Environmental Report:
WAPSIPINICON NORTH WIND PROJECT

In the Matter of the Wapsipinicon Wind Project, LLC
Application for a Certificate of Need for a
Large Wind Energy Conversion System in Mower County

PUC Docket No. IP6670/CN-08-334

Energy Facilities Permitting
85 7th Place East, Suite 500
Saint Paul, MN 55101

August 2008

Responsible Governmental Unit	Project Proposer
Minnesota Office of Energy Security	**Wapsipinicon Wind Project, LLC**
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Abstract

Wapsipinicon Wind Project, LLC, (Applicant or WWP) made an application to the Minnesota Public Utilities Commission (PUC or Commission) for a Certificate of Need for the Wapsipinicon North Wind Project (Project) on April 1, 2008, pursuant to the provisions of Minnesota Statutes 216B.243 and 216F.

The Applicant is proposing to construct and operate a new 105 MW Large Wind Energy Conversion System (LWECS) in Mower County. The Project would be part of the larger Wapsipinicon Wind Project 205.5 MW LWECS as proposed by the enXco Development Corporation (enXco) in PUC Docket No. IP6646/WS-07-839.

The Office of Energy Security (OES), Energy Facilities Permitting (EFP) is responsible for preparing the Environmental Report ("ER") required for the Certificate of Need. This report has been prepared as per Minnesota Rule 7849.0010-0110.

Persons interested in these matters can visit the Project Docket webpage at http://energyfacilities.puc.state.mn.us/Docket.html?Id=19234 or contact David Birkholz, Energy Facilities Permitting, 85 7th Place East, Suite 500, St. Paul, Minnesota 55101, phone (651) 296-2878, e-mail: david.birkholz@state.mn.us. Documents of interest can be found at the above website or by entering "08-334" as the search criteria after going to https://www.eDockets.state.mn.us/EFiling/search.jsp.

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1.0 Introduction

On April 1, 2008, Wapsipinicon Wind Project, LLC, (Applicant or WWP) filed an application with the Minnesota Public Utilities Commission (PUC or Commission) for a Certificate of Need (PUC Docket No. IP6670/CN-08-334) for the Wapsipinicon North Wind Project in Mower County. enXco Development Corporation (enXco) is the sole member of WWP. The Applicant has a Power Purchase Agreement with Southern Minnesota Municipal Power Agency (SMMPA). SMMPA selected the Project to help meets its renewal energy objectives.

The Minnesota Office of Energy Security (OES), Energy Facilities Permitting (EFP) is required to perform environmental review on applications for Certificates of Need. This process is undertaken to inform the public, the Applicants and decision makers concerning potential impacts and possible mitigations for the project and any alternatives.

Chapter 2 provides specific information about the proposed project, the project proposer, and the regulatory process for the Certificate of Need. Chapters 3 and 4 describe and analyze alternatives to the proposed Project that attempt to reduce, mitigate or eliminate the need for the proposed Large Wind Energy Conversion System (LWECS). This analysis of alternatives is required by Minnesota Rule 7849.0230 and 7849.7060 for the Certificate of Need application.

Chapter 5 provides the analysis of the impacts of the proposal and alternatives required under Minnesota Rule 7849.7060. Chapters 6 and 7 address possible mitigations to the human and environmental impacts of Applicant's proposal and the alternatives and the feasibility of each. Chapter 8 describes the additional permits that may be required for this project.

Much of the information used in this ER is derived from the *Application for a Certificate of Need for the Wapsipinicon North Wind Project*, dated April 1, 2008. Additional information was gleaned from earlier, related Environmental Quality Board and EFP reports. First hand information was gathered by EFP staff field inspection and review of aerial photography along the proposed site.

2.0 General Description of the Proposed Project

Minnesota Rule 7849.7060, subp. 1. A requires the Environmental Report to provide a description of the proposed project. This section describes the proposed project and the proposed owners. Additionally, this section reviews the regulatory process for an environmental review at the Certificate of Need (CN) stage.

2.1 Project Description

The project under review is called the Wapsipinicon North Wind Project (Project). The Project is a large wind energy conversion system, as defined in the Wind Siting Act, Minnesota Statute 216F.01–216F.07. This Project is also a large energy facility (LEF), as defined in Minnesota Statute 216B.2421.

The Wapsipinicon North Wind Project as proposed would be an LWECS of up to 105 MW and would consist of up to seventy 1.5 MW wind turbine generators. The towers would be 80 meters (262.5 feet) in height. The rotor diameter would be 77 meters (252.6 feet), resulting in a maximum overall height of 118.5 meters (388.8 feet) when one blade is in the vertical position.

The electrical collector system would consist of underground 34.5 kV collection lines and facilities providing step-up transformation. The Applicant is also proposing to build a 161/34.5 kV project substation which would consist generally of 2 161/34.5 transformers, and associated switching and protection equipment as well as metering equipment and a small control house. Power from the turbines would be collected at this substation and transmitted to the Pleasant Valley Substation located in section 19 of Pleasant Valley Township via approximately 6 miles of overhead 161 kV transmission line.

If one assumes an estimated net capacity factor of approximately 35-40 percent, projected average annual output would be 321,930 to 367,920 megawatt hours (MWh). The annual capacity factor will vary based on weather conditions and operational and maintenance issues associated with the facility. Output will also be dependent on final design, site-specific features, and equipment.

The Project would be located in central Mower County, near the town of Dexter, in portions of Grand Meadow, Pleasant Valley, Dexter and Sargeant townships, and approximately 20 miles east of Austin, Minnesota. The Applicant has designated

approximately 40 square miles as the Project area. The town of Dexter is adjacent to the project site to the Southwest. Interstate 90 is the southern border of the Project area.

The Project is part of a larger Wapsipinicon Wind Project site application. The entire project comprises up to 137 GE 1.5 MW turbines with a nameplate capacity of 205.5 MW. The remainder of the project site covers approximately 40 square miles southeast of US HWY 90. That site has already received a CN and been permitted as the Grand Meadow Wind Farm. The current Project was issued a site permit at the same time, pending the resolution of this CN process.

2.2 Project Proposers

enXco Development Corporation (enXco) is the sole member of WWP and has developed and retained an ownership position in two LWECS in the State of Minnesota. These are the 85.5 MW Chanarambie Wind Project and the 205.5 MW Fenton Wind Project. In both cases, enXco performed complete development, engineering, procurement, construction, and financing of the projects.

enXco has a long history of project development in Minnesota. enXco was involved in the development and construction of three 1.98 MW projects, the first of which, the Chandler Hills Project, came online in 1999 and was followed by the Moulton and Champepadan Wind Projects in 2001. enXco was also involved in the financing and construction of the 12 MW Viking Project, which came online in 2003. enXco provides operation and maintenance services to all four of these projects.

2.3 Summary of the Environmental Report Process

The Applicant filed its CN Application on April 1, 2008. On May 21, 2008, the PUC accepted the CN as complete, given the Applicant's filing of supplemental materials.

The OES is the responsible governmental unit required to prepare an Environmental Report on large energy projects for which a certificate of need is required from the PUC. Minnesota Rule 7849.7010–7849.1110.

OES staff has followed the process for preparing an Environmental Report outlined in Minnesota Rule 7849.7050. Interested persons were notified of the project by mail. A

project page was constructed on the PUC's Energy Facilities website in conjunction with the site permit application site. In accordance with Minnesota Rule 7849.7050, subp. 3, OES EFP staff held a public meeting on the project on July 22, 2008, in Elkton, Minnesota. The public was provided with an opportunity to ask questions, present comments, and suggest alternatives and possible impacts to be evaluated in the Environmental Report. The public comment period closed on August 4, 2008. Two public comments were received on the Environmental Report during the comment period.

