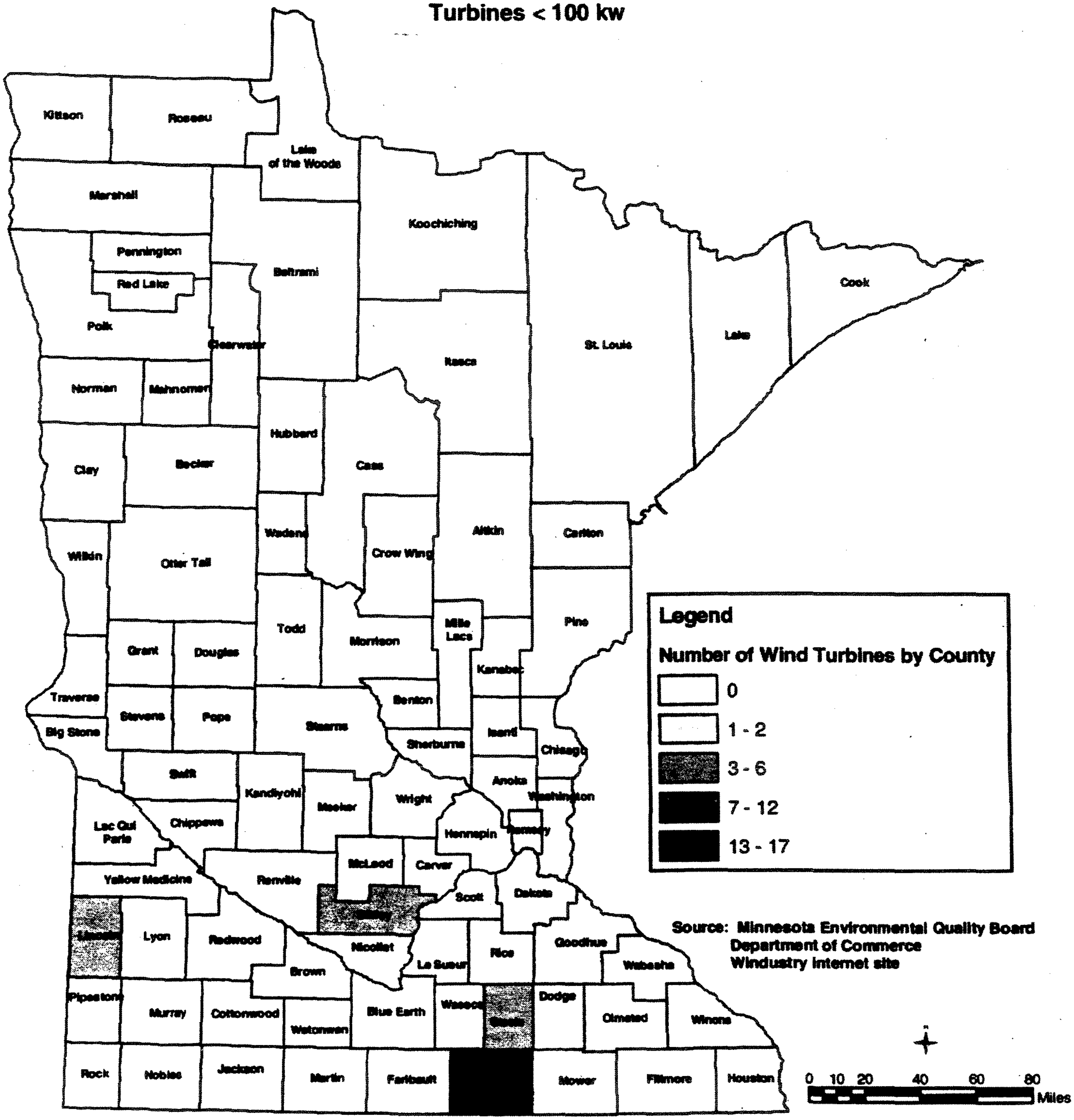
Includes 32 turbines listed with start date of 12/31/04 and 5 with start date in 2005 and the 11 proposed sites in Dodge county by Garwin McNeilius.

