Community Wind Development Handbook

Developed on behalf of RURAL MINNESOTA ENERGY BOARD

by: WINDUSTRY™

AURI AG INNOVATIONS
Agricultural Utilization Research Institute

center for producer owned energy

Promoting New Markets for CORN
MCR&PC
Minnesota Corn Research & Promotion Council

the MINNESOTA PROJECT
working for strong local economies,
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CLEAN ENERGY RESOURCE TEAMS

SOUTHWEST INITIATIVE FOUNDATION

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This handbook is intended as a guide and may not contain all the information needed to build a wind project.

Handbook Table of Contents

Introduction to Community Wind Development

Wind energy development is expanding rapidly, creating many opportunities for communities to participate in wind development. Windy acreage, once cursed for losing top soil, is now seen as a potential goldmine. Many farmers and landowners are clamoring to get in on the action. Wind energy offers many financial, environmental, and social benefits to the communities and individuals who choose to get involved with its development.

The concept of community wind is simple and flexible. Projects can be any size – one turbine or one hundred, usually commercial-scale and greater than 100 kW, connected on either side of the meter. Community wind includes both on-site wind turbines used to offset the customer's load and wholesale wind generation sold to an unrelated third party. Community wind projects are in the planning stages in nearly every state with wind development, and the concept is continually being re-defined as new community groups and models for ownership emerge. ***The key element is local ownership and local benefits.***

In the United States, community wind projects are owned by farmers, schools, colleges and universities, tribal governments, municipal utilities, local businesses, rural electric cooperatives, and non-profit organizations, to name a few. These projects have come together through hard work, local innovation, and public policies that support locally owned projects, local champions, and the need for new economic opportunities in rural America.

At-a-Glance: What is Community Wind?

Community wind projects are locally owned by farmers, investors, businesses, schools, utilities, or other public or private entities and they optimize local benefits. The key feature is that local community members have a significant, direct financial stake in the project beyond land lease payments and tax revenue. Projects may be used for on-site power or to generate wholesale power for sale, usually on a commercial-scale greater than 100 kW.

This Handbook focuses on "wholesale" community wind development of projects in the 2-50 MW range intended for third party power purchase. The information does not necessarily apply to small-scale on-site wind systems.

If you are interested in information about small or mid-sized wind turbines designed to supply energy for on-site use for a single home, farm, or small business, see *Windustry's Small Wind Turbine Pages*.

Community Wind Handbook

This Handbook is designed to give developers of "wholesale" community wind projects practical knowledge of what to expect when developing commercial-scale community wind energy projects in the range of 2 to 50 Megawatts (MW). These wind projects are designed for bulk power generation for sale to a utility company or large electricity user and can supply enough energy to serve several hundred to thousands of homes. Typically, planning and developing a wholesale community wind project takes several years, working with a dedicated team of professionals that have expertise in business and finance, easements, power purchase agreements, engineering, construction and project management, and experience in the utility sector as well as other aspects of the wind industry.

The Handbook provides insight into every aspect of the community wind development process and helpful information about managing a project from the beginning of the development process through decommissioning. It includes a primer on wind resource assessment based on current technology and industry standards, and information about financing, business structures, tax incentives and liability, the interconnection of your project and acquiring a power purchase agreement, and selecting and purchasing turbines and associated equipment. It is intended to provide prospective developers with tools for each these steps, cost estimates, and guidance on when and where to involve outside expertise.

Developed and reviewed by a broad team of wind, legal, engineering, and financial experts, Windustry's Community Wind Handbook includes:
- A new pro forma model tool;
- Annotated examples of various legal agreements;
- Detailed review of policy incentives; and
- New case studies.

A community wind project has many parallels to the development of an ethanol plant or any other large energy facility. It is a multi-million dollar business that requires expertise in business, finance, and engineering, the participation of a diverse board of directors, much patience and perseverance, and equity and/or debt finance partners. It is not easy, but with the completion of a well-planned project, the rewards for a community are great.

Why Community Wind Energy?
The rapid expansion of wind energy can be attributed to improving economics and effective public policies. When wind is developed locally, the economic, social, and environmental advantages accrue to local farmers, landowners, and other members of the community. As a potential community wind developer, it is important that you understand both the benefits and challenges of wind energy so you can explain to others in your community how the project will help keep their power costs down and accurately answer their basic question: "Why wind?"

Economic Benefits of Community Wind

- **Revitalizes Rural Economies:** Locally-owned and locally-controlled wind development can diversify the economy of rural communities, substantially broadening the tax base. Wind turbines provide a new source of property taxes in rural areas that otherwise have a hard time attracting new industry.
- **Stimulates the Local Economy:** Community wind projects have higher multiplier effects and greater local returns in creating new jobs, growing business opportunities, and bringing new investment into the community than outside development, keeping energy dollars local.
- **Stabilizes Energy Prices:** Wind as a fuel for electrical generation has zero cost and does not need to be mined or transported, removing two expensive and fluctuating aspects from long-term energy costs. Fixed-price wind projects can help hedge against fossil fuel price spikes.
- **Promotes Cost-Effective Generation:** The cost of wind-generated electricity has fallen from nearly 40¢/kWh in the early 1980s to 2.5-5¢/kWh today depending on wind speed and project size.
- **Creates Jobs:** Wind energy projects create new short and long term jobs. Related employment ranges from meteorologists and surveyors to structural engineers, assembly workers, lawyers, bankers, and technicians. According a study by the New York State Energy Research and Development Authority, wind energy creates 27%

more jobs than a coal plant and 66% more than a natural gas combined-cycle plant per unit of energy generated.

Social Benefits of Community Wind

- **Promotes Energy Independence/National Security:** Local wind generation diversifies our energy portfolio and reduces our dependence on imported fossil fuels. Distributed community wind generation adds reliability to the nations electrical grid by decentralizing generation.
- **Creates a New Crop:** Community wind is a new revenue source for farmers and rural landowners, diversifying their income. It is compatible with agricultural use of the land as wind turbines can be installed amid cropland with minimal affect on people, livestock, or agricultural production.
- **Promotes Local Ownership:** Small clusters of turbines or even single turbines operated by local landowners and small businesses increase local control of energy production, making a significant contribution to the regional energy mix.
- **Galvanizes Support and Neutralizes Opposition:** Increased local benefits broaden support for wind energy, engage rural and economic development interests, and build a larger constituency with a direct stake in the industry's success. Local investment in wind can reduce local opposition to new wind farms and will cultivate local advocates.

Environmental Benefits of Community Wind

- **Produces Clean Electricity:** Widespread community wind development addresses climate change by providing a non-polluting source of energy that reduces greenhouse gas emissions.
- **Keeps Water Sources Clean:** Turbines produce no particulate emissions that contribute to mercury contamination in our lakes and streams. Wind energy also conserves water resources; producing the same amount of electricity can take about 600 times more water with nuclear power than wind, and about 500 times more water with coal than wind.[1]
- **Protects Natural Resources:** Harvesting the wind preserves natural resources as there is no need for destructive resource mining or fuel transportation to a processing facility.
- **Preserves Land:** Wind farms are spaced over a large geographic area, but their actual footprint covers only a small portion of land resulting in a minimum impact on crop production or livestock grazing. Wind farms preserve open space, preventing residential sprawl.

Organization of the Handbook

The Handbook is modular so that prospective community wind developers can read section by section as you plan your project, refer to the checklist as needed, quickly find contact information for consultants and experts, and gain easy access to various tools. Scattered throughout Windustry's Handbook are examples from experienced professionals in the wind industry, valuable pieces of advice from those who have developed community wind projects, and links to ***Additional Resources*** for more in-depth information on the issues at hand.

The Handbook begins with a description of the key players of the wind industry, an overview of community wind development, and checklist of key development steps.

[1] http://www.awea.org/10GW.html and http://www.awea.org/faq/water.html

Conclusion

Wind energy is rapidly expanding across the U.S., but much more needs to be done so that community wind can reach its full potential. Wind energy offers many significant benefits to the communities that choose to get involved in project development. Developing wind energy can be a complicated process requiring substantial time and effort, but it can also be very rewarding, both financially and on a personal level. Windustry's Handbook will help guide you through the process of wholesale community wind development and put you on the path toward becoming a community wind farmer!

Additional Resources on Community Wind Energy Basics

- Windustry:
  - Community Wind Energy Clearinghouse: www.communitywindenergy.org
  - Community Wind Energy Conferences: http://www.windustry.org/conferences/default.htm
  - Basic Factsheets: http://www.windustry.org/basics/default.htm
- National Wind Coordinating Committee:
  - Wildlife/Wind Publications: http://www.nationalwind.org/publications/wildlife.htm
- American Wind Energy Association
  - Basics Factsheets: http://www.awea.org/pubs/factsheets.html
  - Radar Issues: http://www.awea.org/pubs/factsheets/060602_Wind_Turbines_and%20_Radar_Fact_Sheet.pdf
- National Renewable Energy Laboratory:
  - Myths & Facts: http://www.nrel.gov/docs/fy05osti/37657.pdf
  - Radar Issues: http://www.eere.energy.gov/windandhydro/windpoweringamerica/issues_radar.asp
- Small Packages, Big Benefits: Economic Advantages of Local Wind Projects, by Teresa Welsh of The Iowa Policy Project, 2005: www.iowapolicyproject.org/2005_reports_press_releases/050405-wind.pdf.

Community Wind Development Overview and Checklist

Community wind project development requires many steps and involves many diverse people and organizations. As a community wind developer you will need to be creative, flexible, and patient in overcoming a variety of challenges. Much of the necessary work will require hiring experienced consultants and lawyers, such as for site assessment, interconnection studies, and developing easements. From the basics of building your project team and creating a realistic plan to the highly technical wind resource assessments and interconnection studies, you will want to manage your risk and exposure to ensure that your investments will pay off.

