Potential for Merchant Wind Energy in Nebraska

Report of the Nebraska Power Association
To Governor Mike Johanns

February 2002

In September of 2000 at a Wind Energy conference, Nebraska Governor Mike Johanns posed several questions regarding the potential for development of Nebraska's wind resources. This request resulted in the formation of an informal group called the Nebraska Wind Energy Task Force. This task force represented a broad group of stakeholders, including public utilities, state government, farmers and ranchers, landowners, environmentalists, consumers, and private industry. A report from this task force was delivered to Governor Johanns on January 25, 2001. The primary recommendation of the Wind Energy Task Force report was for the Governor to establish a steering committee to work closely with the Nebraska Power Association to devise a wind development plan for Nebraska. The Governor has not done so and NPA believes appropriately to await the outcome of the NPA study of wind power potential.

In April, Governor Johanns asked the Nebraska Power Association (NPA) to prepare a business plan detailing how the state could develop its wind power assets and sell most of the electricity outside of the state. On April 23rd, the Board of Directors of NPA approved going forward with the studies necessary to address the essential elements of a plan as set forth in the Governor's letter. Members of NPA formed a Project Team to study all relevant aspects of wind power in Nebraska necessary to prepare such a business plan.

This report summarizes the results of the studies and presents an overview of the potential for the creation of a public entity in Nebraska to undertake an entrepreneurial enterprise as necessary to achieve the goals set forth in the Governor's request.

1. Objective

The objective of the NPA effort was to prepare by the fall of 2001 a business case of the engineering, economic, and financial feasibility of a newly created public entity in Nebraska to plan, develop, finance, operate, and market the output of one or more major wind farms strategically located in Nebraska. The business case was to include analysis of the following specific items:

(1) an assessment of the market demand for large amounts of wind generated energy in states surrounding Nebraska,
(2) an assessment of potential sites in Nebraska,
(3) an estimate of the cost of construction of wind generation facilities,
(4) an estimate of the cost of ownership, operation and maintenance of wind facilities on large wind farms in Nebraska,
(5) an organizational structure that will allow a public entity in Nebraska to do all that is necessary to accomplish a successful development, and

(6) a plan to finance the cost of acquisition and construction of one or more large wind farms under the selected structure.

2. Wind Energy Overview

The development of wind energy as a “central station” source of electric generation has seen dramatic growth in recent years as a result of technological advances, legislated wind energy mandates, renewable energy incentives and growing consumer interests in renewable energy. Technological advances have improved wind turbine efficiency and reliability and have extended wind turbine life expectancy. Mass production to meet the increased demand has lowered the cost of manufacturing wind turbines. Since wind energy does not require fuel for combustion and has no associated emissions or solid wastes subject to regulations, its costs are considered stable over the life of the turbine, barring public policy changes intended to tax energy output.

Current costs for wind energy from sites considered a good wind resource (Class 5 or better) with reasonable transmission access are higher on average than existing fossil fired generation. Nevertheless, current Federal subsidies for public utilities building wind generating facilities bring wind energy busbar costs into a competitive range with all-in-busbar costs of new fossil fired generation. It should be noted however that the overall value of wind energy is less than that generated by conventional central station generators for the reasons as set forth in the succeeding paragraph.

Wind generated energy is intermittent since it is only available when the wind speed at the turbine exceeds eight miles per hour. Fluctuations in consumer demand and fluctuations in wind speed result in the need for other dispatchable central station generation resources that can vary generation to the degree necessary to instantaneously match generation output to energy consumed by all customers at any time. Since electricity is consumed at all times and cannot be stored to any great extent, wind energy can only be a small portion of the generation resource mix necessary to provide consumers energy as required. One factor to consider when evaluating wind generation as a central station source is that in our region, not more than 15 to 18 percent of a wind turbine’s nameplate capacity can be counted upon for reliability purposes thus significantly discounting wind’s contribution to capacity.

The intermittent nature of wind energy impacts transmission systems as well. Wind can serve as a ‘load reducer’ in areas where wind energy is consumed locally. Typically though, central station wind energy sources as large as are being contemplated in this report must be transmitted to loads substantial distance from the wind energy site. Therefore, wind energy development must include arrangements for long term transmission rights to deliver output to a remote load center. One value of wind energy generating facilities in remote areas is their capability to occasionally and unpredictably provide voltage support to the transmission system.

The intermittent nature of wind also impacts scheduling of production of energy within an electric system's load frequency control area. Limited predictability of wind speed makes it difficult to schedule power from wind even on an hourly basis. Therefore, generation and transmission control centers must make special accommodations for wind energy in order to include it while providing overall reliable power to consumers in the control area.

Despite the technical hurdles which must be considered, wind energy can also have a positive impact on local economies. Not only is there the immediate, short-term economic boost associated with construction, wind energy siting leases can provide annual revenue to landowners while having little impact on the existing use of the land with careful location of the individual turbine assemblies.

Based on the positive factors discussed above, six Nebraska utilities created the Nebraska Distributed Wind Generation Project consisting of two 750 kW turbines located about 1.5 miles west of the town of Springview on leased grazing land in Keya Paha County. The two units were connected to the electric distribution system of the KBR Rural Public Power District. The turbines were installed and energized in October 1998, and were released for full-time operation in late January 1999. Lessons learned from the construction and operation of this facility were utilized in the preparation of the studies supporting this report. In addition, the wind turbine assemblies installed and operated by Lincoln Electric System (LES) provided useful information to the NPA Study.

3. Issues to Consider

The Governor's request for a business case supporting a decision to create a public entity to produce wind energy for sale and delivery to load centers outside of Nebraska has many business elements and facility components that must be addressed.