Prepared for the Minnesota Environmental Quality Board by the Minnesota Department of Administration's Land Management Information Center, November 2004.

Map document: countynew.mxd

Distribution of Wind Turbines in Minnesota

Turbines < 100 kw



Based on Department of Commerce's Wind Energy Incentive Database, received 11/4/04, that are not yet located. Data was supplemented by turbine locations listed on the Windustry internet site.

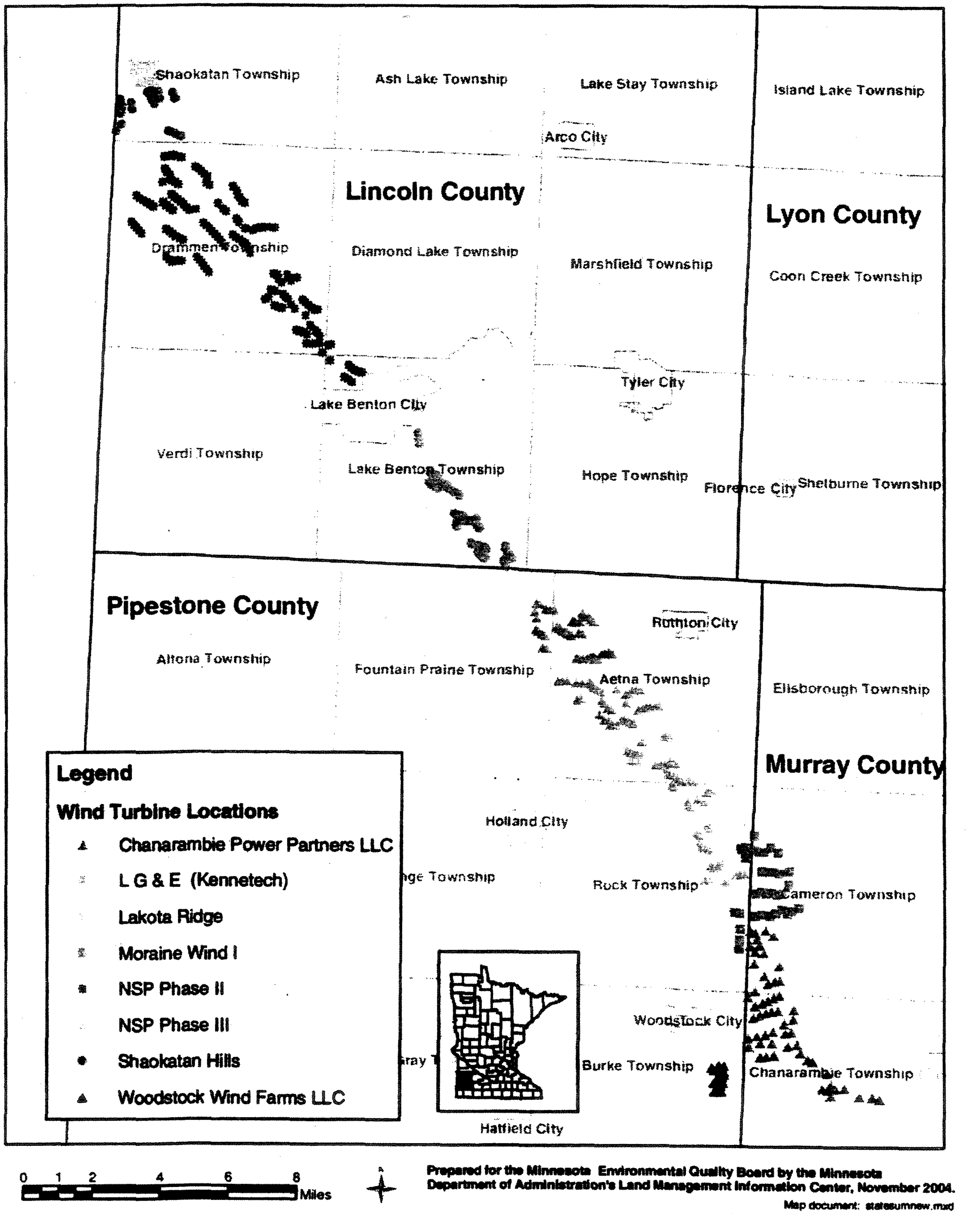
Includes one with start date in 2005.