This section introduces the key players and their roles in community wind development. It gives an overview of the steps involved in the development process, and provides a checklist to help you organize your community wind development project. Here are the main topics covered:

Key Players in the Wind Industry

Key players with a role to play in community wind development include: wind turbine manufacturers, dealers, and distributors; wind project developers; consultants and contractors; electric utilities, advocacy groups; government agencies; and rural landowners and communities.

Wind Turbine Manufacturers

The firms dealing with wind energy run the gamut from small retail shops or mail-order catalogs selling micro turbines to corporate wind energy developers with annual revenues in millions of dollars. Fewer than 20 large wind turbine manufacturers worldwide produce commercial Megawatt-scale wind turbines. Many of the large turbine manufacturers are based in Europe, especially in Denmark and Germany. Large wind turbines are either sold directly by the manufacturer or by the manufacturer's regional dealers and distributors. A list of large turbine manufacturers is provided in the Turbine Selection and Purchase section.

Wind Developers

Wind developers buy or lease windy land, finance the installation of wind turbines and operate and maintain the turbines for an extended period. After a project is constructed, the wind developer's role varies. The developer may own and operate the wind farm, or merely operate the project for a different owner.

Private Consultants and Contractors

Private consultants and contractors serve the needs of any party in wind turbine transactions willing to pay their fees. They provide specialized skills or knowledge not generally available. A consulting meteorologist can independently evaluate the wind resources at a site. Engineering consultants can offer technical comparisons among competing wind turbines or provide "due diligence" reports to banks considering loans for proposed wind projects. Contractors are often needed for the construction phase of wind projects for tasks such as pouring concrete and erecting the turbines. The American Wind Energy Association (AWEA)'s membership directory can be a good resource for finding consultants: www.awea.org/directory.

Electric Utilities

The cooperation of electric utilities is required to interconnect any wind turbine with the power grid. Selling electricity to a utility involves negotiations between the non-utility generator (NUG), such as a farmer, and the electric utility. These negotiations generally result in a contract binding both parties to an agreement for a fixed amount of time. Electric utilities also represent the main market for wind-generated electricity, whether they are interested in wind power for their own purposes or are under political, regulatory, or legal pressure or obligation to invest in wind energy.

Advocacy Groups

Clean energy advocates work to educate the public about the benefits of renewable energy and influence public policy to favor clean energy technologies like wind. The fact that wind energy projects often mean large investments in rural communities has captured the attention of groups interested in rural economic development, such as local elected officials, farm groups, and other rural advocacy organizations.

Government

Government agencies play many roles in wind energy development at the local, state, regional, and national levels. Local government units are responsible for zoning and permitting wind turbines and often for determining how they are taxed. The federal and state governments control many of the incentives available to wind projects and generally play a regulatory role in the energy industry.

Rural Residents and Landowners

As the suppliers of windy land, rural landowners can have substantial influence over how wind energy develops. As the industry has grown, windy landowners and their communities are gaining an understanding of the tremendous value of their wind resource and are finding ways to keep more of the benefits in the local community. These methods range from farmers negotiating better land leases with developers to local and community investments in wind projects.

Community Wind Project Development Steps

Developing a wind project can be a time-consuming and complex process. Before beginning, you will want to familiarize yourself with all of the necessary steps and gain a solid understanding of the elements of a wind project. The time required to complete development of a community wind project depends on several critical path milestones:

- ✓ Securing land with a demonstrated bankable wind resource;
- ✓ Securing permits and development financing;
- ✓ Completing negotiation of a power purchase agreement (PPA) with a utility or other off-taker;
- ✓ Completing interconnection and transmission agreements;
- ✓ Arranging capital financing;
- ✓ Procuring wind turbines, transformers, and other components, and contracting for construction; and
- ✓ Building and commissioning the project.

Although presented as a list, the process of planning and developing a project from beginning to end is a much more organic process with many of these milestones happening in parallel to one another. For instance, although placing deposits for a firm order of turbines is listed toward the end of the critical path sequence, placing your turbine order is a long negotiation process which must be done fairly early in the process in order to complete projects in a timely manner in today's equipment-constrained wind market.

Project Goals – Decisions to be Made Up Front

The scale of a community wind project is often dictated by the number of interested investors, the size of the site, and the utility system's existing ability to interconnect generation without significant and costly upgrades. As a community wind project developer, you will have control over some of these decisions such as the number and types of investors you will work with. Other issues, such as the design of the existing utility grid, are already defined for you. Some questions, such as the area available to you for development, may be somewhat flexible.

You may find that joining forces with others and aggregating your development efforts to achieve a larger project may substantially improve your economic return, as an $85 million 50 MW project may be more profitable than a $4 million 2 MW project. On the other hand, a combination of state and federal incentives targeting 2-5 MW projects may help make smaller projects more feasible and easier to justify.

Before moving down the development path, you should determine and prioritize your primary project goals so that, as your project evolves and key decisions are required, you can be sure to preserve your most important objectives. You should also have a clear mission statement that will help to frame your project for potential investors and to keep clear in your own mind the objectives of the project as it evolves.

Like any multi-million dollar business venture, collaboration with experts in various areas of the industry is key to developing a successful project. A capable CEO and a diverse and qualified board of directors will provide sound guidance when making key decisions. A well skilled project manager with a solid understanding of the wind industry and the roles of key players is essential for a successful project. The Project Management and Planning section of the Handbook describes the qualities of vital team members and their roles in the development process. That section also outlines many of the stumbling points in the development process and suggests strategies for hedging against risks.

Characteristics of a Good Community Wind Site

Finding and securing a good site is key for a successful community wind project. A good site not only has strong wind resources but also has access to high voltage distribution or transmission lines, appropriate zoning for wind turbines, minimal environmental concerns, and favorable attitudes toward wind development from neighbors. Once you have identified a promising site to investigate developing a project, if you do not own or otherwise control the land, you will need to obtain an easement or lease from the property owner. For more information about wind energy easements/leases visit the ***Leases and Easements*** section of the Handbook.

At-a-Glance:
Site Characteristics Checklist

- ✓ Strong wind resource
- ✓ Access to high voltage distribution or transmission lines
- ✓ Appropriate zoning for wind turbines
- ✓ Minimal environmental concerns
- ✓ Favorable attitudes towards wind energy

Once you have control of a suitable wind development site, you can complete more detailed site planning such as micro-siting turbines. For more information about siting turbines, visit the ***Siting Guidelines*** section of the Handbook.

Wind Resource Assessment

Once you have determined your project goals and identified a potential site or sites, the next step is typically to determine a rough estimate of the wind class at your sites. A wind resource map of your state can be found online at:
http://www.eere.energy.gov/windandhydro/windpoweringamerica/wind_maps.asp

If your land appears to be Wind Class 4 or higher, is clear of trees and buildings, is higher than its surroundings, and in close proximity to 3-phase distribution or transmission lines, then you are justified to investigate your resource further. Next you will need to undertake site-specific meteorological studies to help you and your financial advisor determine your site's economic feasibility. The ***Wind Resource Assessment*** section of the Handbook includes detailed information about assessing site wind resources for "wholesale" community-scale development and what it takes to collect "bankable" wind resource data to convince financers and investors that your project will produce enough energy and generate enough revenue to meet their required returns.

Financing Your Project

The economic rewards of your development effort will depend greatly on your financing mechanisms. It is important to develop a comprehensive budget and investigate possible financing options at the start of your project. Project cost components include the wind resource assessment, the turbines, towers, construction costs, interconnection fees and system upgrades, operations and maintenance, insurance, and any consulting services you use. Summaries of state and federal incentives that you may be able to take advantage of to reduce your project costs can be found at: www.dsireusa.org. All of these components must be taken into consideration as you put together your project's pro forma. The ***Financing*** section of the Handbook includes detailed information about project financing and helps answer the question "What will your banker want to know?"

Choosing a Business Structure

Once you have confirmed that your site has a strong wind resource and the property is suitable for development, you will want to decide what level of involvement in the project you are comfortable with. If you own the land yourself, there are three basic ways to participate in wind energy development:

1) You can lease your land to a wind developer,
2) You can join with others in investing, or
3) You can own the turbine(s) yourself.

Any combination of the above is possible. If you do not own the land, then options 2 and 3 are still available. Your commitment level will depend upon a few factors, including the time and effort you want to put in, the risk and return you are willing to take on, your tax liability (or tax credit appetite), and the legal feasibility of your situation.

Your overall project motivations will help determine your ownership structure. Is your intention for local community members to be the project owners? Do you want to develop a wind project as a hedge against rising energy prices for a farming operation? Or is your goal to create a steady, long-term stream of revenue for a public school district? Financial incentives typically are designed for specific business models, so you may find it necessary to modify your business plan to be eligible for the variety of wind energy incentives, tax shelters, and financing options available to help develop community wind projects. Some of your investors may require certain rates of return from a project, and this will likely direct project outcomes to some degree. Hiring a legal consultant familiar with community wind development can walk you through the benefits and drawbacks of potential ownership models.

The Handbook section on Business Models includes descriptions of many of the innovative ways that projects have been structured to help you decide which is right for you. The Handbook also features an in-depth analysis of the model most widely used to date for community wind projects: the "Minnesota Flip." Written by an attorney experienced in setting up such projects, this section provides detail unprecedented in the public domain on how this complex business structure works in practice.

Power Purchase Agreements

One of the most formidable tasks in developing a community wind project is attaining the power purchase agreement (PPA). PPAs are lengthy legal documents which define the financial obligations between your wind project and the utility purchasing your energy. They contain language defining when your project can and can not produce energy, payment schedules, reporting obligations, and indemnity clauses in addition to the rate or rates at which the utility will purchase your energy. It is strongly advisable to enlist the help of an attorney with experience in power purchase agreements. This will be a significant but worthwhile expense that can keep your project out of legal and financial trouble after your project begins producing energy. The Handbook section on Power Purchase Agreements has descriptions of typical terms found in wind energy PPAs as well as excerpts from agreements for actual projects with annotations by an attorney with experience in negotiating wind project PPAs.