First, there are the organizational and legal questions that arise when creating a public entity formed in Nebraska with authority to finance, build, own and operate wind generators in Nebraska for the purpose of selling and delivering the output to entities who distribute electricity to load centers located in States other than Nebraska. Statutory as well as income tax issues must be considered before going through the expense of locating, financing and constructing substantial numbers of wind turbine assemblies in the suitable parts of Nebraska.

Second, collecting the electric output of some 270 wind turbine assemblies scattered over several square miles of land in suitable locations for delivery into the regional transmission system poses a particular problem for those rural distribution utilities whose right to condemn property and build such distribution and transmission facilities is limited under law to the purpose of providing electric service to customers in their respective certified service territories.

Third, The electrical output from the wind turbines must be marketed and sold to entities outside of Nebraska who, for whatever reason, are seeking a large supply of wind energy for delivery to electric customers within their load centers. There is a risk element to wind energy development that can't be ignored, if it is to be done on an entrepreneurial basis as a public venture. There will be marketing groundwork and sales efforts, legislative effort and tax opinions to be obtained before any significant developmental work can get underway in Nebraska. That means that a public entity will be putting rate payer dollars at risk, without assurance of cost recovery.

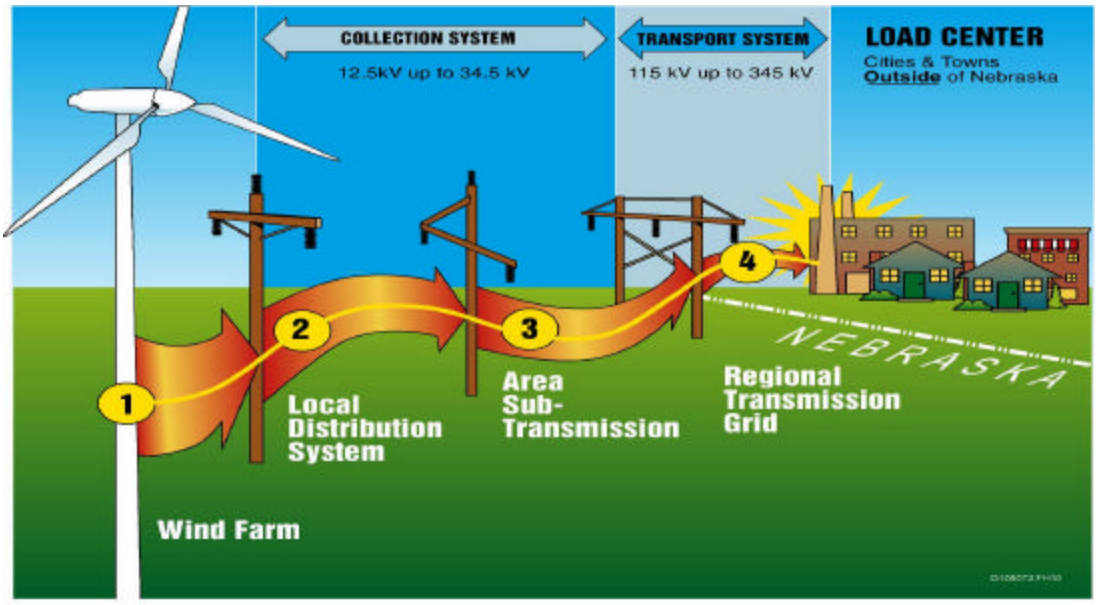


Figure 1 above provides a pictorial representation of the number of electric systems and entities that would become involved in a wind energy development program as contemplated in the Governor's request.

4. Potential Sites

In March of 1994, the Nebraska Legislature's Natural Resources Committee, the Nebraska Power Association (NPA), and the Nebraska Energy Office (NEO) reached an agreement to complete a statewide wind monitoring study. The purpose of the study was to identify and quantify the wind resource at locations within the state with potential for wind development. Global Energy Concepts (GEC) was awarded the work through a competitive bid process and signed a contract in September 1994. Data collection at eight sites began in April 1995 and continued through March 1999, resulting in four consecutive years of wind resource data.

The eight sites monitored included Imperial (Chase County), Rushville (Sheridan County), Winnebago (Thurston County), Wahoo (Saunders County), Kimball (Kimball County), Valentine (Cherry County), Springview (Keya Paha County), and Stuart (Holt County). The selection of these sites was the result of a screening process based on estimates of the wind resource, distance to transmission lines, sufficient land area for utility-scale project development, and exposure of local terrain features to the prevailing wind directions. The possible sites were then ranked for consideration based on landowner interest, suitability for development, environmental and public acceptance issues, and site access. Detailed Site Evaluation Reports are provided in Appendix C.

Over the four-year study period, the annual average wind speeds at the 40-meter level ranged from 13.9 to 16.8 mph at the eight monitoring sites. Based on wind power density, the sites are rated as Class 3, 4, and 5 wind sites. Class 3 is generally considered to be the minimum rating at which wind power development is technically viable. The highest average annual wind speeds were recorded at Imperial and

Valentine, while the lowest speeds were recorded at Rushville and Wahoo. The wind speeds were also analyzed for seasonal patterns, which were observed to be similar across the state. The winds are highest during the fall and winter, decrease during the spring, and are lowest in the summer months of July and August. Operating results of the two wind projects in Nebraska (4 turbine assemblies) have continued this predicted performance. Finally, wind speeds at all eight sites decrease slightly in the early morning and evening hours.

For this current study, the Project Team reviewed and considered the findings of the Nebraska Wind Energy Site Data study completed by GEC still viable. The sites, with associated wind speeds and wind class, are included below.