Prepared for the Minnesota Environmental Quality Board by the Minnesota Department of Administration's Land Management Information Center, November 2004.

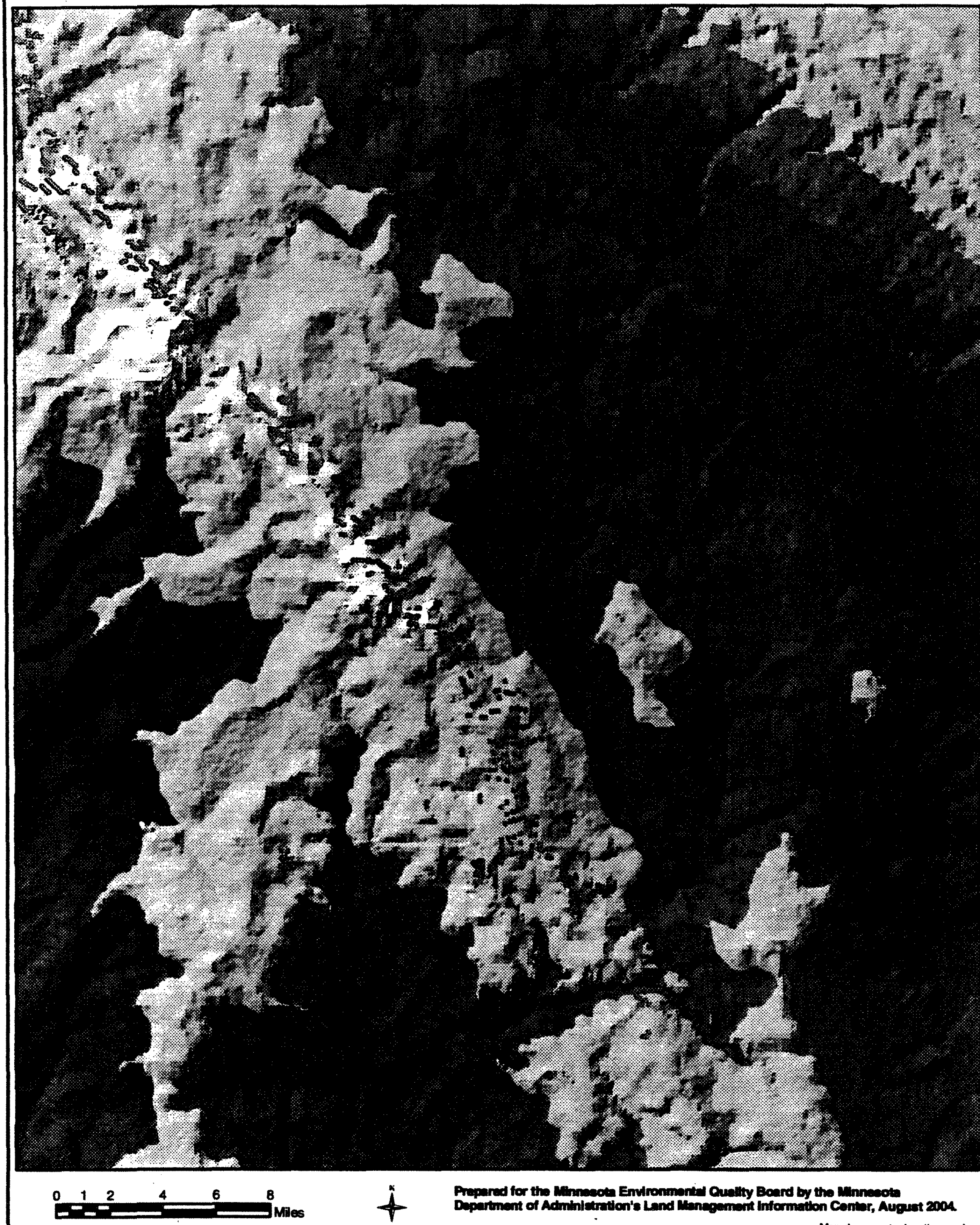
Map document: countysmall.mxd

Distribution of Large-Scale Wind Turbines in Minnesota

Large Scale Projects: Permitted by EQB and Generate > 5 MW



Wind Turbines along Buffalo Ridge



Prepared for the Minnesota Environmental Quality Board by the Minnesota Department of Administration's Land Management Information Center, August 2004.

Map document: elevation.mxd

Project Name	Total Number of Wind Turbines by Project	Capacity MW	Start Date	Power Purchaser	Number of Turbines in Township	County	City/Township	Township	Range
Large-Scale Projects Permitted by EQB and generate > 5 MW.									
L G & E (Kennetech)	73	25	May 1994	Xcel Energy	73	Lincoln	Lake Benton Township	109	45
NSP Phase II	143	107.25	Sept. 1998	Xcel Energy	2	Lincoln	Diamond Lake Township	110	45
					132	Lincoln	Drammen Township	110	46
					9	Lincoln	Lake Benton Township	109	45
Lakota Ridge	15	11.25	May 1999	Xcel Energy	15	Lincoln	Shaokatan Township	111	46
NSP Phase III	138	103.5	May 1999	Xcel Energy	98	Pipestone	Aetna Township	108	44
					12	Pipestone	Fountain Prairie Township	108	45
					28	Pipestone	Rock Township	107	44
Shaokatan Hills	18	11.88	May 1999	Xcel Energy	13	Lincoln	Shaokatan Township	111	46
					5	Lincoln	Shaokatan Township	111	47
Woodstock Wind Farms LLC	17	10.5	May 1999	Xcel Energy	17	Pipestone	Burke Township	106	44
Chanarambie Power Partners LLC	57	85.5	October 2003	Xcel Energy	16	Murray	Cameron Township	107	43
					41	Murray	Chanarambie Township	106	43
Moraine Wind I	34	51	November 2003	Xcel Energy	26	Murray	Cameron Township	107	43
					8	Pipestone	Rock Township	107	44
Total	**495**								
Garwin McNeilus (Proposed)	11				11	Dodge	Ashland Township	106	17
Small or Middle-Scale Projects									
Agassiz Beach LLC	3	1.98	February 2001	Xcel Energy	3	Clay	Keene Township	141	45
Moorhead Public Service	2	1.5	May 1999/Aug 2001	Missouri River Energy Services	2	Clay	City of Moorhead	140	48