Interconnection

Installing wind turbines and generating electricity is meaningless unless you can get that electricity onto the electric grid. In order to sell electricity you will need to interconnect with your local utility's transmission lines. Interconnection requires that the correct voltage distribution or transmission lines be located nearby, and that they are capable of handling the additional electricity you produce. You will need to obtain an interconnection study to determine the capacity and cost, and then negotiate an interconnection agreement with your utility. The Handbook section on Interconnection will guide you through the process.

Turbine Selection and Purchase

The turbine that you select for your project will depend on your wind resource and the goals of your project, as well as on the price, availability and down payment required to secure a turbine. Keep in mind that there are long waiting lists for many wind turbines, often more than a year. When deciding which turbine is right for your project, you should talk with other wind developers in your area to learn about their experiences working with various manufacturers. For a list of turbine manufacturers that service the U.S. and guidance on selecting a turbine, visit the Turbine Selection and Purchase section of the Handbook.

Legal Issues

There are many complex legal issues associated with any wind energy project. You may need to secure land control, often through leases and easements; you must make sure that you have all of the necessary permits and are in compliance with local zoning laws; you will need to understand the tax structure of your project in order to take advantage of all the possible incentives; and you will need to negotiate a power purchase agreement with your utility. All of these issues will require a great deal of paperwork and legal knowledge, as well as interaction with multiple regulatory agencies and governmental entities. We have included a number of sample legal agreements throughout the Handbook to give you an idea of what each entails.

Next Steps: Building and Operating a Community Wind Project

Once you have fully developed your project plan and performed all the necessary pre-development steps, as laid out in the preceding section, you can begin the construction phase of your project. The delivery and installation of your turbine(s) will be managed by an experienced construction manager and we will not deal with that stage in this Handbook. Your project does not end after construction, however, as your turbine will need periodic maintenance checks. This Handbook also does not cover the operations and maintenance phase of your project, as this is usually managed by hired experts.

Construction

One of the key members of a wind project development team is the construction manager. When hiring a construction contractor, you should talk with experienced developers in your area to gauge their experiences. Once all of the essential project elements are in place, the construction manager can begin site preparation for delivery and installation of the turbine(s).

Operations and Maintenance

Once the wind project is operational, it must be maintained for its lifespan by a qualified firm. Operating costs also include warranties, administrative fees, insurance, property taxes, land-lease payments, and a contingency fund for unforeseen problems. How well you maintain your turbine will affect your project's lifetime and return on investment. After the useful lifetime of the turbine, decommissioning costs will be incurred for removal of the machines and restoration of the site.

Wind Project Development Checklist

The checklist below is intended to give you an idea of the steps involved in developing wholesale community wind energy projects and to help you organize your development process. It is important to understand that many of the steps in the list below will happen simultaneously or may be dependent upon the completion of other steps and that the path to development is not linear. This checklist is meant to provide a framework, not a hard-and-fast rulebook for the exact steps you must take or a set order for the process. Each community wind project is unique and distinct from others, and your project may require additional steps or it may be less involved.

Development Phase

Project Management & Planning

- ☐ Identify your project goals and areas where you will need to hire an expert
- ☐ Make preliminary contacts with consultants
- ☐ Select your business structure, project manager and CEO
- ☐ Raise seed capital to hire experts and perform feasibility studies
- ☐ Identify risk factors and how to mitigate them
- ☐ Develop your project plan and timeline

Wind Resource Assessment

- ☐ Preliminary wind assessment
    - o Review your site on state/county wind maps
    - o Collect information from nearby monitoring sites
    - o Estimate annual electricity production
    - o Estimate economic feasibility
- ☐ Detailed site characterization
    - o Research feasibility study grants and anemometer loan programs
    - o Set up anemometers and other instruments
    - o Consult with a wind modeling company (optional)
    - o Collect, validate, and analyze data
    - o Develop detailed production estimates and cash flow projections

Siting

- ☐ Site Assessment

- Inspect site: How much open space is available? Are there substantial wind obstacles? What is the topography like? How close are distribution and transmission lines?
    - Gain control of site for installation of anemometer through easement or land purchase
    - Investigate interconnection opportunities
    - Investigate site access
    - Design and initiate wildlife surveys
    - Discuss project with your neighbors
- ☐ Qualify your land's potential for wind energy
    - Create a wind rose
    - Calculate wind shear
    - Review setback and spacing requirements
    - Determine turbine layout

Permitting and Zoning

- ☐ Investigate which Federal, State, and Local permits are required for your project
- ☐ Meet with permitting authorities to process pre-applications
- ☐ Conduct community informational meetings
- ☐ Prepare and submit permit applications
- ☐ Permit review and determination

Land Control

- ☐ Determine existing right-of-way easements
- ☐ Negotiate easements and royalties for landowner(s)
- ☐ Establish control of land and secure easements

Financing

- ☐ Research loan and grant options
- ☐ Identify tax incentives and eligibility requirements
- ☐ Develop cash flow, balance sheet, and income statements
- ☐ Complete applications for loans and grants
- ☐ Conduct equity drive
- ☐ Negotiate and execute agreements with equity investors
- ☐ Negotiate and execute Power Purchase Agreement
- ☐ Negotiate and execute contract to sell renewable energy credits

Business Model

- ☐ Establish legal entity
- ☐ Determine ownership rights, capital contributions, distributions and allocations
- ☐ Execute contracts

Tax Incentives

- ☐ Determine eligibility
- ☐ Prepare applications and documentation

Cost Estimates

- ☐ Define insurance requirements and solicit estimates
- ☐ Execute insurance and other agreements

Interconnection

- ☐ Meet with utility and agree on interconnection studies
- ☐ Perform interconnection studies
- ☐ Complete interconnection application
- ☐ Negotiate and execute transmission agreement (if needed)

Turbine Selection and Purchase

- ☐ Review turbine spec sheets and determine which turbine is best for your project based on capacity rating, size, price, and availability
- ☐ Negotiate and execute turbine purchase agreement and warranty
- ☐ Place turbine order with deposit

Next Steps

Construction Preparation

- ☐ Investigate potential construction companies and solicit estimates
- ☐ Execute construction contract

Construction Phase

Site Preparation

- ☐ Grading and road improvements/construction
- ☐ Trenching, cable-laying, and transformer installation
- ☐ Foundation and crane pad construction
- ☐ Fencing and erosion projects
- ☐ Substation construction/improvements and testing

Turbine Installation

- ☐ Turbine and tower transportation
- ☐ Turbine and tower installation
- ☐ Interconnection

Testing and Commissioning

Site Restoration

Inspections Completion

Operations and Maintenance Phase

- ☐ Establish maintenance contract
- ☐ Perform routine maintenance checks and repairs
- ☐ Decommissioning and site restoration

Additional Resources for Developing Community Wind Energy

- o U.S. Department of Energy, Wind Powering America - state wind resource maps: http://www.eere.energy.gov/windandhydro/windpoweringamerica/wind_maps.asp
- o Database of State Incentives for Renewable Energy (DSIRE): www.dsireusa.org
- o Windustry's Wind Energy Companies webpages: http://www.windustry.org/resources/companies.htm
- o The American Wind Energy Association (AWEA)'s membership directory: www.awea.org/directory
- o New York State Energy Research and Development Authority's (NYSERDA) Wind Energy Toolkit: www.powernaturally.org/Programs/Wind/toolkit
- o Energy Trust of Oregon and Northwest Sustainable Energy for Economic Development guidebook: "Community Wind: An Oregon Guidebook": www.nwseed.org/publications

Community Wind Project Planning & Management

This section focuses on project management and planning, two elements that are essential to a successful 2-50 MW community wind project. Topics covered in this section include putting together a reliable project team and understanding risks and ways to mitigate them. The section also provides resources for creating a realistic project plan and timeline, as well as tips from experienced community wind developers.

Note: This section builds on an excellent previous publication, "Community Wind: An Oregon Guidebook" prepared for the Energy Trust of Oregon by Northwest Sustainable Energy for Economic Development in 2005, available at www.nwseed.org/publications.

Putting Together the Project Team

Community Wind Development Team = Board of Directors + Wind Energy Consultants

The first step in project management and planning is to put together a reliable project team. This team should have entrepreneurial spirit, experienced leadership, and a governance structure, as it will guide the project and provide accountability for decision-making. If this is your first wind project, the people that you and your project manager bring together can make or break your project.

Project Governance

As with any multi-million dollar business venture, launching a community wind development effort requires a sound business operations structure. This includes an experienced Chief Executive Officer supported by team members, all of which are described below. If you have never presided over an enterprise of this scale, you may want to partner with a veteran project executive to help you steer though major decisions and management issues. Once your project is built, you will need to ensure ongoing oversight for maintenance monitoring, operations, and reporting on the various financial aspects of the business.

Chief Executive Officer. Developing a community wind energy project is similar to developing an ethanol plant. It takes a dedicated and diverse team to bring it into production, including a strong Chief Executive Officer and Board of Directors who will keep the project on track. The CEO should have experience in business, preferably in the energy sector, and should have a strong understanding of the wind industry and the associated risks and rewards of community wind development. The CEO is instrumental in developing relationships with potential investors and financing institutions. These are relationships that the project will depend on when capital is needed to move forward with development steps. The CEO should be savvy enough to understand when and how to exercise these relationships to ensure you meet the goals for investment share and return that you set out at the beginning of the project.