SITE	Wind Speed (mph)	**Wind Class**
106: Valentine	16.4	5
101: Imperial	16.3	5
107: Springview	16.0	5
108: Stuart	15.8	4
105: Kimball	15.4	4
103: Winnebago	15.2	4
102: Rushville	14.6	3
104: Wahoo	14.4	3

In addition to the availability of wind data, other considerations for selecting a site include proximity to and capabilities of the distribution and communication systems, adequate transmission capability, minimal environmental impact, compatible land use, ease of access, a cooperative distribution system owner, and the local public's interest in wind energy. The transmission concerns for five of the sites were identified in the study and summarized hereinafter. Permitting and environmental issues were also studied and will be summarized also. Once a decision is made for the general location of the project, additional work needs to be conducted to identify and evaluate specific land parcels in the vicinity.

5. Electrical Transmission to Remote Load Centers

In addition to the local distribution and area sub transmission systems that may have to be improved to collect the output of the large wind farms, the wind energy will have to be transported over the regional high voltage transmission grid from Nebraska to the load centers of the utilities in areas remote from Nebraska who purchase the output.

Load flow studies were performed of the regional high voltage transmission system to determine what improvements would be necessary to receive the output of both a 50 MW and a 200MW wind farm at various locations in Nebraska and transmit it to remote load centers out of Nebraska.

The studies were made at two levels, first to address the impacts of various new proposed wind sites upon the regional transmission system and second to identify transmission constraints that would limit the full capability of the proposed new wind

power resource(s). If transmission constraints were evident from the studies, second iterations were performed to identify proposed fixes and approximate costs. This screening analysis was intended to provide a high level summary of transmission system impacts and is not considered a detailed analysis of the specific sites to be selected eventually.

To model the collection system for delivery of wind turbine output to the transmission system, certain baseline assumptions were developed and utilized for all five wind turbine sites studied. A 34.5 kV collector system was assumed which would aggregate all of the individual wind turbine generation into one interconnection voltage. A 115/34.5 kV step-up transformer was modeled to provide a transformation to the Nebraska Public Power District (NPPD) 115 kV transmission voltage. Ten miles of 115 kV line construction was assumed to address the required transmission line additions to tie into the nearest 115 kV switching station. Each of the wind site development options utilized the same interconnection modeling assumptions in the screening analysis.

The results of the Loadflow Screening Analysis focused on the Nebraska area transmission system and the impacts on existing facilities. Results are obtained for each individual size option and site.

Option W1: Wind Farm near Ainsworth

The development of a 50 MW wind farm near Ainsworth would not involve substantial transmission facility additions. The overloaded equipment impacted by the 50 MW incremental addition is primarily substation facilities. The impacts to regional constrained paths would require either facility upgrades or mitigating transactions. An estimated $6 Million investment in transmission facilities would be required to accommodate a 50 MW wind farm near Ainsworth. This assumes that the wind farm is within 10 miles of the existing Ainsworth 115 kV substation. If the site development is further away from existing transmission facilities, then the estimated interconnection costs will be greater.

The development of a 200 MW wind farm near Ainsworth would require substantial transmission facility additions. The existing 115 kV transmission lines from Ainsworth – O'Neill – Neligh would need to be re-conductored and/or rebuilt. There are also additional substation facilities that would need to be replaced and the impacts to regional constrained paths are magnified. The estimated cost to accommodate a 200 MW wind farm near Ainsworth is $26 Million.

Option W2: Wind Farm near Imperial

The development of a 50 MW wind farm near Imperial would not involve substantial transmission facility additions. The overloaded equipment impacted by the 50 MW incremental addition is primarily substation facilities. The impacts to regional constrained paths would also require either facility upgrades or mitigating transactions. This location is within the Gerald Gentleman Station (GGS) Stability Interface, which would require additional detailed stability analysis to address the impacts of this facility on present operational stability limitations. For this screening analysis, it was assumed that this wind farm would be integrated into the existing GGS Remedial Action Scheme and tripped off-line during any critical disturbance. An estimated $8 Million investment in

transmission, substation and communication facilities would be required to accommodate a 50 MW wind farm near Imperial.

The development of a 200 MW wind farm near Imperial would require substantial transmission facility additions. The existing 115 kV transmission lines from Grant to Beverly would need to be re-conductored and/or rebuilt. There are also additional substation facilities that would need to be replaced and the impacts to regional constrained paths are magnified. The impacts on the GGS Stability Interface and the Western Nebraska – Western Kansas Interface are also concerns that have not been completely addressed in this screening analysis. The estimated cost to accommodate a 200 MW wind farm near Imperial is $30 Million.

Option W3: Wind Farm near Rushville

The development of a 50 MW wind farm near Rushville would not involve substantial transmission facility additions. The overloaded equipment impacted by the 50 MW incremental addition is primarily substation facilities. The impacts to regional constrained paths would also require either facility upgrades or mitigating transactions. This location is within the GGS Stability Interface and Laramie River Station Stability Interface, which would require additional detailed stability analysis to address the impacts of this facility on present operational stability limitations. For this screening analysis, it is assumed that this wind farm would be integrated into the existing GGS Remedial Action Scheme and tripped off-line during any critical disturbance. An estimated $8 Million investment in transmission, substation and communication facilities would be required to accommodate a 50 MW wind farm near Rushville.

The development of a 200 MW wind farm near Rushville would require substantial transmission facility additions. The existing 115 kV transmission lines from Chadron – Rushville – Gordon - Shannon would need to be re-conductored and/or rebuilt. There are also additional substation facilities that would need to be replaced and the impacts to regional constrained paths are magnified. The impacts on the GGS Stability Interface and the Laramie River Station Stability Operating Guide are also concerns not addressed in this screening analysis. The estimated cost to accommodate a 200 MW wind farm near Rushville is $37 Million.