Ashland Windfarm	2	1.9	May 2003	Xcel Energy	2	Dodge	Ashland Township	106	17
Asian Children Support	2	1.9	Feb 2003	Xcel Energy	2	Dodge	Ashland Township	106	17
BT LLC	4	3.7	Sept 2002 & Feb 2003	Xcel Energy	4	Dodge	Ashland Township	106	17
Bangladesh Children Support	2	1.9	February 2003	Xcel Energy	2	Dodge	Ashland Township	106	17
Brandon Windfarm	1	0.9	2002	Xcel Energy	1	Dodge	Ashland Township	106	17
Burmese Children Support	2	1.8	February 2002	Xcel Energy	2	Dodge	Ashland Township	106	17
Elsinore Wind LLC	1	1.65	August 2003	Xcel Energy	1	Dodge	Ashland Township	106	17
GM LLC	4	3.7	Sept 2002 & Feb 2003	Xcel Energy	4	Dodge	Ashland Township	106	17
GarMar Foundation	4	3.7	Sept 2002 & Feb 2003	Xcel Energy	4	Dodge	Ashland Township	106	17
GarMar Wind I LLC	1	1.8	2002	Xcel Energy	1	Dodge	Ashland Township	106	17
Grant Windfarm	2	1.9	May 2003	Xcel Energy	2	Dodge	Ashland Township	106	17
Henslin Creek Windfarm	1	0.9	2002	Xcel Energy	1	Dodge	Ashland Township	106	17
Indian Children Support	2	1.9	February 2003	Xcel Energy	2	Dodge	Ashland Township	106	17
McNeilus Windfarm	4	3.7	Sept 2002 & Feb 2003	Xcel Energy	4	Dodge	Ashland Township	106	17
SG LLC	2	1.8	September 2002	Xcel Energy	2	Dodge	Ashland Township	106	17
Salvadoran Children Support	2	1.9	February 2003	Xcel Energy	2	Dodge	Ashland Township	106	17
Triton Windfarm LLC	1	0.9	2003	Xcel Energy	1	Dodge	Ashland Township	106	17
Wasioja Wind LLC	1	0.9	2003	Xcel Energy	1	Dodge	Ashland Township	106	17
Wihelm Wind LLC	1	0.9	2003	Xcel Energy	1	Dodge	Ashland Township	106	17
Zumbro Windfarm	2	1.9	January 2003	Alliant Energy G	2	Dodge	Ashland Township	106	17
B & K Energy Systems LLC	2	1.9	July 2003	Great River Energy	2	Jackson	Ewington Township	102	38
DL Windy Acres LLC	2	1.9	July 2003	Great River Energy	2	Jackson	Ewington Township	102	38
S&P Windfarm LLC	2	1.9	July 2003	Great River Energy	2	Jackson	Ewington Township	102	38
Autumn Hills LLC	3	1.98	February 2001	Xcel Energy	3	Lincoln	Shaokatan Township	111	46
Borderline Wind LLC	1	0.9	December 2003	Otter Tail Power Co.	1	Lincoln	Hendricks Township	112	47