On August 5, 2008, OES Director Edward Garvey issued a scoping decision determining alternatives and items to be addressed in the Environmental Report and the schedule for completion of the Environmental Report. The Scoping Order is available in Appendix A.

3.0 General Description of Project Alternatives

Minnesota Rule 7849.7060, subp. 1. B requires the Environmental Report to address alternatives to the proposed project. The purpose of an Environmental Report is to provide the Public Utilities Commission and the public with information on the potential environmental impacts of a proposed project and of alternatives to the project that meet the stated need of the project. Normally, that would involve comparing the impacts of burning coal with burning natural gas or other fuels, or compared with the impacts of using renewable alternatives or constructing additional transmission facilities.

In this case, however, since the proposed project is a wind project intended to address SMMPA's obligations to increase its use of renewable resources for electricity generation, there is no reason to evaluate the impacts of 105 megawatts of generation from fossil fuels or the impacts associated with the use of increased transmission. Those options are not technologies eligible to be counted towards SMMPA's compliance with the Renewable Energy Standard (RES). Therefore, this Environmental Report analyzes the potential impacts associated with the Wapsipinicon North Wind Project and the impacts of three alternatives to the proposed project: (1) a "no-build" alternative, (2) a generic 100.5 megawatt wind project in some other location; and (3) a biomass plant.

3.1 No-build Alternative

The no-build alternative means that no wind project is constructed.

3.2 100 MW LWECS

In most certificates of need proceedings, where the issue is whether additional electricity is needed to serve certain customers or a certain area, the PUC considers the various means by which an increased demand for electricity can be met. This usually involves analyzing the impacts associated with construction of new generating facilities burning various fossil fuels, such as coal and natural gas, and the impacts related to construction of new transmission facilities. After the PUC determines the need for a new facility, and the size, type, and timing of that facility, or voltage if the need is for more transmission, the Public Utilities Commission then determines the appropriate site for the new power plant or route for a new transmission line.

In this case, however, where the need is progress toward achieving the Renewable Energy Standard, that kind of comparison is not applicable, as the electrical generating technologies eligible to be counted toward the RES are limited to specific renewable technologies. What is appropriate is to evaluate the impacts of a different wind project. A wind project could be constructed, for example, in another part of the state. The project could theoretically be one 100 MW system or a combination of smaller, dispersed projects. The analysis here will attempt to describe any differences in the impacts associated with the specific location of one 100 MW wind project.

3.3 38.5 MW Biomass Plant

The third alternative to be evaluated in this Report is a biomass plant. Biomass includes materials such as trees and plant material. A biomass plant would be considered an eligible renewable technology and would count toward the state's Renewable Energy Standard.

There are various sources of biomass fuel that could be considered. One proposal was made a few years ago to burn alfalfa. St. Paul District Energy, a combined heat and power facility in downtown St. Paul is an active facility fueled primarily by waste wood and has an electric generation capacity of 25 MW. This capacity is sold to Xcel Energy to satisfy part of Xcel Energy's biomass mandate. The 55 MW Fibrominn plant recently completed in Benson, Minnesota, burns turkey litter. Finally, the Laurentian Energy Authority operates facilities in Hibbing and Virginia with a combined capacity of 35 MW that convert wood, wood wastes and agricultural biomass into electricity.

The biomass alternative included for review in this Environmental Report is one that would burn a combination of hybrid willows, poplars, and corn stover, with natural gas as a backup fuel. This alternative was considered because such a plant, a proposed NGPP Minnesota Biomass, LLC, electric generation facility, has already undergone environmental review in Minnesota, and data regarding potential environmental impacts associated with such a plant are already available. Given the likelihood of available feedstock in the project area, such a biomass plant is more feasible than one burning alfalfa or a second turkey litter plant.

The plant was reviewed by the Environmental Quality Board in 2003 when it prepared an Environmental Assessment Worksheet on the proposed facility. See EQB Docket No. 03-67-EAW-NGP Biomass. The EAW can be found on the EFP website at:

http://energyfacilities.puc.state.mn.us/Docket.html?Id=4452

At the time that it was reviewed by the EQB, the NGPP project was a 38.5 MW project. The analysis that was conducted on that facility by the EQB is still valid for use as an alternative analysis in this Environmental Report. Since the Wapsipinicon North Wind Project calls for a capacity of approximately 100 MW, but will have an estimated capacity factor of 35 to 40 percent, the biomass alternative examined in this document is an appropriately-sized generation alternative.

4.0 Addressing the No-build Alternative

Often, in conducting environmental review, the analysis of the no-build alternative involves a discussion of the environmental impacts of continuing the status quo. For example, with a proposed highway project, the no-build alternative would take into account the impacts associated with continuing to have traffic increase along existing roads and highways and for development to occur along these existing arteries.

Three categories of impacts have been identified if the Wapsipinicon North Wind Project is not built. One is the impact not building the project will have on the state's goal to achieve greater production of electricity through renewable resources. The second is the impact not building the project will have on the people and the economy in the area where the Wapsipinicon North Wind Project has been proposed. And the third is the impact associated with the generation of electricity in a manner other than by the Wapsipinicon North Wind Project.

4.1 Renewable Energy Standard

In February 2007, the Minnesota Legislature enacted a Renewable Energy Standard (Minnesota Session Laws 2007, Chapter 3, Section 1) requiring electric utilities to provide 25 percent of the electricity used by their retail customers to come from eligible renewable energy sources by the year 2025.

SMMPA anticipates that the Project will satisfy 105 MW towards satisfying its Renewable Energy Standard requirements.

4.2 Impacts on the Wapsipinicon North Area

Not building the Wapsipinicon North Wind Project would, of course, impact the farmers and landowners who are participating in the project and who anticipate receiving annual payments from the project. No figures are available for what those payments would be, but the amounts are likely to be in the thousands of dollars annually for each participant. The Project will also provide income to the community through production tax payments, jobs, and local spending. These income streams would not be available in the Wapsipinicon North area if this project were to be constructed elsewhere.

4.3 Replacement Power

If the Wapsipinicon North Wind Project is not built, the electricity that it would generate would come from somewhere else. And, if the Wapsipinicon North Wind Project is not built, SMMPA would have to find another renewable energy project to provide electricity, resulting in a delay in obtaining this 105 MW of renewable energy or a possible increase in the cost of energy.

It is possible to perform the math to determine how many additional tons of certain pollutants would be emitted into the atmosphere based on assumptions of what generating facility the electricity were to come from if the Wapsipinicon North Wind Project were not available. The Minnesota Pollution Control Agency has determined the emission rates per unit of electricity generated for a number of generating facilities in the state. These results are found in the Energy Planning Report prepared by the Department of Commerce in 2001 at page 95, Figure A-4. That report is available at:

http://www.state.mn.us/mn/externalOESs/Commerce/Energy_Planning_Report_121602022402_2002PlanningRpt.pdf

The Wapsipinicon North Wind Project would produce approximately 345,000 MWh per year when it is up and running. If this electricity were replaced by electricity generated at Xcel Energy's Sherco Plant, for example, the additional emissions of NOx, SO2 and CO2, based on the PCA figures in the Planning Report, would be:

517.5 tons/year of NOx
517.5 tons/year of SO2
412,275.0 tons/year of CO2.