Option W4: Wind Farm near Emerson

The development of a 50 MW wind farm near Emerson would not involve substantial transmission facility additions. The overloaded equipment impacted by the 50 MW incremental addition is primarily substation facilities. The impacts to regional constrained paths would require either facility upgrades or mitigating transactions. An estimated $6 Million investment in transmission facilities would be required to accommodate a 50 MW wind farm near Emerson. This assumes that the wind farm is within 10 miles of the existing Emerson 115 kV substation. If the site development is further away from existing transmission facilities, then the estimated interconnection costs will be greater.

The development of a 200 MW wind farm near Emerson would require substantial transmission facility additions. The existing 115 kV transmission lines from Twin Church – Emerson – Bancroft - Oakland would need to be re-conductored and/or rebuilt. There are also additional substation facilities that would need to be replaced and the impacts to

regional constrained paths are magnified. The impacts to Ft.Calhoun South are significant and facility contributions in the Omaha Public Power District (OPPD) system would be required to accommodate this resource. The estimated cost to accommodate a 200 MW wind farm near Emerson is $20 Million.

Option W5: Wind Farm near Wahoo

The development of a 50 MW wind farm near Wahoo would not involve substantial transmission facility additions. The overloaded equipment impacted by the 50 MW incremental addition is primarily substation facilities. The impacts to regional constrained paths would require either facility upgrades or mitigating transactions. An estimated $4 Million investment in transmission facilities would be required to accommodate a 50 MW wind farm near Wahoo.

The development of a 200 MW wind farm near Wahoo would require substantial transmission facility additions. The existing 115 kV transmission lines from Columbus East – David City – Wahoo – Davey – 70th & Bluff would need to be re-conductored and/or rebuilt. There are also additional substation facilities that would need to be replaced and the impacts to regional constrained paths are magnified. The estimated cost to accommodate a 200 MW wind farm near Wahoo is $17 Million.

The results of the Regional Constrained Path Analysis indicate the relative impacts of the new wind generation sites on MAPP area constrained interfaces. The 200 MW wind generation exported into the St. Louis, Missouri region would represent a worst-case impact on regional constrained interfaces.

6. Environmental and Permitting Requirements

Several permits and approvals are required to build wind projects. Due to the lack of combustion in the generation of wind energy, air emission and water discharge issues are virtually non-existent. In general, local permits and approvals, especially regarding zoning compliance, become critical path issues. Visual impacts and impacts to local and migratory bird populations are also an important issue to address. The studies identified all of the federal, state and local permits or approvals that are generally required of electric generating facilities, and their applicability to wind energy.

While the list is extensive, the NPA does not believe that permitting, which is a normal process involved for any power resource project, will be a major problem in the development of wind farms in Nebraska. However, the public policy of Nebraska for building generation and transmission facilities in Nebraska is an issue that will need to be addressed.

The Nebraska Power Review Board (NPRB) must authorize the construction of any type of power generation facility in the state of Nebraska, including wind turbine generators, the output of which is sold at either retail or wholesale in Nebraska.

The application for authorization consists of a two-page questionnaire requesting a description of the proposed facility (including the identification of alternative locations and unit types), overall project schedule and total estimated costs. Any engineering

feasibility studies must be submitted. The NPRB examines the application upon filing and holds a public hearing to discuss concerns and to discover any issues from the public or alternative generating sources (such as already functioning power suppliers in the area). The applicant has the opportunity to answer all questions and to resolve all issues of concern from parties contesting the application.

Under the Nebraska Revised Statutes, section 70-1024, the NPRB must find that the project "will serve the public convenience and necessity" before approving any generation or transmission project. There is a serious legal question as to whether generation or transmission facilities sited in Nebraska to serve the export market would meet the "public convenience and necessity" criteria.

Another regulatory process that may have to be addressed for the successful creation of a entrepreneurial public entity in Nebraska, and one which is unfamiliar to public power entities in Nebraska, is a requirement for permission from the Federal Energy Regulatory Commission (FERC) to be an exempt wholesale generator (EWG).

EWGs are a designated class of independent power producers created under the 1992 Energy Policy Act. An EWG is defined as a person or entity determined by FERC to be engaged directly or indirectly and exclusively in the business of owning and/or operating an "eligible" facility and selling energy at wholesale.

7. Legal and Organizational Issues

There are basically six structures under which a public power entity can be formed in Nebraska to undertake this venture. These structures are a public power district, a cooperative (either non-profit or for profit), an inter-local agreement, a joint action agency, or a limited liability company. These traditional structures are believed to have substantial legal limitations on transferring funds to the State of Nebraska. Creation of a non-profit foundation to conduct the entrepreneurial affairs of a Nebraska wind energy merchant company may have some possibilities not available in any of the other corporate structures considered such as transfer of excess funds of the state. Each structure was examined extensively in the study.

7.1 Public Power District

A public power district (PPD) is organized under Chapter 70, article 6, of the Nebraska Revised Statutes. As such, it is a public corporation and political subdivision of the state of Nebraska. A district may be composed of the territory of one or more municipalities, whether contiguous or otherwise. It is organized by filing a petition with the NPRB. The petition must define a PPD's operating area and the populace to be represented by the Board of Directors.

Once created, a PPD has the power to borrow money and incur indebtedness for any corporate use. Any indebtedness or obligation is payable solely from revenue or income derived from its operation and management of its electrical system, or from proceeds of the sale of property of the district. A PPD also has the power of eminent domain, whereby it can acquire property useful for the generation, transmission or distribution of electricity.