Board of Directors. The Board of Directors should be diverse, and comprised of members of the community with experience with energy, rural politics, business management, and legal issues. The Board's job is to guide the project toward desired goals by providing input at various stages of project development and giving advice when important decisions must be made involving business planning, finance, and legal issues. Board members should be selected not only for these qualities but also for their ability to make sound business decisions that are not clouded by emotions or local politics. A strong and diverse board will help the project thwart troubles before they develop into substantial problems by drawing on their past experiences with similar endeavors and making difficult decisions when issues do arise. A strong board can also help attract equity to the project, when needed, because investors will have assurance that their money will be used in a responsible way.

Project Manager. An effective project manger acts as the development team leader. He or she is responsible for making sure that tasks are assigned to the proper team members and completed within the timeframe required to meet project deadlines. The project manager should be experienced in wind energy development and able to properly assess project risks and team member talents. In addition, this person is responsible for making sure team members exchange needed information in a timely manner. A project manager should communicate well, be organized, and be capable of managing all team members to ensure efficient use of resources and time.

The project manager, in many cases, will be the public face of the project, engaging community members and meeting with officials. He or she will be closely involved in the negotiations for turbine purchase, power purchase agreement, and interconnection. An understanding of business metrics, as they pertain to community wind development and local politics, is a must for a well-qualified team leader.

The project manager is often a seasoned wind developer who the project proponent hires. You may wish to hire a project manager who has developed other types of large energy projects, since the skill sets for developing community wind projects and other generation facilities are similar. The key is to hire someone that you trust, because this person will be primarily responsible for making sure that you and your investors realize your desired return on your investment.

Key Consultants

Putting together the right team to execute community wind energy development is very important; you should consult with others who have completed similar projects to learn about their experiences with specific consultants, manufacturers, and construction companies. You need to make sure that your project's team of consultants consists of experienced and reliable individuals with whom you have good rapport. Your project will require expertise in areas that include but are not limited to:

- ✓ Wind resource assessment
- ✓ Environmental impact studies
- ✓ Interconnection design
- ✓ Construction management
- ✓ Foundation design

- ✓ Legal agreements.

How many experts you decide to hire for your project will depend on the Board’s experience and level of comfort – and the time the Board is willing to devote – in each of these areas. If you have little expertise in wind energy, you may want to hire experts for each of these project development aspects. Some community wind developers may feel qualified to undertake certain tasks themselves.

Wind Resource Assessment. Evaluating and documenting the wind resource at your site is one of the most important steps in the design of your project. For a commercial-scale project, you will need to conduct extensive on-site data collection and analysis. The wind data requirements to finance a 50 MW project are often substantially more rigorous than what lenders may require for a 2 MW project. Consulting a meteorologist or wind assessment professional for input on where turbines should be sited is required for some federal grants, and is recommended for sites with complex terrain. A meteorologist or site modeling specialist can confirm the best positions for the equipment and for the project’s expected output.

Environmental Impact Studies. For many community wind projects, an environmental impact assessment is required. Professional scientists can help negotiate study protocols and conduct a scientifically sound field survey. A defensible set of environmental studies is important for obtaining permits and community support. Many grants come with requirements for who needs to perform the study and what it must cover. Consulting with local, state, and federal wildlife and environmental agencies will help you to understand what expertise will be required to complete environmental impact studies.

Interconnection Design. The utility your project interconnects to will design the interconnection system for your wind project, but it may be a good idea to contract with an engineer who is independent of the utility to help design the interconnection system, ensure that the utility’s plans are within reason, and confirm that associated costs are realistic. Construction managers are often able to recommend an engineer with interconnection experience.

Construction Management. The construction manager is a critical team member, responsible for overseeing construction of the project and operating within budget and schedule constraints that may be imposed by power purchase agreements or the expiration of incentives. Ideally, you will be able to hire a local general contractor with previous experience managing wind turbine installations. If not, your turbine manufacturer should be able to recommend one or more high quality construction managers.

Foundation Design. The turbine foundation is a site-specific structure, and it must be properly designed to bear the substantial loads placed on it by the wind turbine. A civil engineer will be consulted to conduct soil tests and recommend a foundation design, or to create a new design as the case warrants. Your turbine manufacturer may be able to provide a list of engineers who have previously designed foundations for their turbines.

Legal Assistance. You will most likely have to hire multiple attorneys with different areas of expertise to see the project through to fruition. Power purchase agreements, turbine procurement, project financing, land control, and various associated contracts are specialized to the independent power industry. Some attorneys also specialize in permitting and environmental compliance. These parts of a community wind development process must meet industry standards. A community wind project is a multi-million dollar investment and it is worthwhile to consult attorneys experienced in corporate and tax law to make sure that your assets are protected should the project not perform as expected.

Risk Management

Wind projects often have a protracted period of at-risk investment. Until all permits, financing, and equipment are obtained, risk remains that the project will not be completed. It is therefore essential to be prepared to face and manage risks. The right project team, including a project manager who is familiar with the associated risks, should be able to incorporate risk mitigation into a successful management plan.

Wind project development risk factors, or sources of risk, fall into three main categories:

1. **Energy Production Factors**
   - Wind resource
   - Equipment
   - Operations and maintenance
   - *Force majeure*
2. **Other Revenue Factors**
   - Value of energy produced
   - Tax benefit allocation
   - On-again/off-again tax subsidies
   - Transmission
3. **Other Project "Make or Break" Factors**
   - Permits
   - Environmental impacts
   - Public acceptance/politics
   - Site control
   - Construction

> **Community Wind Developer Tip:**
>
> ***Get the Numbers Right***
> Good projects sell themselves and economics are the main selling point so it is very important to get your numbers right.
>
> ***Involve the Community***
> Getting public feedback with regards to project siting is absolutely essential in gaining public support for a project, especially in relatively densely populated areas.
>
> Loren Pruskowski, Sustainable Energy Developments, Inc
>
> Ontario, NY

The typical sources of risk within each of these categories are described in the table below, along with key tools to help manage that risk. Though all of these risks can prevent a project from coming to fruition, you may have more control over and can more easily mitigate some than others. Ratings of risk levels shown in the table below illustrate how much of a factor each risk plays in the overall project plan. A one-star rating is typically easy to deal with, if you have planned appropriately. Five stars means that you have no control over this risk or that it should be evaluated early in the development process because it represents a potentially "fatal flaw" – one that can terminate a project.

Note: The following is adapted from similar tables found in "Community Wind: An Oregon Guidebook" prepared by Northwest SEED and "Community Wind Financing" published by the Environmental Law & Policy Center.

RISK FACTOR TABLE		
FACTOR	**Issues**	**Mitigation**
Energy Production Factors		
Wind Resource Level of risk *****	Cash-flow projections based on wind resource assessment are only as accurate as the assessment. Long term cash-flows determined from a year when wind speeds are 10-12% higher than the long-term average of your site will cause your project to fall short of meeting return requirements set by investors.	Higher-quality and longer term resource assessment mitigates the risk of inadequate long-term production. However, more robust resource studies and record extensions require more upfront capital that may not see return. To balance this risk, consider getting expert opinions and using public reference stations for data. When making assumptions for the project's *pro forma*, you should take the wind data's uncertainty into account by using conservative assumptions for long-term production projections.
Equipment Level of risk **	As with any equipment, wind turbines require regular maintenance and occasionally break down. Turbines not properly maintained will break down more frequently with more costly repairs. An offline turbine also means lost production and lost revenue. Typical equipment warrantees are two years, and extended contracts may be purchased for up to five years. After this period, if the turbine faults it is your responsibility to get it running, which can mean costly repairs.	Siting your project close to existing projects with the same manufacturer can provide easier access to maintenance personnel and spare parts. After the manufacturer's maintenance contract expires, you will need to negotiate a contract for future maintenance or find another firm to maintain the turbines for you. Extending the turbine warranty will cost extra in the short run but can provide peace of mind and make financing easier to acquire. Begin setting funds aside in year one to safeguard against equipment failures after the warranty has expired.
Operation and Maintenance Level of risk ****	As described above, the turbines will need to be maintained through their 20-year lifetime to keep producing well and prevent failures.	Mitigate operation risks by hiring an experienced site manager and entering into a solid maintenance contract. Your manufacturer will provide the maintenance schedule and requirements for the turbine warranty to remain valid, and may be willing to train you or a member of your team to perform maintenance on the turbines after the warranty expires. This will involve regularly climbing the towers as well as an understanding of electrical equipment.
***Force Majeure* (Acts of Nature)** Level of risk *	Ice storms in the winter, lightning strikes in the summer, and other extreme weather events can damage wind turbines and other system components, reducing production of the turbines and potentially requiring extensive repairs.	Fully insuring the project mitigates your financial loss due to *force majeure*. This will add to project costs but will provide much needed peace of mind against the loss of your investment. Financing institutions will probably not lend capital to a project without proper insurance.

Other Revenue Factors		
Value of Energy Produced Level of risk **	In order to secure financing of the project, required revenue streams are needed to appease lending and/or other financing institutions as well as investors. The largest component of project cash flow is from the sale of electricity. If the power purchase rate is not high enough, it will be very difficult or impossible to acquire financing.	Consider what type of utility provides service in the area where the project is located, that utility's attitude towards community wind projects, and its need for power. If the prospective power purchaser is obligated by a renewable energy standard or is actively looking for wind energy for its generation portfolio, this will affect Power Purchase Agreement (PPA) negotiations. Also, consider Renewable Energy Credits as an additional commodity worth negotiating. **Wheeling** might also be an option to increase overall revenue, but will add cost and complexity.
Tax Benefit Allocation Level of risk **	When developing a project, the projected cash flow is only as accurate as the assumptions made. Tax treatment of wind energy projects can be complicated, especially when taking advantage of tax-based incentives such as the PTC, accelerated deprecation, or state tax-based incentives. Falsely representing your project to the IRS, even if you are unaware you are doing it, could send your project into financial ruin and cause penalties or even criminal prosecution.	Consult with a tax professional to make sure that the proposed tax benefit allocations are acceptable. IRS Private Letter rulings may be necessary to address specific technical tax issues. A professional may also suggest more efficient ways of structuring your project to decrease your project's tax burden, as well as how to better take advantage of tax-based incentives.
On-again / Off-again Tax Subsidies Level of risk ****	The uncertainty of incentives such as the federal PTC can wreak havoc on projects dependent on the revenue from these incentives, creating development deadlines and market uncertainty with large fluctuations in turbine availability, price, and other project variables.	Be aware of any assumptions made in the financial plan, and have contingency financing plans whenever possible.
Transmission Level of risk ****	Without transmission, your project does not have a route to get the energy it produces to consumers. If the electric grid faces transmission constraints, you may have to downsize or relocate your project to avoid expensive upgrades that can severely impact the cost structure of the project and its viability.	This risk can be mitigated with careful siting within the utility system, relocation, or resizing of the project. Be flexible with these variables so that when interconnection study results come back, your project plan is not so rigid as to kill your project.