The math is as follows: MWh/yr x (emission lbs/kWh x 1000 kWh) x 1 ton/2000 lbs = tons/yr. (The emission rate per unit of electricity for NOx and SO2 is .003 lbs and 2.39 lbs per kWh for CO2.) The report estimates emissions from existing baseload generating plants in Minnesota total approximately 80,000 tons for NOx, 90,000 tons for SO2, and 34 million tons for CO2.

5.0 Human and Environmental Impacts

Minnesota Rule 7849.7060, subp. 2 outlines the impacts to be addressed in the Environmental Review for any Large Electric Power Generating Plant in a Certificate of Need proceeding. Those 10 impacts are evaluated below for the proposed LWECS and each alternative.

5.1 Emissions

Minnesota Rule 7849.7060, subp. 2. A requires the Environmental Report to address the anticipated emissions of the following pollutants at the maximum rated capacity of the project and as an amount produced per kilowatt hour: sulfur dioxide, nitrogen oxides, carbon dioxide, mercury, and particulate matter, including particulate matter under 2.5 microns in diameter. The Environmental Report must also provide the calculations performed to determine the emissions.

5.1.1 100 MW LWECS

A 100 MW LWECS would not result in any emissions of these pollutants.

5.1.2 38.5 MW Biomass Plant

The following information was obtained from air permit application documents submitted to the Minnesota Pollution Control Agency (MPCA) in support of a biomass facility that had been proposed for construction in southern Minnesota.

Table 4.1 Potential Emissions from a 38.5 MW Biomass Plant

Pollutant	CAS* #	lb/hr	lb/kWh
Sulfur Dioxide (SO2)	7446-09-5	26.37	0.0007
Nitrogen Oxides (NOx)	10102-43-9	79.12	0.0021
Carbon Dioxide (CO2)	NA	102,853	2.6715
Mercury	7439-97-6	1.58E-03	4.11E-08
Particulate Matter (PM)	NA	13.71	0.0004
Particulate Matter <10 microns (PM10)	NA	13.71	0.0004
Particulate Matter <2.5 microns (PM2.5)	NA	13.71	0.0004

(* Chemical Abstracts Services Number)

The proposed facility was a generation plant primarily fueled by a combination of hybrid willows, poplars, and corn stover, with natural gas as a backup fuel. The emissions were calculated based on a variety of vendor information and factors obtained from the Environmental Protection Agency (EPA). With the exception of the carbon dioxide emissions calculation, the emissions information presented below was obtained from the MPCA permit application file for the biomass facility. The carbon dioxide emission rate was calculated based on an EPA emission factor of 195 lb/MM Btu heat input.

5.1.3 Wapsipinicon North Wind Project

The Wapsipinicon North Wind Project will not result in any air emissions.

5.2 Hazardous Air Pollutants and VOCs

Minnesota Rule 7849.7060, subp. 2. B requires the Environmental Report to address the anticipated emissions of any hazardous air pollutants and volatile organic compounds (VOCs).

5.2.1 100 MW LWECS

Regardless of where it is located, the 100 MW LWECS alternative would not result in any emissions of hazardous air pollutants or volatile organic compounds. There are three types of petroleum-based fluids used in the operation of wind turbines. These fluids are necessary for the operation of each turbine and include: gear box oil (synthetic or mineral depending on application), hydraulic fluid, and gear grease. The very low vapor pressures of these products do not cause the release of any measurable VOCs.

5.2.2 38.5 MW Biomass Plant

Information on VOCs was obtained from air permit application documents submitted to the MPCA in support of a 38.5 MW biomass facility proposed for construction in southern Minnesota. Emissions were calculated based on a variety of vendor information and factors obtained from the EPA. Reference to the specific document from which the emissions information was obtained, a copy of the table, or a copy of the backup calculations, is on file with the Environmental Quality Board. In summary, there should be little matter of concern at the low concentrations of these compounds.

5.2.3 Wapsipinicon North Wind Project

The OES does not anticipate the release of emissions of hazardous air pollutants or volatile organic compounds from the Project. There will be three types of fluids used in the operation of the wind turbines that are petroleum products. These fluids are necessary for the operation of each turbine and include: gear box oil (synthetic or mineral depending on application), hydraulic fluid, and gear grease. The very low vapor pressures of these products will not cause the release of any measurable VOCs.

5.3 Visibility Impairment

Minnesota Rule 7849.7060, subp. 2. C requires the Environmental Report to address the anticipated contribution of the project to impairment of visibility within a 50-mile radius.

5.3.1 100 MW LWECS

The installation of a 100 MW LWECS will alter the visual environment. By one measure of standards, the 100 MW LWECS could be perceived as an industrial visual intrusion, characterized by metal structures intruding on the natural aesthetic of the landscape. On the other hand, wind farms have their own aesthetic quality, distinguishing them from other non-agricultural land uses. The land use would not involve any ongoing industrial use of non-renewable resources or emissions into the environment. The area would retain the rural sense and remote characteristic of the vicinity. The turbines are a new feature on the landscape and are compatible with the rural, agricultural heritage of Minnesota.

Wind projects in Minnesota are generally located in rural areas with open space and minimal tree cover because these sites minimize energy losses from surface roughness. A 100 MW LWECS would include the addition of wind turbines, access roads, an operations and maintenance facility, electrical transformers and lines, and substation. A typical l00 MW project would permanently occupy approximately 80 acres. Potential impacts of placing an equivalent wind farm in a place other than Wapsipinicon North Wind Project are the possibility of needing to use different size turbines or a larger number of turbines, depending on the site specific wind resource characteristics.

A 100 MW LWECS could require as little as 44 turbines or as many as 61 turbines, depending on the capacity of the wind turbines installed. For instance, if a 2.3 MW turbine were installed (the size of the turbines in the High Prairie Wind Farm 1 Project located just south of the proposed Project), 44 turbines would be required to obtain 100 MW of capacity. If as has been proposed for the Wapsipinicon North Wind Project, wind turbines

with a capacity of 1.5 MW were installed, up to 67 turbines would be necessary to obtain the required capacity.

Other visual characteristics include turbine lighting, as required by 49 CFR Part 77, FAA Advisory Circular – AC 70/7460. In general, turbines on the perimeter of the wind project are lighted using dual lights. This system consists of red lights for nighttime and medium intensity flashing white lights for daytime and twilight.

Access roads are typically single-lane, low profile, Class 5 gravel roads. Operations and maintenance facility buildings are typically 2,000+ square feet pole barns that house the necessary equipment to operate and maintain the site.

5.3.2 38.5 MW Biomass Plant

A 38.5 MW biomass plant would be visible from all directions and have an industrial characteristic. The stack would be approximately 150 feet tall and the boiler house would be approximately 130 feet tall. The conveyors used for handling fuel would rise at an incline between the fuel handling area and the boiler. The conveyors would be lighted at night to allow for continuous operation of the plant. A transmission line would connect the plant to the transmission grid.

The plant, associated buildings and parking would cover approximately 10 acres, and the wood storage area would cover approximately 50 acres. A large portion of the site would be used for fuel storage. Fuels may include wood, wood waste materials, and agricultural biomass (corn stover and other biomass fuels).

The exhaust gas would have little particulate matter, so plumes or vapor clouds would not be visible from exhaust stacks for most of the year. On some occasions, particularly in cold weather, a water vapor plume from the exhaust stack may be visible. In addition to the vapor plume from the exhaust stack, a plume from the cooling tower may also be visible during periods of high humidity.