7.2 Cooperatives

Cooperative, nonprofit, membership corporations may be organized under Chapter 70, article 7 or under Chapter 21, article 13 of the Nebraska Revised Statutes. Most of the state's cooperatives are organized under the general non-profit corporation statutes contained in Chapter 21. However, several are organized under the more restrictive provisions for electric cooperatives contained in Chapter 70.

A cooperative can be formed by 10 or more persons or one or more cooperative companies for the transaction of any lawful business. If the cooperative engages in a business subject to regulation under another law of this state, it may incorporate only if permitted by, and subject to all limitations of, the other laws. Once incorporated, it has the same powers and duties as required of other types of corporations. It can: (1) purchase, lease or acquire real or personal property, (2) sell, mortgage or dispose of all or any part of its property and assets, (3) make contracts and guarantees and incur liabilities, and (4) make and alter operating agreements. It can also make donations for the public welfare or for charitable, scientific, or educational purposes. It may be either for-profit or a non-profit organization.

The business and affairs of the cooperative are managed under the direction of a board of directors in accordance with written by-laws. These directors are elected annually, or as otherwise provided in the by-laws, by the members. The qualifications for directors are prescribed in the articles of incorporation or the by-laws.

7.3 Interlocal Agreement

Chapter 13, article 8 of the Nebraska Revised Statutes governs the creation of a joint entity pursuant to an interlocal agreement. Under these statutes, any two or more public agencies may enter into agreements with one another for joint or cooperative action pursuant to the Interlocal Cooperation Act. Once created, an interlocal constitutes a separate public body corporate and politic of the state of Nebraska, capable of exercising public powers and acting on the behalf of the public agencies which are parties to such agreement. An entity created by local public agencies pursuant to the Interlocal Cooperation Act is not considered to be a state agency.

An administrator or joint board governs an entity created under an Interlocal agreement. In the case of a joint board, the public agencies creating the joint entity must be represented. If any provision of services or facilities fall under state governmental control, the Interlocal agreement must be submitted to the agency having such power of control to be approved or disapproved.

Any powers, privileges, or authority capable of exercise by a public agency of this state may be exercised and enjoyed jointly with any other public agency of this or any other state. Its only limitations are the limitations of the participating agencies and the terms of the agreement.

7.4 Joint Public Agency

A Joint Public Agency is organized under Chapter 13, article 25 of the Nebraska Revised Statutes, to permit local governmental units to make the most efficient use of the powers by allowing them to cooperate with other governmental units. The participating parties create this joint entity under the Joint Public Agency Act through a resolution, ordinance, or appropriate action.

7.5 Limited Liability Company

A Limited Liability Company (LLC) is organized pursuant to Chapter 21, article 26 of the Nebraska Revised Statutes, for any lawful purpose other than being a financial institution. The words "limited liability company" or the abbreviation LLC must be the last words of the name of the company. A LLC is formed by two or more persons executing and delivering articles of organization in duplicate to the Secretary of State.

Once created a LLC has most of the powers granted to a corporation in Nebraska. It can: (1) purchase, lease or acquire real or personal property, (2) sell, mortgage or dispose of all or any part of its property and assets, (3) make contracts and guarantees and incur liabilities, (4) make and alter operating agreements, and (5) cease its activities and surrender its certificate of organization. A LLC can also become a member of a general partnership, limited partnership, joint venture or similar association, or other limited liability company.

7.6 Non-Profit Foundation

Non-profit foundations or corporations are organized under Chapter 21, article 19 of the Nebraska Revised Statutes and under section 501(c)(3) or section 509(a) of the Internal Revenue Code, for the purpose of engaging in any lawful activity unless a more limited purpose is set forth in the articles of incorporation. If the corporation intends to engage in an activity that is subject to regulation under another statute, it may proceed only if incorporation under the act is not prohibited by the other statute. The corporation is subject to all limitations of the other statute.

One or more individuals or entities may create a corporation by delivering articles of incorporation to the Secretary of State for filing. The articles of incorporation should include, among other things, the purpose for which the corporation is organized, the name of each incorporator; whether or not the corporation will have members; and provisions not inconsistent with law regarding the distribution of assets on dissolution.

Each corporation must have a board of directors. All corporate powers are exercised by or under the authority of, and the affairs of the corporation managed under the direction of its board. Also, unless otherwise provided in the articles or bylaws, a corporation shall have a president, a secretary, a treasurer, and such other officers as are appointed by the board.

Unless its articles of incorporation provide otherwise, every non-profit corporation has perpetual duration and succession in its corporate name and has the same powers as an individual to do all things necessary or convenient to carry out its affairs. It can: (1) purchase, lease or acquire real or personal property, (2) sell, mortgage or dispose of all or any part of its property and assets, (3) make contracts and guarantees and incur

liabilities, (4) make and alter operating agreements, and (5) cease its activities and surrender its certificate of organization.

The NPA believes that a non-profit foundation for corporate structure offers the best possibilities of accomplishing most of the goals that the governor envisions with a entrepreneurial public entity capable of becoming a merchant wind generator and transferring the profits of such an enterprise over to the state for economic development purposes.

8. Market Potential for Wind Energy Sales

To determine the market potential for exporting substantial portions of the output of a large wind farm in Nebraska, the NPA Board hired the national consulting firm R.W. Beck (See Appendix A for copy of their report). The following is a summary of the results of their study.

The general public has viewed environmentally friendly forms of electric generation favorably for many years, but until recently the cost associated with many renewable technologies was prohibitively high. Advancements in wind power technology in the U.S. and abroad have led to substantial decreases in the cost of wind energy over the past decade. This, coupled with record high and widely fluctuating natural gas prices and capacity shortages that have resulted in wholesale price spikes, have caused resurgence in the development of renewable generation, including wind, as the economic cost of these resources compared to traditional resources has narrowed.