Other Project "Make or Break" Factors		
Permits Level of risk *****	Commercial-scale wind electricity generating facilities need many different permits before construction can commence, including: building permits, Federal Aviation Administration permits, and permits for access roads. State agencies may also require that you provide proof that your project will not interfere with communications, television reception, or other forms of electromagnetic communication that require studies.	Contact the appropriate agencies early in the planning process so you understand what is involved in obtaining the required permits. Doing so will allow you to plan other aspects of the development process around these requirements and timelines. FAA permits are "fatal flaw" tests for a project. The application fee for an FAA permit is inexpensive, so apply for it early to determine if your project can stay where it is being planned, or if it needs to be moved because of its proximity to an airport or military radar installation.
Environmental Impacts Level of risk ****	In deciding whether to issue a permit, local planning departments may require a number of environmental studies on sound, wildlife presence, rare plants, land-use impacts, and aesthetics.	Researching existing information will help determine whether the project might raise critical environmental concerns. Early involvement of environmental and wildlife experts (such as the state Department of Natural Resources) and potential critics (such as local wildlife organizations), as well as thorough responses to concerns, careful project layout, and a detailed construction plan can mitigate these risks and make the permitting process go much more smoothly.
Public Acceptance / Politics Level of risk ****	Objections from the public can range widely and are hard to predict. Some neighbors may be concerned about noise from the turbines, while others may not want to have turbines visible on the landscape or see them as encroachment of civilization in a rural area.	It is important to understand local concerns and plan appropriately. Siting the project to minimize sound, visual, and wildlife impacts decreases the likelihood of public opposition. Plan to consult with community members and other stakeholders early in the project development. At the least, you will learn what opposition you may face early, and at best, the open communication will alleviate public resistance to the project.
Site Control Level of risk **	You will need to obtain control of the proposed project site to obtain permits, financing, and some grants and incentives for the project. Securing control of the site requires an investment of time and more importantly, money. In "locking up" land too soon, there is risk of investing in a site that turns out to be unsuitable. Waiting too long increases the risk of investing in the site only to lose building rights.	To protect project development investments, it is prudent to execute a pre-development option agreement upon completion of the fatal flaws review. Work with property owners, a title company, and county planning office staff to ensure that no surprises related to land ownership or use restrictions arise later in the development process.
Construction Level of risk **	Time frames for project completion can be tight due to PPA stipulations, requirements from granting or lending institutions, as well as incentives that your project may depend on for a good return. Construction delays also mean lost revenue from no production.	To mitigate the risks associated with construction delays, develop a contract that includes completion dates and penalties if the construction firm, turbine delivery/supplier company, and/or material suppliers do not meet these deadlines.

Feasibility Study

To determine whether significant resources should be spent to move a project forward, it is wise to hire an outside firm to perform a feasibility study. This study will help you to better understand the market that the project is entering into, aid in developing a comprehensive business plan, and consider many of the "fatal flaw" tests up front. There are many consulting firms with experience in wind energy project development that can help to draft a portion or all of the feasibility study.

Items typically included in a feasibility study are[2]:

- Description of the Project
- General Setting and Need for the Project
- Market Potential (both Current and in the Future)
- Supply of Raw Materials and Equipment Procurement Plan
- Supply of Labor and other Key Inputs
- Technical Characteristics and Specifications
- Development Schedule and Production Plan
- Capitol Requirements and Investment Schedule
- Sales Plan and Revenue Schedule
- Projected Operating Costs and Net Revenue
- Schedule of New Benefits – Partial Budget
- Economic Feasibility of Project
- Financial Plan for Project
- Appendices and Notes
- Management Requirements for the Project

A project that fails a "fatal flaw" test most likely should be abandoned. Sticking with a fatally flawed project will cost a great deal of time, money and legal headaches, so it is important to know when to terminate the project development.

Tips for Managing Community Wind Development

Project Plan and Timeline

Planning a community wind project requires juggling many processes at once and dealing with a lot of different people, agencies, and businesses. It is important to be organized during the development of your project so that critical steps are not missed. One way to make sure that you stay on top of all the necessary steps and required paperwork is to develop a detailed project plan and timeline before advancing too far along in development.

Your project plan should identify the project's team members, define the tasks that need to be completed, assign tasks to team members, determine task dependencies, and lay out the project's timeline. A good way to organize

> **Community Wind Developer Tip:**
>
> Persistence! Before completion of our project we contacted many power companies, and made progress with only three. After lengthy discussions with one company we could not come to agreement on a term sheet. A second company signed PPA expired because the tax credits were not extended in a timely manner. After renegotiating a PPA with a third company, we were finally successful.
>
> Ryan Wolf
> LeSueur, MN

[2] James Matson and Joe Folsom, USDA

your project plan is to break it up into the typical phases of project development. The chart below shows an example project timeline that can serve as a good guide for your project plan.

Note: The following is adapted from similar chart developed by Northwest SEED for "Community Wind: An Oregon Guidebook."

Conducting a successful equity drive

One of the key pieces to moving the project forward is to attract equity for constructing the project. The more equity you are able to raise, the less money the project will have to borrow or seek from an outside equity firm. David Kolsrud, a farmer who has successfully developed both farmer-owned wind and ethanol facilities, suggests these 13 steps for a successful equity drive:

1. Select an equity fund manager (if necessary)
2. Prepare an offering circular
3. Write a budget
4. Identify potential investors
5. Identify size and scope of area to hold meetings
6. Organize and set equity meeting schedule
7. Develop your presentation
8. Visit and educate area lenders on the project
9. Advertise, advertise, advertise
10. Set up a schedule for which board members will attend and conduct the meetings
11. Set up escrow account and agent
12. Conduct meetings
13. Conclude drive and continue communication with new membership

The key is persistence and having clear objectives when conducting an equity drive. Depending on the number of investors you are seeking, the number of shares you are offering and at what price, you may have to set up many meetings with potential investors. When raising funds for past projects, Mr. Kolsrud has set up three meetings a day, five days week, for several months at a time. Before setting up these meetings you should establish clearly defined goals and have performed economic feasibility analysis to justify to yourself and would-be investors that the wind project, if built, will succeed.

Community Wind Developer Tip:

Realism
Be realistic about the outcomes of your project. Being overly optimistic in assumptions about your project financials can jeopardize the entire venture.

Make Friends
Networking is key to success. Learn from others who have traveled the path before you. This can add valuable insight to your project. Aiding other developers today by lending expertise or contributing capital can reap rewards tomorrow when you in turn need assistance in developing your own project.

Reason not Emotions
Do not let emotions cloud your decision-making ability. Decisions about project governance, who will host turbines and investors should be made on a purely economic basis. For instance, wind towers should be placed on the land with the best wind resource and ease of access to transmission, regardless of who owns it.

David Kolsrud, DAK Renewable Energy
Brandon, SD

Seek Legal Advice Before Advertising Your Project

You must be aware of legal constraints and Securities and Exchange Commission (SEC) rules and regulations so that you remain within the law. SEC rules and regulations will dictate when, where, and how you can advertise or talk about investment opportunities in your project.

It is advisable to hire skilled legal expertise for guidance.

It is also very important to make it clear to investors, especially early investors, that there is the potential that the project might not be constructed. They should be aware of the risk involved due to the volatile nature of the wind industry and electricity markets. Addressing these risks in your business plan and offering a prospectus is a must. Researching the wind industry and market for wind energy and being realistic to investors up front will help you to manage risk much better as the project moves forward. It will also convey to your investors that you fully understand earnings potential AND loss potential and that you are developing strategies for dealing with each of them. Open and honest communication from the outset is key to developing a successful project.

Some of the steps in performing an equity drive require legal assistance, such as when you are preparing the offering, setting up the LLC, and organizing financial arrangements. You need to be clear from the outset as to what the funds will be used for as well as to whom you are marketing your wind business. Visit Windustry's case study on the ***Minwind*** projects for an example of how projects can be structured for smaller investors.

Conclusion

Developing a farmer-owned community wind project has many analogies to constructing an ethanol cooperative. Farmers own corn and other feed stocks that can be utilized to create bio-fuels. Communities that possess a robust wind resource have the opportunity to develop wind projects themselves or market their natural resource and be a partner in its development. Participating in an ethanol cooperative provides larger rewards than simply selling corn to a company that will in turn process the corn into ethanol and sell it at a much higher margin than the farmer is receiving for producing the raw commodity. Owning the wind turbines and directly benefiting from the sale of electricity and incentives yields a much higher return than just simply leasing land to a developer for periodic payments.

Community wind projects can be complex and may involve many different experts and stakeholders. You may have the initiative and vision to recognize an opportunity, but may not have all the skills needed to transform that vision into a reality. A reliable and experienced project team and a well defined project plan will be instrumental to the success of your wind project.