Stack lighting would be necessary and would conform to the current FAA Advisory Circular – AC 70/7460 and FAA recommendations for obstruction marking and lighting. Exterior lighting would be sufficient to allow 24-hour operation of the fuel handling system. Minor maintenance and walk down inspections of the conveyor systems would be required during all shifts of the 24-hour period. Exterior lighting is anticipated for all

conveyor walkways and stackout and reclamation areas. Lighting would also be required at all fuel receiving points, scales and vehicle access roadways, and parking areas.

The site for the biomass plant would not require a rural, open space, and it may be situated in a more urban or industrial setting.

5.3.3 Wapsipinicon North Wind Project

Although the Project area is near the 98.9 MW High Prairie Wind Farm I Project and the 100 MW High Prairie II Wind Farm Project, as well as the 100.5 Grand Meadow Wind Farm currently under construction, the predominant character of the project area is rural. The installation of the Wapsipinicon North Wind Project will alter the visual environment of the rural area. The Project would include up to 70 wind turbine generators that will alter the landscape. However, wind farms have their own aesthetic quality, distinguishing them from other non-agricultural land uses. The predominant existing land use would remain rural. The area would retain the rural sense and remote characteristic of the vicinity. Although the turbines are new features on the landscape, they are arguably compatible with the rural, agricultural heritage of Minnesota. The wind turbines would be visible on the horizon for a distance up to approximately five miles. The project site is spread across approximately 25,000 acres.

The towers will be 80 meters (262.5 feet) in height. The rotor diameter will be 77 meters (252.6 feet), resulting in a maximum overall height of 118.5 meters (388.8 feet) when one blade is in the vertical position. There will be a project substation 161 kV HVTL in order to transmit the electricity approximately five miles to the point of interconnection at the GRE Pleasant Valley Substation.

Visual characteristics include turbine lighting, as required by 49 CFR Part 77, FAA Advisory Circular – AC 70/7460. In general, turbines on the perimeter of the wind project are lighted using dual lights. This system consists of red lights for nighttime and medium intensity flashing white lights for daytime and twilight. Access roads are typically single-lane, low profile, Class 5 gravel roads. Operations and maintenance facility buildings are typically 2,000 square feet pole barns that house the necessary equipment to operate and maintain the site.

5.4 Ozone Formation

Minnesota Rule 7849.7060, subp. 2. D requires the Environmental Report to address the anticipated contribution of the project to the formation of ozone expressed as reactive organic gases. Reactive organic gases are chemicals that are precursors necessary to the formation of ground level ozone.

5.4.1 100 MW LWECS

Wind projects do not produce reactive organic gases. A 100 MW LWECS would not contribute to ozone formation

5.4.2 38.5 MW Biomass Plant

The potential NOx and VOC emissions are 347 tons per year and 39 tons per year, respectively. The proposed project area is designated as attainment for ozone by EPA for the current 1-hour standard and, based on ambient monitoring data, is expected to remain in attainment status when the new 8-hour standard becomes effective. Therefore, given the location of the proposed project (rural southern Minnesota) and the current attainment status of the area, ground level ozone would not be a concern.

5.4.3 Wapsipinicon North Wind Project

The Wapsipinicon North Wind Project would not produce reactive organic gases and would not contribute to ozone formation.

5.5 Fuel Availability and Delivery

Minnesota Rule 7849.7060, subp. 2. E requires the Environmental Report to address the availability of the source of fuel for the project, the amount required annually, and the method of transportation to get the fuel to the plant.

5.5.1 100 MW LWECS

Wind projects do not require any fuel besides wind. The actual availability of wind varies considerably across Minnesota, and has been analyzed by the Minnesota Department of Commerce. Reference the historical documentation of Minnesota's wind resources, "Wind Resource Analysis Program 2002," by reviewing the report on their website at:

http://www.state.mn.us/mn/externalOESs/Commerce/WRAP_Report_110702040352_WRAP2002.pdf.

In addition to this effort, the Department of Commerce has developed updated wind maps showing the statewide potential that exists for wind energy. These maps were developed for the Department by *WindLogics*, a Minnesota-based company that is at the leading edge of wind resource assessment by using atmospheric modeling techniques. The 80-Meter Wind Speed and Capacity Factor maps are provided in Appendix B. In addition to illustrating wind speed throughout the state, the maps also provide an estimate of wind capacity factors based on a 1.65 MW wind turbine at 80-meters. Capacity factors represent a ratio of the amount of energy that a wind turbine will generate in a given wind resource to the total potential energy that the turbine could generate, i.e. nameplate capacity multiplied by the total annual hours (8760).

At an 80-meter hub height capacity factors of 35 to 40 percent are typically achievable in areas that are considered economically feasible for development.

5.5.2 38.5 MW Biomass Plant

A representative 38.5 MW steam turbine biomass plant would use approximately 40,000 tons of wood, wood wastes, and agricultural biomass materials per month. Fuel would most likely be delivered by truck using the existing highway network. The frequency of trucks is dependent on the demand for materials and the available payload of each vehicle. An average flow of three to five semi-combination vehicles per hour would be typical for such a facility. The origin of loaded trucks and the destination of empty trucks would depend upon the location of the fuel source.

A biomass plant would most likely have some backup fuel available for startup or in the event that the biomass fuel supply was interrupted. Backup fuel may be natural gas or fuel oil. Natural gas would be delivered by a pipeline, and fuel oil would be delivered by truck.

5.5.3 Wapsipinicon North Wind Project

The Wapsipinicon North Wind Project requires no fuel. Instead, it is dependent on converting wind energy to electricity at the site. Based on the most recent Department wind maps the estimated average annual wind speed at 80-meters (in meters/second and miles/hour) at the Project site is 7.9 m/s (17.7 mph), with a range of 7.7 to 8.1 m/s (17.2 to

18.1 mph). The estimated capacity factor in the project area is in the range of 36% to 38.8%.

5.6 Associated Transmission Facilities

Minnesota Rule 7849.7060, subp. 2. F requires the Environmental Report to address associated facilities that would be required to transmit electricity to customers.

5.6.1 100 MW LWECS

A 100 MW LWECS alternative may require new electric transmission facilities to move the power to customers. A transformer is typically installed at the base of each turbine to raise the voltage to distribution line voltage, usually 34.5 kV. Power is typically run through an underground collection system, buried in trenches adjacent to project access roads, to the project feeder system. The feeder system delivers the power from the wind farm to a substation. At the substation the electric voltage is stepped up to transmission level voltage (69 kV or greater) and enters the grid. Based on engineering and safety requirements to connect to the high voltage transmission system, which differ based on the location of a project's connection, a wind facility may require a small to a quite large expenditure in new high voltage transmission line and substation construction to safely deliver electricity to customers.

5.6.2 38.5 MW Biomass Plant

The 38.5 MW biomass plant alternative could require new transmission facilities to provide power to customers. Transmission requirements would most likely include a transformer at the plant to step the voltage up to transmission levels and a transmission line between the plant and a substation where the power would enter the grid.

5.6.3 Wapsipinicon North Wind Project

The Wapsipinicon North Wind Project would have a 34.5 kV project feeder electrical system that would feed power to the project substation. At the project substation, already under construction as part of the Grand Meadow Wind Farm project, the electric voltage would be stepped up to a transmission level voltage of 161 kV. Up to a five-mile 161 kV transmission line would be required to deliver power from the project substation to the GRE Pleasant Valley Substation north of Dexter. The 161 kV transmission line that would be constructed as part of this project has already gone through local review for the necessary approvals.

5.7 Water Appropriations

Minnesota Rule 7849.7060, subp. 2. G requires the Environmental Report to address the anticipated amount of water that will be appropriated to operate the plant and the source of the water if known.