Data Sources: EQB, Department of Commerce, Wind Turbine Owners/Developers

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Project Name	Total Number of Wind Turbines by Project	Capacity MW	Start Date	Power Purchaser		Number of Turbines in Township	County	City/Township	Township	Range
Florence Hills LLC	3	1.98	January 2001	Xcel Energy		3	Lincoln	Lake Benton Township	109	45
Hadley Ridge LLC	3	1.98	December 2000	Xcel Energy		3	Lincoln	Lake Benton Township	109	45
Hendricks Wind I LLC	1	0.9	May 2002	Otter Tail Power Co.		1	Lincoln	Hendricks Township	47	2
Hope Creek LLC	3	1.98	February 2001	Xcel Energy		3	Lincoln	Lake Benton Township	109	45
Jack River LLC	3	1.98	February 2001	Xcel Energy		3	Lincoln	Shaokatan Township	111	46
Jessica Mills LLC	3	1.98	February 2001	Xcel Energy		3	Lincoln	Shaokatan Township	111	46
Julia Hills LLC	3	1.98	February 2001	Xcel Energy		2	Lincoln	Shaokatan Township	111	46
Julia Hills LLC - Second township						1	Lincoln	Shaokatan Township	111	47
Ruthton Ridge LLC	3	1.98	January 2001	Xcel Energy		3	Lincoln	Lake Benton Township	109	45
Soliloquoy Ridge LLC	3	1.98	January 2001	Xcel Energy		3	Lincoln	Lake Benton Township	109	45
Spartan Hills LLC	3	1.98	January 2001	Xcel Energy		3	Lincoln	Lake Benton Township	109	45
Sun River LLC	3	1.98	February 2001	Xcel Energy		3	Lincoln	Shaokatan Township	111	46
Tsar Nicholas LLC	3	1.98	February 2001	Xcel Energy		3	Lincoln	Shaokatan Township	111	46
Twin Lake Hills LLC	3	1.98	February 2001	Xcel Energy		3	Lincoln	Lake Benton Township	109	45
Winter's Spawn LLC	3	1.98	January 2001	Xcel Energy		3	Lincoln	Hope Township	109	44
Buffalo Ridge Wind Farm	1	1.5	December 2003	Xcel Energy		1	Murray	Chanarambie Township	106	43
Champepadan or Moulton Wind Power Partners LLC	3	1.98	December 1998	Great River Energy		4	Murray	Moulton Township	105	43
Moulton Heights Wind Power Project LLC	6	3.96	December 2001	Great River Energy		6	Murray	Moulton Township	105	43
Moulton Wind Power Partners LLC	3	1.5	December 2001	Great River Energy		1	Murray	Chanarambie Township	106	43
Muncie Power Partners	1	1.5	December 2003	Xcel Energy		1	Murray	Chanarambie Township	106	43
North Ridge Wind Farm	1	1.5	December 2003	Xcel Energy		1	Murray	Chanarambie Township	106	43
Vandy South Project	1	1.5	December 2003	Xcel Energy		1	Murray	Chanarambie Township	106	43