Additional Resources for Project Planning and Management

- "Taking Ownership of Grain Belt Agriculture," published by the National Corn Growers Association: http://www.mncorn.org/servlet/mcga/resource/taking_ownership.iml?area_id=14&thispage=resource/taking_ownership.iml
- "Community Wind: An Oregon Guidebook" prepared for the Energy Trust of Oregon by Northwest Sustainable Energy for Economic Development: http://www.energytrust.org/RR/wind/community/guidebook/2.pdf

Wind Resource Assessment

Wind resource assessment is the most important step in planning a community wind project because it is the basis for determining initial feasibility and cash flow projections, and is ultimately vital for acquiring financing. Your project will progress through several stages of assessment:

1. **Initial assessment** – utilizing existing data from state wind resource maps, nearby publicly available wind resource data, and other weather measurement sites to make rough projections about the financials of your project. This step should be used as an indicator to justify a more substantial investment ($10,000-$50,000) to install equipment and hire professionals for a detailed site characterization.
2. **Detailed site characterization** – erecting meteorological tower(s) at the site to perform a full year or more of wind data collection and analysis specific to the site. Depending upon the requirements of your banker, detailed computer modeling may be a helpful supplement to on-site data.
3. **Long-term validation of data** – comparing data at the site to long term weather data over the course of ten years or more. This will help determine whether the data represents a low, medium, or high wind year and allow adjustments to your long-term production estimates.
4. **Detailed cash flow projection and acquiring financing** – using your detailed site profile to combine validated production and revenue estimates from the sale of electricity produced with initial financing sources and any incentives available to your project. This projection is to help you show your lenders and investors that the project will be able to cover debt and generate required returns. It is important to note that you will refine these revenue estimates as the project progresses, and your lender should understand this. The lender wants to see that you are performing due diligence, you understand the type of business you are participating in, and that you are realistic about the project outcomes.

You may be able to conduct the initial assessment yourself with a little research and help from someone with technical background and knowledge about wind energy production projections. You will need to hire an experienced professional for stages 2-4 and make sure that the methods for data collection and validation are accurate and acceptable to your lender. It is also very important to discuss with your lender and potential investors what they require in terms of wind resource due diligence at the beginning, middle, and end of the process so that you do not waste time and money moving down the wrong path.

Wind Resource Assessment – The Basics

The Initial Assessment

Initial assessment of the site is fairly simple in most states with publicly available high resolution wind resource data. Recent advances in computer modeling and the internet have made public wind data sources easily accessible.

Wind Maps

The first place to look for wind resource information is to seek out underlying data projections that may have been used to create state wind resource maps. The Department of Energy's Wind Powering America website has a comprehensive collection of these maps: http://www.eere.energy.gov/windandhydro/windpoweringamerica/wind_maps.asp. However, you will want to import the image into a GIS tool such as Google Earth in order to zoom in and accurately identify your specific parcel. The maps include a "Wind Power Class" to help define the potential of a particular wind resource. Generally speaking, a site that appears to have class 4 wind speeds (7-7.5 m/s at 50 m OR 15.7-16.8 mph), is considered promising for commercial scale wind. Class 3 is marginal, and class 5 is excellent. These maps can be used to make rough production estimates at sites. It should be noted that wind resource estimates presented in wind maps have a relatively large uncertainty. As a rule of thumb, the wind speed estimate should be considered to be +/- 10 to 15% and any energy estimate generated using the wind maps should be considered to be +/- 20%.

Existing Data

Other resources for public data include state energy offices and the University of North Dakota Energy and Environmental Research Center (http://www.undeerc.org/wind/). You may even be able to find existing wind data collected close to your site. Public data can be found for airports and other public facilities, but these data are often compromised by being sited in sheltered areas and collected on short (10 meter) towers.

With a typical wind turbine power curve (the instantaneous power output of a specific turbine design at various wind speeds) and some experience with computer programming or an Excel spreadsheet, you can take a wind resource dataset collected on a met tower and scale it up to your expected turbine hub height using an assumed wind shear coefficient to calculate rough estimates for production. When creating an initial estimate of production, it is also important to consider the average air density for the site and make sure that the power curve you are using is adjusted for the site density. You can find several wind turbine power curves as well as a calculation tool to help generate production estimates utilizing large amounts of raw wind data at Idaho National Laboratory's website: http://www.inl.gov/wind/software/.

Once you couple these rough production estimates with some assumptions about how the project will be structured as a business, interest rates on loans, various incentives available to the project, and the installed costs, you can then begin to see what kind of power purchase agreement is needed to make the economics of the project work out. You can use this cash flow model to begin testing the sensitivity of your project to various factors such as reduced production numbers, unexpected expenses (e.g. equipment failure after the warranty has expired, etc.), or higher than expected interconnection costs.

Keep this initial cash flow model and continually refine your assumptions as you move through detailed wind resource assessment and other steps of the development process so that you can begin to make apples to apples comparisons on how different decisions will affect project economics.

If the numbers are not looking good at this point, the project site should be reconsidered or the project must be structured differently. This phase is very important because it will either justify spending substantial up-front funds to develop the site or show you that your money would be better spent on another site or investment.

Detailed Site Characterization

Once you have determined from preliminary evaluations that you have a promising site to install wind turbines and you plan to continue with the project development, you will need to hire an expert to perform a detailed wind resource site assessment with wind measurement equipment at your site for at least one year. This is necessary to assure you and your banker that the project is feasible. The level of detail of your study, however, will depend on the size of your intended project. The larger the project or investment under consideration, the larger and more expensive resource assessment effort is warranted.

The instrumentation used for wind resource assessment includes three major components: (1) anemometers and wind vanes, which are sensors to measure the wind speed and direction, (2) a data logger, and (3) a meteorological mast, or tower. Measurement of temperature and pressure, which requires additional sensors, is also standard. Meteorological towers typically are at least 50 m (164 ft) lattice or monopole towers supported by guy wires.

Computer Modeling of Wind Resource

Site-specific measurements using anemometers are considered by some to be the most reliable estimates of the wind resources for a project. However, they can be quite costly and require from one to several years to complete. Other methods also exist where large scale computer weather models are created to extrapolate wind conditions at a specific site from historical data. Many times these computer models of a site's wind resource can be less expensive than taking meteorological readings for a year or more. As scientists and lending institutions are beginning to understand weather modeling and the wind industry better this method of resource assessment is becoming more acceptable by lenders, but sometimes they may require a combination of site specific meteorological measurements coupled with computer models from long-term weather data for validation of conditions at the site.

Computer modeling and direct measurement have their positives and negatives and can be a substantial cost to the project. As a result, determining the scale of your measurement study hinges on an evaluation of the costs and benefits of such an effort as well as what your lender and investors are comfortable with. The measurement program that you undertake should carry a cost that is consistent with both the scale of your proposed project investment and with the uncertainty of the resource in your area. The next section gives an overview of what degree of resource assessment is needed for both on-site commercial and large-scale community wind projects.

You will need to ask your banker what specific wind resource information your bank requires in order to confidently finance your project, as each bank may have slightly different requirements. Many lenders follow the general guidelines described below based on the proposed project size and the estimated wind class.

1-10 Megawatt Commercial-Scale Projects

If you are contemplating a multi-million dollar wind project in an area where no wind measurements have been taken, it is wise to take two or more years of measurements with a multilevel meteorological tower to characterize your wind resource. If the terrain surrounding your site is rugged or you are installing several turbines, it may be appropriate to install several anemometers at the expected wind turbine hub height to ensure that you have a reliable estimate of the variation of wind speed across your site. Many lenders for large wind turbine projects even hire independent meteorologists to perform due diligence and validate the developer's estimates of the available wind resources.

For a community project with a cluster of commercial-scale turbines, you will usually need to collect at least a full year's worth of wind data. You should have anemometers at three different heights on the tower, with two anemometers at each height to document a good cross section of the wind at your site as well as provide some redundancy in case one of your instruments stops working. The height of your anemometers depends on how tall your turbine(s) will be. You generally want to be sure to get one set of measurements at hub height. This can be difficult, however, as many anemometer towers are not tall enough to reach the hub height of modern commercial-scale turbines. In the past, measurements at 10 m, 30 m, and 50 m were common, but measuring at 40 m, 70 m, and 100 m, if possible, would give you more confidence in your resource. The best approach is to collect one set of measurements at hub height, one at the lowest point the tip of the blade reaches, and another at the highest point that the tip reaches. You should use heated anemometers to prevent lost data during icing events and verify the accuracy of the data collected, although these should be used together with calibrated, unheated anemometers as the accuracy of heated anemometers is not sufficient to allow an accurate assessment of the wind resource. If you are not sure where on your land you should site your turbine(s), you should place one measurement tower at the highest point on your land to get an idea of your best resource, and another elsewhere in order to extrapolate information across your site. Wind resource assessment companies and consultants can help you to determine the best placement of meteorological towers on the property.

10-50 Megawatt Commercial-Scale Projects

Multiple towers with heated anemometers and non-heated, calibrated anemometers are recommended for commercial-scale wind developments, especially in marginal Class 4 areas or sites with complex terrain. For sites with strong Class 5 resources that are well characterized, multiple towers may not be needed and modeling can be used to optimize the turbine layout.

It is important that you know how to interpret the information your wind resource assessment consultant will provide you with in terms of your project's economics as well as what your banker will require. See the Bankable Wind Resource section of this Handbook for detailed information about typical wind resource data results.

Long-Term Validation of Data

Once you have collected both short-term and long-term data from the site and from other sources, you can make some comparisons between historical data and that collected at your site. If there is an airport or a weather station within several miles of your site with similar topography to your site, with the help of your meteorological consultant you can determine if the on-site data was collected during a year that was windier or less windy than the historical average. This will help to ensure that your production estimates are descriptive of the site and not inflated due to an abnormally windy year. It is important that you consult with your investors as well as your lending institution throughout the process to make sure that your methods are acceptable to them.