5.7.1 100 MW LWECS

A 100 MW LWECS alternative would typically require some water appropriations to supply potable water to the project's operations and maintenance facility. Because of the project's rural location, water would need to be supplied either through a rural water supply system or, more typically, construction of a single domestic-sized well. The source of the water will depend upon the location of the project.

5.7.2 38.5. MW Biomass Plant

The 38.5 MW biomass plant alternative would require water for both process and sanitary purposes. Project water could come from well water or city water. In addition, well water or city water effluent from a wastewater treatment plant could be used for cooling tower makeup, and possibly for other process water.

The amount of water used would depend upon the plant equipment and the water quality. A biomass facility currently in the permitting phase anticipates an average water flow of between 56.5 to 592 gallons per minute (gpm) and maximum water flows of between 567 to 592 gpm. Water use would be on the lower end of that range if effluent were used for part of the process water and on the upper edge of that range if only well water or city water is used. The source for the water would depend upon availability of water sources in the project area.

5.7.3 Wapsipinicon North Wind Project

The Wapsipinicon North Wind Project Project would require water appropriations for potable and sanitary water for the operations and maintenance facility. Water would be supplied through either rural water or a single domestic-sized well.

5.8 Wastewater

Minnesota Rule 7849.7060, subp. 2. H requires the Environmental Report to address the potential wastewater streams and the types of discharges associated with such a project including potential impacts of a thermal discharge.

5.8.1 100 MW LWECS

A 100 W LWECS would only generate wastewater at the operations and maintenance facility. Wastewater would be from the sanitary system and minor equipment maintenance. The wastewater would be disposed of in a septic system or sanitary sewer system.

5.8.2 38.5. MW Biomass Plant

A 38.5 MW biomass plant would generate wastewater from the following sources:

Table 4.2 Potential Wastewater Streams and Discharges

Wastewater Source	Well Water	
	gpm	Million gpy
Cooling Tower Blowdown	136.0	71.5
Sanitary	1.0	0.5
Plant Wash & Misc.	13.0	6.8
Demineralization	3.5	1.8
Oil/Water Separation	2.0	1.1
Total Discharge	155.5	81.7

The wastewater from a 38.5 MW biomass plant could be discharged without pretreatment to a municipal wastewater treatment facility with available capacity. It is also possible to approach zero discharge, but there would still be some wastewater associated with the cooling tower blowdown and boilers. The wastewater would include minerals and sanitizers, and have an increased temperature. The wastewater would be discharged to a holding pond where it would evaporate or infiltrate. The wastewater stream would be contained and not impact surface water resources. Sanitary wastewater would be disposed of in a septic system or sanitary sewer system.

5.8.3 Wapsipinicon North Wind Project

The Wapsipinicon North Wind Project will generate wastewater at the operations and maintenance facility. Wastewater would be from the sanitary system and minor equipment maintenance, and it would be disposed of through a septic system.

5.9 Solid and Hazardous Wastes

Minnesota Rule 7849.7060, subp. 2. I requires that the Environmental Report address the types and amounts of solid and hazardous wastes generated by the project, including potential impacts of a thermal discharge.

5.9.1 100 MW LWECS

The 100 MW LWECS alternative would generate solid waste during the construction of the facility. Material would be disposed of in an appropriate landfill facility. There would be a small amount of solid waste during operations of the facility that would be disposed of appropriately. Wind turbines require three types of petroleum-based fluids for operation: gear box oil, hydraulic fluid, and gear grease. All fluids are contained within the wind turbine structure.

The 100 MW wind project alternative would generate some very small quantities of hazardous wastes that may include fluorescent lights, lubricating oil, ethylene glycol, de-greasers, cleaning solvents, and batteries. Hazardous waste generation would fall below the quantity of a small quantities generator (220 pounds per month).

5.9.2 38.5. MW Biomass Plant

The 38.5 MW biomass plant alternative would generate solid wastes during construction. The solid waste would include normal construction debris such as, scrap wood, plastics, wallboard, packing material, cardboard, scrap metals, and electrical wires. No hazardous waste would be anticipated from project construction. A biomass facility would generate ash from fuel combustion. Typically ash would be collected and stored on site in an ash storage building. The ash would be removed periodically and re-used as a soil enhancer or disposed of at an off-site solid waste disposal facility.

The biomass alternative would generate very small quantities of hazardous wastes that may include fluorescent lights, lubricating oil, mineral oil, ethylene glycol, de-greasers, cleaning solvents, and batteries. It is anticipated that the facility would be classified as a "Very Small Quantity Generator" of hazardous wastes.

5.9.3 Wapsipinicon North Wind Project

The Wapsipinicon North Wind Project would generate solid waste during the construction of the facility. Material would be disposed of in an appropriate landfill facility. There would be a small amount of solid waste created during operations of the facility that would be disposed of appropriately. Used parts or other equipment could generally be rebuilt or recycled.

There are three types of fluids used in the operation of the wind turbines that are petroleum products (gear box oil, hydraulic fluid, and gear grease). All fluids would be contained within the wind turbine structure.

The Wapsipinicon North Wind Project would generate some very small quantities of hazardous wastes during operations that may include fluorescent lights, lubricating oil, ethylene glycol, de-greasers, cleaning solvents, and batteries. Hazardous waste generation would fall below the quantity of a small quantities generator (220 pound per month). Any wastes, fluids or pollutants generated during the Project would be handled, processed, treated, stored and disposed of in accordance with Minnesota Rules Chapter 7045.

5.10 Noise

Minnesota Rule 7849.7060, subp. 2. J requires the Environmental Report to address anticipated noise impacts of a project, including the distance to the closest receptor where state noise standards can still be met.

5.10.1 100 MW LWECS

A 100-MW LWECS will create noise. The sound level varies with the speed of the turbine and the proximity of the receptor. Sound is generated from the wind turbine at points near the hub or nacelle, from the blade rotation, and from transformers near ground level.

The representative sound power level (L_p) of a GE 1.5 MW wind turbine, such as those used in the Trimont Wind Farm in Martin and Jackson Counties, is 104.5 dBA. It was converted to a sound pressure level for comparison to the Minnesota Daytime and Nighttime L_{10} and L_{50} Standards given in Minnesota Rule 7030.0040. Turbines were modeled using the following equation for a hemispherical point source: $L_p = L_w - 10 \log (2*pi*r^2)-A_{atm}$ where L_p is defined as the sound pressure level at the distance of interest (r), L_w is the sound power level provided by the turbine manufacturer for a 1.5 MW turbine, and A_{atm} defined as the attenuation provided by atmospheric absorption.

The maximum distance calculated where an exceedence of a state noise standard would no longer occur is 623 feet for the Nighttime L_{50} standard of 50 dBA. Due to the possibility of cumulative noise levels being generated by the operation of multiple turbines, no turbines would normally be sited within 1000 feet of an occupied residence in order to avoid exceeding the MPCA Nighttime L_{50} Standard.

5.10.2 38.5. MW Biomass Plant

A 38.5 MW biomass plant is predicted to produce operational noise from a variety of sources including the turbine/boiler building operations, conveyor/reclaiming system, hammer mill and bale choppers, front-end loaders, and idling trucks. The stationary equipment will be housed in buildings or enclosures designed to provide additional noise attenuation.

During peak hour operations, noise emissions from the facility are assumed to be steady state. Under steady state conditions, the modeling results are considered to be equivalent to an L_{50} (the average sound level). Also under steady state noise emission conditions, an L_{10} value is approximately 3 dB higher than an L_{50} value. Therefore, noise modeling results were directly compared to MPCA daytime and nighttime L_{50} limits.