Viking Wind Farm	1	1.5	December 2003	Xcel Energy		1	Murray	Chanarambie Township	106	43
Vindy Power Partners	1	1.5	December 2003	Xcel Energy		1	Murray	Chanarambie Township	106	43
Wilson West Wind Farm	1	1.5	December 2003	Xcel Energy		1	Murray	Chanarambie Township	106	43
Sieve Wind Farm LLC	1	0.95	January 2003	Interstate Power & Light		1	Nobles	Larkin Township	103	42
WMMPA	2	1.8	July 2002	Missouri River		2	Nobles	Worthington Township	102	40
Wilmont Hills LLC	1	1.5	December 2001	Alliant Energy G		1	Nobles	Larkin Township	103	42
Wisconsin Public Power Inc.	2	1.8	July 2002	WPPA Member		2	Nobles	Worthington Township	102	40
Bisson Windfarm LLC	2	1.9	October 2003	Xcel Energy		2	Pipestone	Gray Township	106	45
Boeve Windfarm LLC	2	1.9	August 2003	Xcel Energy		2	Pipestone	Rock Township	107	44
CG Windfarm LLC	2	1.9	July 2003	Xcel Energy		2	Pipestone	Gray Township	106	45
Fey Windfarm LLC	2	1.9	September 2003	Xcel Energy		2	Pipestone	Rock Township	107	44
K-Brink Windfarm LLC	2	1.8	October 2003	Xcel Energy		2	Pipestone	Burke Township	106	44
Kas Bros Windfarm LLC	2	1.5	December 2001	Xcel Energy		2	Pipestone	Burke Township	106	44
Pipestone Area School District	1	0.75	2003	Pipestone School District		1	Pipestone	Sweet Township	106	46
Pipestone Olsen Wind Farm	2	1.5	December 2001	Xcel Energy		2	Pipestone	Eden Township	105	46
TG Windfarm LLC	2	1.9	July 2003	Xcel Energy		2	Pipestone	Gray Township	106	45
Tofteland Windfarm LLC	2	1.9	October 2003	Xcel Energy		2	Pipestone	Gray Township	106	45
Westridge Windfarm LLC	2	1.9	July 2003	Xcel Energy		2	Pipestone	Gray Township	106	45
Windcurrent Farm LLC	2	1.9	September 2003			2	Pipestone	Rock Township	107	44
Minwind III	1	1.65	Summer 2004	Xcel Energy		1	Rock	Beaver Creek Township	102	46
Minwind IV	1	1.65	Summer 2004	Xcel Energy		1	Rock	Beaver Creek Township	102	46
Minwind V	1	1.65	Summer 2004	Xcel Energy		1	Rock	Beaver Creek Township	102	46
Minwind VI	1	1.65	Summer 2004	Xcel Energy		1	Rock	Beaver Creek Township	102	46
Minwind VII	1	1.65	Summer 2004	Xcel Energy		1	Rock	Beaver Creek Township	102	46
Minwind VIII	1	1.65	Summer 2004	Xcel Energy		1	Rock	Beaver Creek Township	102	46
Minwind IX	1	1.65	Summer 2004	Xcel Energy		1	Rock	Beaver Creek Township	102	46
Metro Wind LLC	1	0.66	February 2001	Xcel Energy		1	Sherburne	Elk River City	33	26
Total	**152**									

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