Demand for renewable generation capacity originates from the marketing activities of utility and energy service providers as well as from regulatory or legislatively mandated utility programs. Under green marketing or green pricing programs end-use customers frequently purchase renewable energy at a premium price. But due to a variety of factors, only about one percent of customers has subscribed to green pricing programs, indicating it is still a niche product. According to the U.S. Department of Energy (DOE), 75 megawatts (MW) of renewable energy had been built in the U.S. in response to green pricing programs as of December 2000. At that time an additional 205-MW of capacity were planned.

Some states have mandated Renewable Portfolio Standards (RPS) as part of their deregulation initiatives, while other states, through legislative or regulatory initiatives, have issued directives to the investor owned utilities to increase renewable requirements regardless of industry restructuring. Demand for wind energy created by state mandate or through a utility's resource planning process is less likely to command a price premium, as it must compete with other technologies.

8.1 Mandated Renewable Portfolios Standards

In most of the states covered in the R. W. Beck study, legislators and utility commissions have not addressed renewable energy development. Across the country, states that have moved forward with deregulation have often dealt with renewable resource issues as part of their regulatory or legislative restructuring agenda.

Only four states under investigation - Colorado, Wyoming, Minnesota, and Iowa - have utility-scale wind projects totaling over 20-MW of capacity. Minnesota and Iowa are the only two states that also have (RPS) mandated for their investor owned utilities, and these two states have progressed the farthest in developing their wind potential.

The other state of interest that has utility-scale sizable wind production facilities is Wyoming. There are no renewable or wind energy mandates in Wyoming, and most of wind power generated in that state is being sold into the Pacific Northwest or Colorado.

8.2 Green Power Pricing

Residential participants in utility green pricing programs generally pay $2.50 to $10.00 per month over their normal charges for electric service. Price premiums for energy-based green pricing offerings range from 0.4¢ per kWh to as much as 20.0¢ per kWh for 100 percent new renewable energy content, with a median of 2.5¢ per kWh.

Competitive green power products typically carry a price premium over the regulated cost of service for retail customers of 1.0¢ per kWh to 2.0¢ per kWh. Some marketers are using a fee-based system, where they charge a fixed monthly program fee with the electricity priced at the default market price.

The R.W. Beck study, as well as NPPD's and LES's own green power marketing programs inside of Nebraska leaves NPA with the belief that substantial work remains to be done to determine where wind power will be incorporated into the electric utility resource base, whether mandated or voluntarily. Similarly, the issue of retail deregulation needs to be examined to determine whether a green market is emerging in a state where specialty product marketers can market and sell to end-use customers who are interested in wind energy. It is a part of the initial hard work of any entrepreneurial organization that sees an opportunity to make a profit where extant resources are readily available to meet the emerging demand.

8.3 Nebraska Market for Wind Energy

The majority of power purchase agreements are confidential, but industry data shows that wind generation can deliver electricity at a cost of 3¢ to 6¢ per kWh. Electricity from the 300-MW Stateline Wind Generating Project on the border of Washington and Oregon currently in development reportedly will cost less than 2.5¢ per kWh. A Wind Energy Supply Agreement indicates that Public Service Company of Colorado contracted for wind energy at a price of 3.72¢ per kWh in 2000. Certain NPA members were informed, but did not confirm, that wind energy is being developed as a wholesale product in Texas and sold at a long-term price below 3.0¢.

9. Project Schedules

A wind turbine project schedule has five major phases: Planning, Design and Procurement, Construction, Commissioning and Acceptance, and Operation. Each phase consists of separate tasks. These tasks are representative of the NDWGP project, and may not be all-inclusive. Details of the schedule for the Wind turbine facilities were studied and time frames for each have been estimated.

In addition, the schedule needs to include the parallel work of the local distribution utilities to be able to collect the output of the generators and deliver them to a point of interconnection to the regional transmission system. In order to successfully interconnect the output of the collection system to the regional grid, the transmission entity must make the necessary transmission improvements to receive the output as well as clear any constraints in the grid that will arise as a result of the energy being delivered to the designated purchaser of the output.

The NPA believes that it will take approximately 30 months following authority to proceed with construction to bring the wind power facilities into commercial operation and have an appropriate interconnection contract for delivery to the remote load centers. Prior to that date, all of the legal, legislative, tax, formation, marketing, sales contracts, financing, licensing, permitting and authority to construct must be addressed and resolved. Considering the experimental nature of creating a public entity to undertake a venture of this nature, it may be two to two and a half years from start of the efforts to commencement of construction.

NPA has a serious concern about who will fund the at-risk development costs, which are at serious risk until non-recourse debt financing can be arranged. Non-recourse funding is not likely to be available until after the marketing, sales agreements and long-term transmission arrangements are completed and the critical permits and authorities to construct and operate are in hand. It is very clear that the public power entities in Nebraska cannot pledge their credit nor secure the at-risk start up costs for such a venture from revenues derived from sales to their customers.

10. Capital Requirements

The estimated cost of development and construction of the wind projects vary depending upon location and the range of transmission improvements necessary to receive the output of the turbine assemblies at the point of interconnection to the area transmission grid, as well as the cost of borrowed funds. The estimated capital requirements ranging from least to highest are as follows:

	Least Cost	Highest Cost
50 MW Wind Farm		
Construction Costs (1)) Interest During Construction) Financing Costs Capitalized)	$65,260,000	$67,960,000
Start Up Costs Capitalized	500,000	500,000
Total Capital Requirements 50 MW	$65,760,000	$68,460,000
200 MW Wind Farm		
Construction Costs (1)) Interest During Construction) Financing Cost Capitalized)	$255,900,000	$266,500,000
Start Up Costs Capitalized	500,000	500,000
Total Capital Requirements 200 MW	$256,400,000	$267,000,000

(1) Assumes Construction based upon 2001 dollars. Inflation would be at 2.5% from 2001 to the actual date of start of construction.