The maximum distance calculated where an exceedence of a state noise standard would no longer occur is 2,100 feet for the Daytime L_{50} standard of 60 dBA, and 6,200 feet for the Nighttime L_{50} standard of 50 dBA. This is a conservative estimate of maximum distance that has not been adjusted for shielding or soft-ground attenuation in the noise model. This distance is also based on maximum operation of equipment, and actual operation levels may vary. Decreased operations activity will result in decreased noise levels and shorter maximum distances.

5.10.3 Wapsipinicon North Wind Project

The Wapsipinicon North Wind Project would generate noise during construction at or above the 85 dBA recommended for eight hour farm exposure by the National Safety Council; however, these impacts would be limited to 50 feet from operating equipment and would not be expected to affect local residents. The Applicant expects on-site noise exposures for project personnel would be managed within OSHA standards.

Operating noise would occur from the wind turbines at points near the hub or nacelle, from the blade rotation, and from motors near ground level. The Applicant anticipates source noise levels of 96-99 dBA while operating, depending on wind speed, speed of the turbines and interference from other sources. Background ambient in the project area is estimated at about 33-38 dBA. Turbine setbacks from residences would be required to meet compliance with the PCA noise standards.

6.0 Mitigative Measures

Minnesota Rule 7849.7060, subp. 1. E, requires the Environmental Report to provide an analysis of mitigative measures that could reasonably be implemented to eliminate or minimize any adverse impacts identified for the proposed project and each alternative analyzed.

6.1 No-build Alternative

The No-build alternative will have no impacts, and mitigative measures are not necessary.

6.2 100 MW LWECS

A 100 MW LWECS will have no significant impacts and mitigative measures are generally not necessary for the following issues: air emissions, hazardous air pollutants and volatile organic compounds, ozone formation, fuel availability and delivery, transmission facilities (although another project might require new transmission), water appropriations, and wastewater.

The potential mitigation for visibility impairment at a 100 MW LWECS must be balanced with maximizing turbine efficiency and exposure to wind. For example, mitigation measures that require shorter towers or placement of the turbines at alternate locations off ridgelines could result in less efficiency per unit. Mitigative measures for a 100 MW LWECS would generally be included as conditions in a site permit and could include the following:

- Turbines would not be located in biologically sensitive areas such as wetlands or relic prairies.
- Turbines would be illuminated to meet the minimum requirements of FAA regulations.
- Existing roads would be used for construction and maintenance where possible. Road construction would be minimized.
- Access roads created for the wind farm facility would be located on gentle grades to minimize visible cuts and fills.
- Temporarily disturbed areas would be reseeded to blend in with existing vegetation.

Mitigative measures for solid wastes at a 100 MW LWECS would include appropriate disposal of construction and facility operation wastes at a licensed landfill. A 100 MW LWECS may generate very small quantities of hazardous wastes during the life of the Project. Mitigative measures for hazardous wastes would include appropriate handling, processing, storage, and disposal of wastes in accordance with Minnesota Rules Chapter 7045.

Mitigative measures for noise at a 100 MW LWECS would include not siting turbines within 672 feet of an occupied residence in order to avoid exceeding the MPCA Nighttime L_{50} Standard (Minnesota Rule 7030.0040).

6.3 38.5 MW Biomass Plant

The biomass plant could be equipped with state of the art control equipment, technologies that would potentially decrease emissions. However, these alternate control technologies have a number of drawbacks as compared to the proposed equipment, such as cost, technological issues, and other adverse environmental impacts.

Many of the visual impacts from the biomass alternative can be mitigated by locating the facility in an industrial or rural area with good access to transportation. Fuel storage can be used to provide a visual buffer between the facility and some of the surrounding land uses. Locating the facility near existing transmission facilities can reduce visual impacts from transmission lines.

Mitigation strategies available to reduce water appropriations would depend upon the water source. Where appropriate, water appropriations can be reduced by cycling water through some of the plant processes multiple times as long as water quality is maintained. Effluent from wastewater treatment can be used in some instances to reduce ground or surface water appropriations.

Wastewater streams can be reduced, though not entirely eliminated, through use of evaporative or infiltration holding ponds. The use of holding ponds would also eliminate potential for impacts from a thermal discharge directly to a water body. Mitigative measures for solid wastes at the 38.5 MW biomass facility alternative would include disposal of construction and facility operation wastes at an appropriate landfill and re-use of the ash as a soil enhancer or disposal of the ash at an off-site solid waste disposal facility.

It is expected that the 38.5 MW biomass facility alternative would be classified as a "Very Small Quantity Generator" of hazardous wastes. Any wastes, fluids or pollutants generated during the Project will be handled, processed, treated, stored, and disposed of in accordance with Minnesota Rules Chapter 7045.

Locating the facility away from sensitive receptors can mitigate noise impacts. Enclosure of some of the heavy equipment would reduce noise impacts to surrounding land uses. Fuel windrows can be located to provide noise attenuation to reduce the impacts from operations noise to sensitive receptors. Limiting the hours of fuel delivery and heavy equipment operation can also reduce noise impacts.

6.4 Wapsipinicon North Wind Project

The Wapsipinicon North Wind Project would have no significant impacts and mitigative measures are not necessary for the following issues: air emissions, hazardous air pollutants and volatile organic compounds, ozone formation, fuel availability and delivery, water appropriations, and wastewater. Transmission facilities mitigations would have been reviewed in the Local Review Environmental Assessment.

The potential mitigation for visibility impairment at the Wapsipinicon North Wind Project must be balanced with maximizing turbine efficiency and exposure to wind. Mitigative measures for Wapsipinicon North Wind Project are included in the pending site permit conditions and include the following:

- Turbines would not be located in biologically sensitive areas such as wetlands or relic prairies.
- Turbines would be illuminated for safety to meet the minimum requirements of FAA regulations.
- Existing roads would be used for construction and maintenance where possible. Road construction would be minimized.
- Access roads created for the wind farm facility would be located on gentle grades to minimize visible cuts and fills.
- Temporarily disturbed areas would be reseeded to blend in with existing vegetation.

Mitigative measures for solid wastes at the Wapsipinicon North Wind Project would include appropriate disposal of construction and facility operation wastes at a licensed landfill. The Wapsipinicon North Wind Project may generate very small quantities of hazardous wastes during the life of the Project. Mitigative measures for hazardous wastes would include appropriate handling, processing, storage and disposal of wastes in accordance with Minnesota Rules Chapter 7045.

Mitigative measures for noise at the Wapsipinicon North Wind Project would include not siting turbines within a sufficient distance of an occupied residence in order to avoid exceeding the MPCA Nighttime L_{50} Standard (Minn. Rule 7030.0040).

7.0 Feasibility and Availability of Alternatives

Minnesota Rule 7849.7060, subp. 1. F requires that the environmental report address the feasibility and availability of each alternative analyzed.

7.1 No-build Alternative

The No-build alternative is available, but would not help SMMPA meet the state's Renewable Energy Standard.

7.2 100 MW LWECS

Minnesota's wind resources are more than sufficient to support numerous 100 MW LWECS facilities, and thousands of MW of wind energy are in development across the state and region. Feasibility and availability may be delayed or financially impacted depending on the location of the alternative's electrical interconnection to the high voltage transmission system, which is at capacity in many locations in Minnesota.

7.3 38.5 MW Biomass Facility

A 38.5 MW biomass facility alternative is feasible. A 38.5 MW biomass project underwent environmental review in late 2003. However, OES Energy Facility Permitting staff is not aware of any large biomass projects that are currently available to meet SMMPA's needs.