Detailed Production Estimates and Cash-flow Projections

Once you have a solid estimation of the wind at your site and can show that the project is financially viable, you can take it to the bank. You can use the projected cost of your project, the cost of financing that your institution is willing to offer you, as well as the required returns from investors and other assumptions to determine the price of energy you need to negotiate to ensure a positive project cash flow.

A Bankable Wind Resource

Wind turbines are similar to crops in that they have good production years and bad production years. Your banker will want a realistic assessment of the energy production and revenues of your project during a poor wind year in order to be sure that you will be able to cover any loan payment that you have. A wind resource is "bankable" if a project's estimated production and financial performance are acceptable to a bank that is lending money to the project. Since most community wind projects require some type of borrowing to pay for the initial investment required to install a turbine, the "bankability" of a project is a key factor in getting it built.

What is a bankable wind resource?

- The wind energy blowing across the potential project site provides enough power to generate revenue; and
- The project developer has collected enough solid data to demonstrate this to the banking institution involved in the project.

This section of the Handbook gives an overview of the information your banker will need from you to evaluate your project. You can use this as a starting point to talk with your banker about the necessary information to confirm that your project is economically feasible.

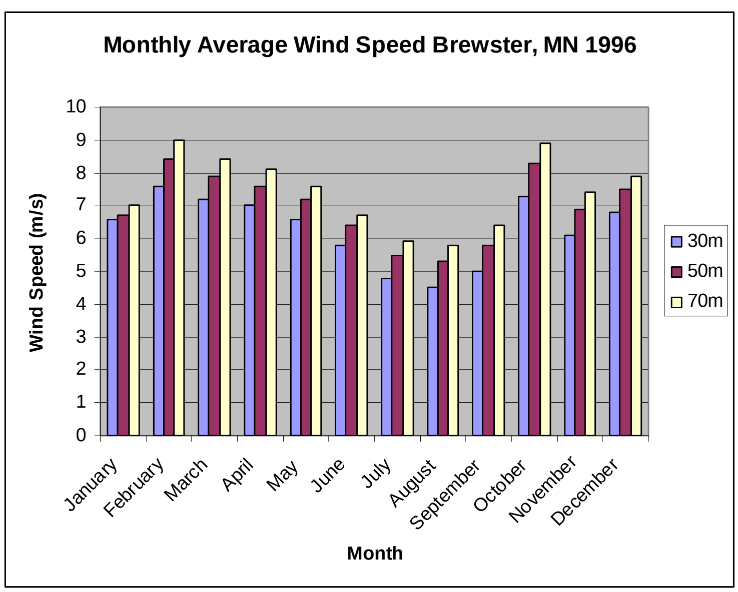
As bankers consider giving you a loan, they will be evaluating the risks of the project and the interest rate they will charge to mitigate that risk. Several conditions must be met before most banks will issue a loan to a wind project. Different bankers are likely to have different perspectives on what makes a wind project bankable; however, all resource evaluations need to rest on an assessment of the year-to-year variations in wind availability over the long term.

The entire financial performance of a project is built upon projections of how much the turbines will generate, which depends on the quality of your wind resource. Wind resources vary from year to year and these variations will affect the cash flow of the project. Quantifying this annual variation will give your banker and investors valuable information about how much risk is associated with low production years and how your business plan will to deal with these fluctuations in cash flow.

Your wind resource assessment process will provide you with wind data at certain heights and times of the year. You will need to analyze that data and calculate figures described below to build a case for acquiring financing for your project. The following list is designed to allow you to become familiar with typical requirements and may not be comprehensive. You will need to discuss with your lending institution what they specifically will require from your project before providing you with financing.

Monthly averages of wind speed

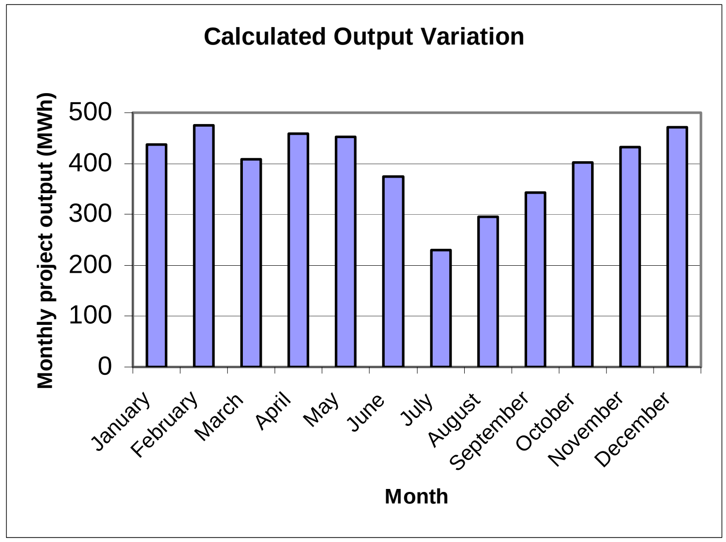
Average monthly wind speed information will inform the banker how the wind resource at your site varies over the course of the year and how seasonal variations will affect the project cash flow. As shown in the example below, the monthly average wind speeds at measured heights should be reported as well as extrapolations to the expected turbine hub height utilizing site-specific wind shear estimates.



An acceptable wind resource for a project is very site specific. It depends on many factors that relate to the total installed cost of the project, the incentives available to the project, the rate at which the energy might be sold, and the investors' required rate of return. Many projects in the Midwest begin to look economically attractive when the average annual wind resource at the site approaches 6.5 m/s or a little over 14 mph.

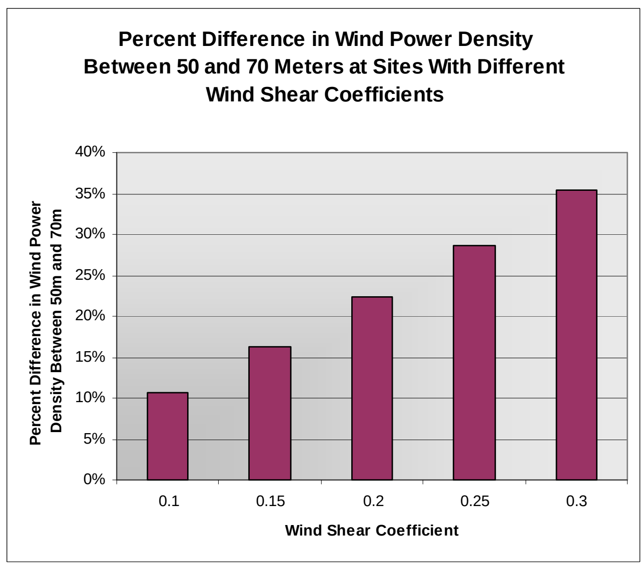
Projected monthly production

Your banker will likely be more interested in your monthly power production estimates (which take into consideration your wind resource frequency distribution), as the amount of electricity produced is directly proportional to the revenue of the project. Power production projections, as shown in the example, demonstrate to the bank whether or not the project will perform well enough to cover the debt service on a loan from the bank.



Wind shear and the optimal height for your turbine

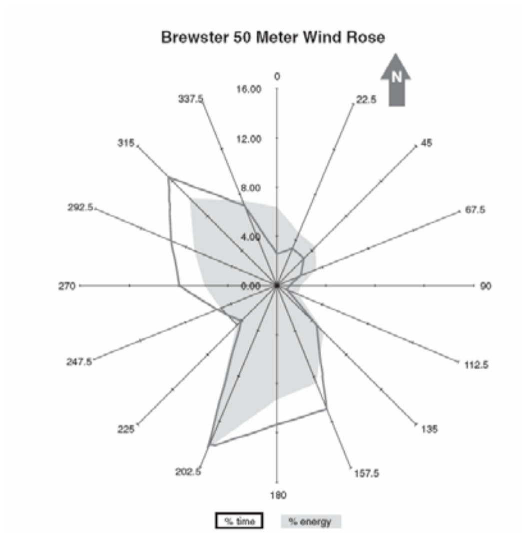
Wind shear is a calculation used to describe the differences in wind speed at two different heights. In general, turbulence decreases and wind speed increases at higher points above the earth's surface. Wind shear calculations come in handy when you use anemometer wind data from a 30 or 50 meter tower to extrapolate your proposed turbine's hub height. In addition, wind shear data can help you determine the optimal height of your turbine. For instance, average wind shear coefficients below 0.1 indicate little difference in wind speeds between 60 meters and 80 meters, and taller towers may not generate enough additional power to justify the added cost of the taller towers.



Wind shear at a site can vary substantially from year to year and from month to month. If these variations in wind shear are not properly taken into account, the production estimates for a project could be substantially inaccurate. You banker will want to know that wind shear has been calculated correctly and "worst case" forecasts are incorporated into estimated production numbers.