NPA cautions against complete reliance of these estimates of capital requirements for any purpose other than an understanding of the orders of magnitude. The actual numbers, based upon the size of a wind farm development, location and extraordinary transmission requirements, could vary measurably from those used in computing the business financial feasibility of the enterprise.

11. Financing Plan

A project of the nature contemplated in this report will require a substantial amount of funds for acquisition and construction of wind turbine assemblies and transmission facilities. Perhaps even more important is a source of risk capital that would be necessary up front to pay for the developmental work before the feasibility of the entrepreneurial venture can be established.

NPA believes that the initial working capital must be considered totally at risk until certain statutory impediments are removed and Federal tax opinions or IRS rulings obtained. In addition, the power marketing work remains to be done to the point of execution of an appropriate power sales contract, which will serve as the principle security for any long-term non-recourse loans. In addition, NPA believes that long-term transmission rights would have to be obtained to insure the lender that there is a transport path for the output of the wind generators in Nebraska to the load centers of the entity purchasing the output will be necessary for a successful debt financing of the cost of construction and repayment of the at-risk investment. NPA estimates the at-risk

capital to be in the range of $500,000 to pay the salaries, benefits and overhead costs of two full time professionals and the charges of the requisite lawyers to change the Nebraska laws and to obtain the opinions or IRS rulings governing the tax matters in this venture.

It is not at all clear where the at-risk capital would come from. Because of a different purpose and charter, a public power entity in Nebraska would not be permitted to lend its credit, nor transfer any of its retained earnings to the new public entity established to own, build and operate the wind facilities. Similarly, unless funded by individual and corporate charatible donations, a foundation structure woul dbe similiarly strained to come up with initial working capital.

The non-recourse debt may be too difficult to effect even after the legal, marketing and transportation arrangements are established. NPA has assumed for purposes of analysis that the new entity could attract 100% debt financing with 30-year maturity through a consortium of banks. The debt financing would probably require both a pledge of net revenues from the operation of the wind generators, and a mortgage on the assets of the entity including the power sales contracts, transmission arrangements and the physical plant.

12. Operations of the Wind Generating Entity

One of the important pieces of this study was the development of the cost analysis of a public wind-powered facility in Nebraska. The following section details the assumptions used in the economic analyses.

12.1 Assumptions

A business case for the scope of a pubic entity wind energy merchant enterprise depends upon the ultimate efficacy of several assumptions. These assumptions fall into four major categories: Equipment, Economic, Construction, and Operations and Maintenance. The assumptions used in the calculations were considered reasonable by the NPA for purposes of analysis that is broad in nature and not to be used for raising venture or debt capital. **Before any effort is made to secure start up working capital to begin this venture, the efficacy of these assumptions need to be established.**

Equipment assumptions deal with the physical attributes of the wind turbines themselves. These assumptions include:

- 750 kW Zond Z-50 wind turbines with life of 30 years
- 65 meter towers
- Class 4 or better wind area.

The economic assumptions deal with general information related to the wind resources and financial costs. These assumptions are:

- The general escalation or inflation rate is 2.5% per year.
- The interest rate assessed on the capital costs is 7.5%.
- The sales tax rate is 5.0% of the costs of the Production and Transmission plant.

The Construction costs assumptions deal with the capital needed to construct the wind facility. These assumptions include:

Construction time is 2.5 years, from siting, permitting to start-up.

- The cost of wind turbine assemblies installed is $1,000 per nameplate kW.
- The transmission costs to collect the output are $110 per nameplate kW.
- Administrative and general costs are equal to 2% of construction costs.
- IDC is calculated at 7.5% over the construction period.
- Financing costs are 2% of the total capital costs due at the time of financing.

Finally, the Operation and Maintenance (O&M) costs relate to the ongoing operation and maintenance of the wind facility. The O&M assumptions include:

- Both variable and fixed O&M costs are escalated at 2.5%.
- All O&M costs do not change relative to the amount of electricity generated.
- O&M costs are $30 per kW per year including overhaul and replacement.
- Insurance costs are $2 per kW per year.
- Annual A&G costs are 15% of fixed O&M costs.
- Annual land rental costs are assumed at $1000 per turbine per year.
- 35% capacity factor

Sensitivity studies were performed on some of the major assumptions. The team developed a High Costs case that adjusted the following assumptions:

- An interest rate on capital of 8.0%
- An equipment life of 20 years
- Fixed annual O&M costs of $35 per kWh
- 25% capacity factor for a Class 3 wind resource

The Low Costs case used the base assumptions with the following adjustments:

- Construction time of 1.5 years
- A 40% capacity factor for a class 5 wind source.