7.4 Wapsipinicon North Wind Project

The Wapsipinicon North Wind Project is feasible and could be developed to help SMMPA meet the state's Renewable Energy Standards.

8.0 Required Permits

Minnesota Rule 7849.7060, subp. 1. G requires that the environmental report address other permits and approvals that the project may require. The federal, state and local permits or approvals that have been identified for the construction and operation of the Project are shown in Table 7.1.

Table 8.1 Potentially Required Permits and Approvals

Agency	Type of Approval
Federal	
Federal Aviation Administration	Notice of Proposed Construction or Alteration within six miles of Public Aviation Facility and structures over 200 feet to complete a 7460 Proposed Construction or Alteration Form
U.S. Army Corps of Engineers	Section 404 Permit
State of Minnesota	
Minnesota Board of Water and Soil Resources	Wetland Conservation Act Approval
Minnesota Department of Natural Resources	Pubic Water Works
	License to Cross Public Lands and Waters
Minnesota Pollution Control Agency	NPDES Permit: Construction
	License for Very Small-Quantity Generator of Hazardous Waste
Minnesota Department of Health	Water Well Permit
	Plumbing Plan Review
Minnesota Public Utilities Commission	Certificate of Need
	Site Permit
Local Permits	
Mower County	Building Permits
	Individual Septic Tank Systems (ISTS) Permit
	Driveway Permit
	Utility Permit
	Moving Permit
Townships	Road Access Permits

Appendix A.
Environmental Report Scoping Decision

In the Matter of the Application of Wapsipinicon Wind Project, LLC for a Certificate of Need for a Large Energy Facility, a 105 MW Large Wind Energy Conversion System (LWECS) in Mower County, Minnesota

ENVIRONMENTAL REPORT SCOPING DECISION PUC Docket No. IP-6670/CN-08-334

The above matter has come before the Director of the Office of Energy Security (OES) for a decision on the scope of the Environmental Report (ER) to be prepared on the proposed Wapsipinicon Wind Project Large Wind Energy Conversion System proposed for Mower County, Minnesota. Staff of the OES, Energy Facilities Permitting unit (EFP) held a public meeting on July 22, 2008, to discuss the project with the public and to solicit input into the scope of the ER to be prepared. The public was offered until August 4, 2008, to submit written comments regarding the scope of the ER. Having received two comments on the matter and consulted with EFP staff, I hereby make the following Scoping Order that the ER shall address the following matters:

ISSUES TO BE EVALUATED

1.0 Wapsipinicon Wind Project Description [Minn. Rule 7849.7060, subp. 1, A]

2.0 Alternatives to be Evaluated [Minn. Rule 7849.7060, subp. 1, B]

2.1 No-build Alternative
2.2 A Generic 100 MW Wind Project
2.3 A 38.5 MW Biomass Plant

3.0 Human and Environmental Impacts [Minn. Rule 7849.7060, subp. 1, C, D]

3.1 Emissions [Minn. Rule 7849.7060, subp. 2, A]

- No-build alternative
- 100 MW wind project
- 38.5 MW biomass plant
- Wapsipinicon North Wind Farm

3.2 Hazardous air pollutants and VOCs [Minn. Rule 7849.7060, subp. 2, B]
- No-build alternative
- 100 MW wind project
- 38.5 MW biomass plant
- Wapsipinicon North Wind Farm

3.3 Visibility impairment [Minn. Rule 7849.7060, subp. 2, C]
- No-build alternative
- 100 MW wind project
- 38.5 MW biomass plant
- Wapsipinicon North Wind Farm

3.4 Ozone formation [Minn. Rule 7849.7060, subp. 2, D]
- No-build alternative
- 100 MW wind project
- 38.5 MW biomass plant
- Wapsipinicon North Wind Farm

3.5 Fuel availability and delivery [Minn. Rule 7849.7060, subp. 2, E]
- No-build alternative
- 100 MW wind project
- 38.5 MW biomass plant
- Wapsipinicon North Wind Farm

3.6 Associated transmission facilities [Minn. Rule 7849.7060, subp. 2, F]
- No-build alternative
- 100 MW wind project
- 38.5 MW biomass plant
- Wapsipinicon North Wind Farm

3.7 Water appropriations [Minn. Rule 7849.7060, subp. 2, G]
- No-build alternative
- 100 MW wind project
- 38.5 MW biomass plant
- Wapsipinicon North Wind Farm

3.8 Wastewater [Minn. Rule 7849.7060, subp. 2, H]
- No-build alternative
- 100 MW wind project
- 38.5 MW biomass plant
- Wapsipinicon North Wind Farm

3.9 Solid and hazardous wastes [Minn. Rule 7849.7060, subp. 2, I]
- No-build alternative
- 100 MW wind project
- 38.5 MW biomass plant
- Wapsipinicon North Wind Farm

3.10 Noise [Minn. Rule 7849.7060, subp. 2, J]
- No-build alternative
- 100 MW wind project
- 38.5 MW biomass plant
- Wapsipinicon North Wind Farm

4.0 Mitigation measures [Minn. Rule 7849.7060, subp. 1, E]

4.1 No-build alternative
4.2 100 MW wind project
4.3 38.5 MW biomass plant
4.4 Wapsipinicon North Wind Farm

5.0 Feasibility and availability of alternatives [Minn. Rule 7849.7060, subp. 1, F]

5.1 No-build alternative
5.2 100 MW wind project
5.3 38.5 MW biomass plant
5.4 Wapsipinicon North Wind Farm

6.0 Required permits [Minn. Rule 7849.7060, subp. 1, G]

SCHEDULE

The Environmental Review will be completed in August 2008.

Signed this 5 day of August, 2008

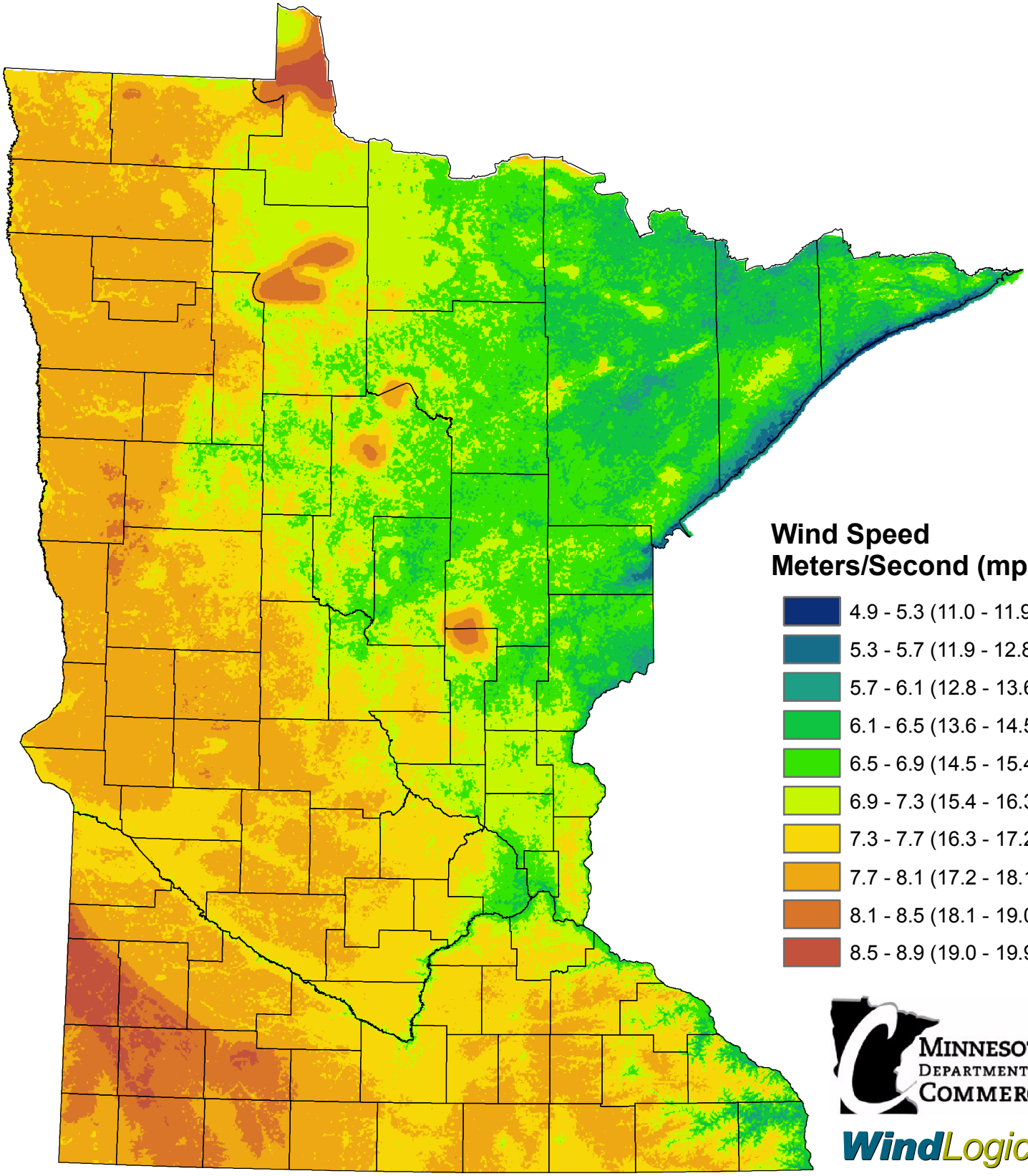
STATE OF MINNESOTA
DEPARTMENT OF COMMERCE
OFFICE OF ENERGY SECURITY

Edward A. Garvey

Edward Garvey, Director

Appendix B.
Minnesota Wind Resource Maps

Minnesota's Wind Resource by Wind Speed at 80 Meters



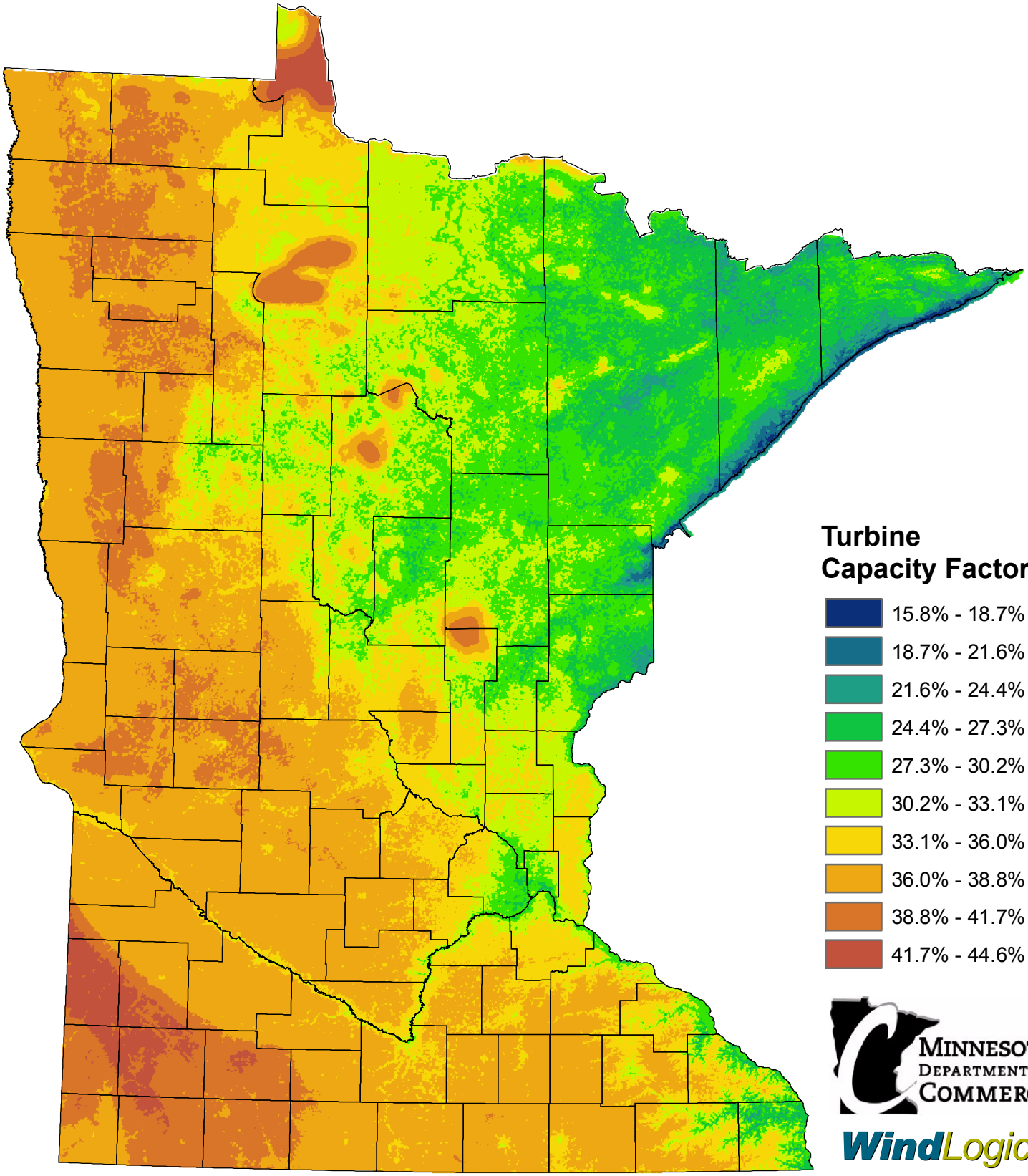
MINNESOTA DEPARTMENT OF COMMERCE

WindLogics®

This map has been prepared under contract by WindLogics for the Department of Commerce using the best available weather data sources and the latest physics-based weather modeling technology and statistical techniques. The data that were used to develop the map have been statistically adjusted to accurately represent long-term (40 year) wind speeds over the state, thereby incorporating important decadal weather trends and cycles. Data has been averaged over a cell area 500 meters square, and within any one cell there could be features that increase or decrease the values shown on this map. This map shows the general variation of Minnesota's wind resource and should not be used to determine the performance of specific projects.

January 2006

Minnesota's Wind Resource by Capacity Factor at 80 Meters



MINNESOTA DEPARTMENT OF COMMERCE

WindLogics®

This map has been prepared under contract by WindLogics for the Department of Commerce using the best available weather data sources and the latest physics-based weather modeling technology and statistical techniques. The data that were used to develop the map have been statistically adjusted to accurately represent long-term (40 year) wind speeds over the state. Capacity factors are based on a 1.65 MW turbine, and production has been discounted 15% to represent real world conditions. Data has been averaged over a cell area 500 meters square, and within any one cell there could be features that increase or decrease the values shown on this map. This map shows the general variation of Minnesota's wind resource and should not be used to determine the performance of specific projects.

January 2006