12.2 Start Up Schedule

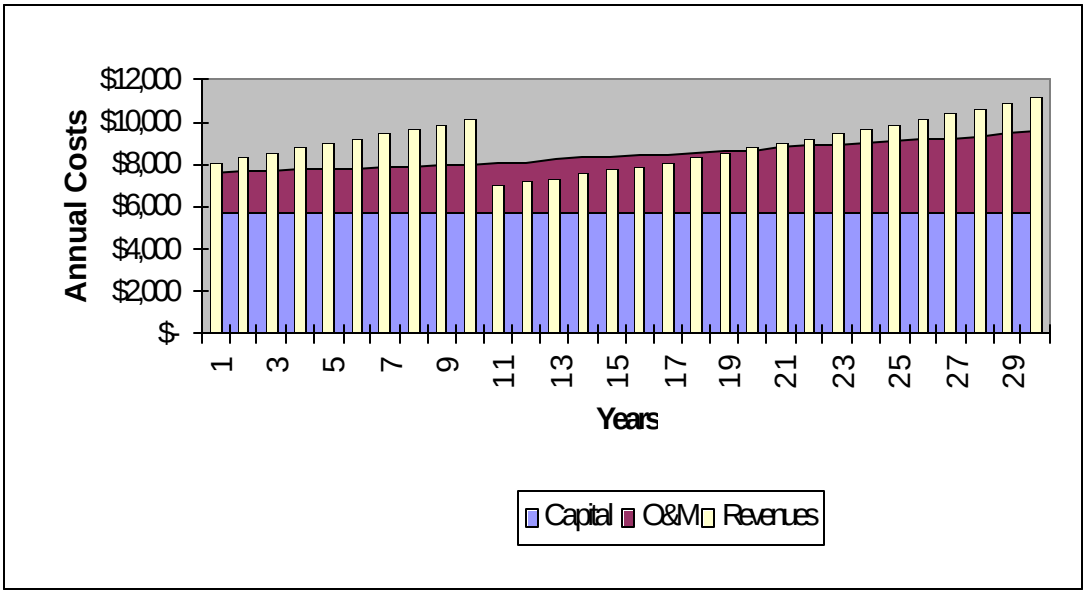
As indicated previously in this report, NPA believes a cost allowance for start up until long term non-recourse debt financing can be achieved for the entire project costs is approximately $500,000. The first tasks would be to hire a senior executive to head up the effort, and to begin resolving the legal and organizational issues. The second task entails hiring an external lobbyist and law firm to address the organizational issues, including working with the state Legislature, NPRB, DOE and the U.S. Treasury Department Parallel to the second task would be a full time person to do the marketing and sales effort to obtain commitments for the output of the wind project and arranging long term transmission paths to the load centers. The first and second task is expected to take up to two years. The third task would involve preliminary engineering, permitting, and financing the cost of acquisition and construction of the wind turbine assemblies and improvements in the transmission collection system. The third task and the construction phase are estimated to take 2.5 years.

13. Forecast of Financial Results

Based on the assumptions outlined above for capital cost and operation costs of a 50 MW wind farm the first year's costs would be approximately $1.8 million. First year annual costs for a 200 MW wind facility would be approximately $7.3 million.

At a 35% capacity factor, the proposed wind facility would cost 4.85 cents per kWh in the first year. With federal REPI credits of 1.7 cents per kWh, the net revenue requirements from the sale of the output of the wind farm would be 3.15 cents per kWh. In the High Costs case, the wind facility can generate electricity at 6.4 cents per kWh in the first year. In the Low Costs case, the wind facility can generate electricity at 2.4 cents per kWh in the first year. The above cost figures do not include wheeling charges beyond the interconnection to the transmission system.

The revenues of a wind-powered facility were estimated by assuming a wholesale contract with a distributor outside of Nebraska that begins with a fixed price and escalates with inflation. At a 35% capacity factor, the total costs of a 50 MW wind facility over a 30-year period is $253 million. A price of 3.3 cents per kWh escalated at 2.5% per year will yield $256 million net present value over a 30 year period. A wholesale contract priced at 3.5 cents per kWh and escalating at 2.5% per year yields revenues over the 30-year period of $270 million. Net revenues for the project are positive for the years 1 through 10 (the period of eligibility for the Federal REPI credit). After the REPI credit is extinguished, the net revenues are negative from years 11 to 19, and become positive beginning in year 20. A graphical representation is provided below. Scaling to a 200 MW wind farm would not appreciably affect the financial performance of the enterprise. Any wholesale contract with a starting price above 3.5 cents per kWh would yield a similar performance as shown in the following graph, only with higher accumulated net revenues. **Based upon recent information that NPA has about competitive market prices for wind power in Texas and the Northwest, prices at 3¢ or above do not currently appear to be likely.**



The above depiction of positive net revenues over the life of the facilities depends upon the Department of Energy granting the new public entrepreneurial entity REPI credits for the first ten years of operation. Even with ten years of Federal subsidy, the entity would have to be able to sustain several more years of deficits after the subsidy ends before the revenues under the terms assumed for the power sales contract begin to exceed all in costs. NPA has some serious doubts that a quasi-public entity without measurable equity capital into the project could attract the amount of long-term non- recourse debt needed for 100% financing.

14. Conclusions

The Nebraska Power Association has estimated the costs to construct, own, operate and maintain wind facilities on large wind farms at various locations in Nebraska. The costs of the necessary transmission additions were also estimated. We have reviewed the regional market for wind energy and looked at possible organizational structures that could be used to own, operate, market and deliver wind generated electricity at wholesale outside of Nebraska with the fundamental purposes of transferring potential profits of such a venture to the State of Nebraska.

Based upon the information developed in this report, we conclude that it would not be financially nor economically feasible at this time to pursue a public power entrepreneurial venture of this nature.

Further, NPA concludes that the development costs for an entrepreneurial venture of this nature exceeds the financial risk that the members of NPA would be willing to incur and we do not believe that a non-recourse loan to cover such costs would be acceptable to a bank. There is just too much developmental work to be done and costs to be incurred prior to determining that a willing buyer outside of Nebraska would execute a take-or-pay contract for a significant portion of the output of wind generation in Nebraska at a price sufficient to cover our costs and provide the State with some profit.

NPA members will nevertheless continue to be committed to pursuing renewable energy for our own firm customer obligations in and out of Nebraska. That pursuit will likely be through smaller scale, customer-supported wind and landfill gas projects until there are further improvements in the economics of wind energy in Nebraska.

APPENDIX A