Wind rose of your site

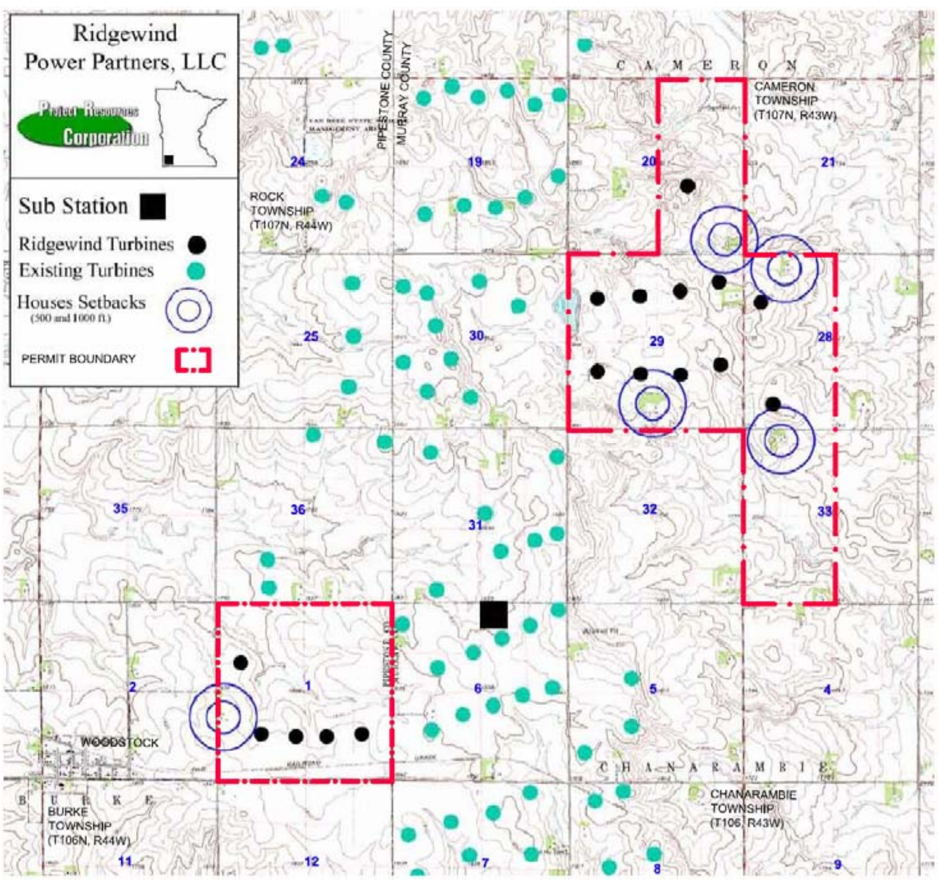
A wind rose shows the direction that the wind blows and the frequency of that direction at a particular location. Wind roses are used in wind projects to portray the amount of energy that comes into the wind project from various directions. The wind rose helps developers site the turbines in such a way as to minimize **wake losses** from other turbines at the site. The banker will want to make sure that the layout of the project optimizes output, and using the wind rose while explaining the layout of the project will help to build your case.



Average wind direction by month, coupled with detailed site maps, can help show where the wind is coming from and how much production might be reduced from obstructions in the area as well as future development.

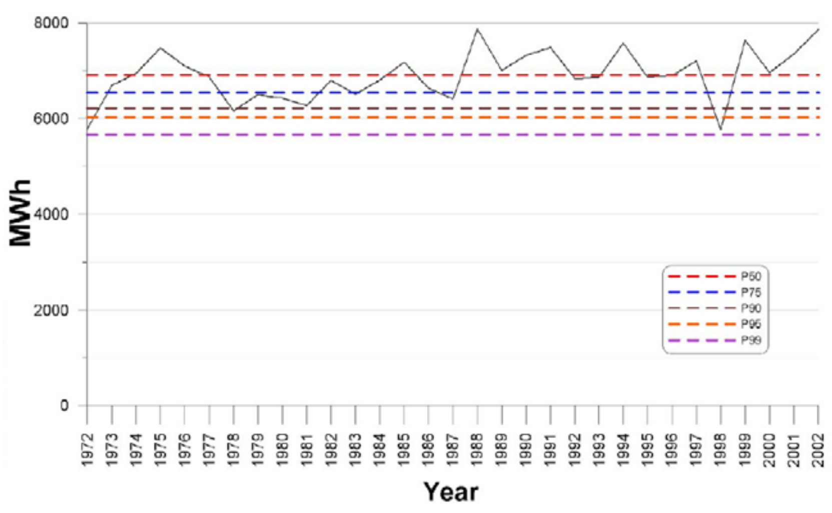
Site documentation

Detailed maps such as shown below along with aerial photos, and plat drawings of your site showing project boundaries and turbine locations are important to show the physical layout of the project in relation to topography, buildings, other wind projects in the area and the wind rose. Together with proof of site control, this documentation will help demonstrate that your project is sited properly for maximum production and show that you have the required permissions to construct the project on the land.



Annual energy production for good years and bad years

Your banker will want to know how bad years of production compare to the average and what kind of fluctuations in cash flow the project can expect to better assess the risk associated with lending to the project. You will also want this information so that you can structure the investor payments so the project can stay in the black in low production years.



Projected cash-flow model

Your lending institution will want to know all of the assumptions that you have made, including your project ownership structure and likely terms of your power purchase agreement, and review your projected cash flow, both to make sure that your assumptions are reasonable and that the project will be able to meet the required **debt service coverage ratio.** The Finance section of the Handbook has a sample proforma that will give you an idea of the data your banker will need.

Wind Resource Assessment Companies

Wind Resource Assessment Providers & Equipment Suppliers

Anemometry Specialists
Equipment Supply and Installation
102 Main Street
Alta, IA 51002
(712)200-2281
www.anemometry.com

AWS Truewind
255 Fuller Road Suite 274
Albany, NY 12203
(518) 437-8660
www.awstruewind.com

Davis - Vantage Pro Weather Station
Equipment Supply (small systems)
Davis Instruments Corp.
3465 Diablo Ave.
Hayward, CA 94545
(510) 732-9229
www.davisnet.com

EAPC Architects Engineers
3100 Demers Avenue
Grand Forks, ND 58201
(701) 775-5507
http://www.eapc.net/

Energy and Environmental Research Center
University of North Dakota
15 N 23rd St., Stop 9018
Grand Forks, ND 58202
(701) 777-5000
http://www.undeerc.org/

Garrad Hassan & Partners Ltd.
Wind Resource Consultant
Garrad Hassan America, Inc
11770 Bernardo Plaza Court, Suite 209
San Diego, CA 92128
(858) 451-7013
www.garradhassan.com

Global Energy Concepts
Wind Resource Consultant
1809 7th Ave, Suite 900
Seattle, WA 98101
(206) 387-4200
www.globalenergyconcepts.com

Inspeed - Pole Mount Anemometer
Equipment Supply
10 Hudson Road
Sudbury, MA 01776
(978) 397-6813
www.Inspeed.com

KB Energy
HC 64, Box 412
Arlington, WY 82083
(307) 378-3480
http://kbenergy.com/index.html

Met One Instruments, Inc
Equipment Supply
1600 Washington Blvd
Grants Pass, OR 97526
(541) 473-7111
www.metone.com

NRG Systems Inc
Equipment Supply
P.O. Box 0509
Hinesburg, VT 05461
(802) 482-2255
www.nrgsystems.com

Onset - HOBO Micro Station Data Logger
Equipment Supply (small systems)
470 MacArthur Blvd.
Bourne, MA 02532
(800) LOGGERS, (508) 759-9500
www.onsetcomp.com

Phoenix Engineering
Wind Resource Consultant
22302 Morning Lake Drive
Katy, TX 77450
(866) 558-9465
www.phoenixengg.com

SecondWind, Inc.
Equipment Supply
366 Summer St.
Somerville, MA 02144
(617) 776-8520
www.secondwind.com

Computer Modeling Specialists

3TIER Environmental Forecast Group
Wind Resource Consultant
2001 6th Avenue Suite 2100
Seattle, WA 98121
(206) 325-1573
www.3tiergroup.com

AWS Truewind
255 Fuller Road Suite 274
Albany, NY 12203
(518) 437-8660
www.awstruewind.com

WindLogics Inc
1217 Bandana Blvd N
St. Paul, MN 55108
(651) 556-4200
www.windlogics.com

Anemometer Loan Programs

U.S. Department of Energy, Wind Powering America Program
www.eere.energy.gov/windandhydro/windpoweringamerica/state_activities.asp
Click on the map to see if an anemometer loan program exists in your state.

Western Area Power Administration (WAPA)
http://www.wapa.gov/es/loan/default.htm
Contact: Equipment Loan Program Manager
Phone: 720-962-7420

Additional Resources on Wind Resource Assessment

- **State Wind Energy Resource Maps**, Wind Powering America website: http://www.eere.energy.gov/windandhydro/windpoweringamerica/wind_maps.asp.
- **"Wind Resource Assessment Handbook: Fundamentals for Conducting a Successful Monitoring Program."** Prepared by AWS Scientific, Inc. for the National Renewable Energy Laboratory: http://www.nrel.gov/docs/legosti/fy97/22223.pdf.
- **"Wind Energy Atlas of the United States,"** U.S. Department of Energy: http://rredc.nrel.gov/wind/pubs/atlas/
- **Iowa State Energy Office Wind Energy Manual:** http://www.energy.iastate.edu/renewable/wind/wem/wem-08_power.html
- **The Plains Organization for Wind Energy Resource (POWER)** has a map of the active and inactive monitoring towers in the Midwest as well as a database of wind resource measurements that have already been taken around the Midwest. This data maybe helpful to refine estimate of the wind potential at your site. http://www.undeerc.org/wind/
- "**Bankable Wind Resources**," Presentation by Mark Ahlstrom of WindLogics Inc.
- "Wind Prospecting," Presentation developed by Wes Slaymaker for Wisconsin Focus on Energy seminar
- Assessing Wind Resources: A Guide for Landowners, Project Developers, and Power Suppliers - from the Union of Concerned Scientists, adapted from original Windustry Harvest the Wind Handbook. Union of Concerned Scientists
- University of North Dakota Energy and Environmental Research Center: A database of publicly available wind resource data: http://www.undeerc.org/wind/
- Idaho National Laboratory's wind energy calculator website: Comprehensive set of wind turbine power curves as well as a tool to help analyze large batches of wind resource data: http://www.inl.gov/wind/software/

Siting Guidelines

As with any large energy facility, community wind projects raise a wide variety of siting issues. Placing turbines to take advantage of the best wind resources must be balanced with minimizing their impact on existing land uses, neighbors, and the environment. The first part of this section of the Community Wind Energy Handbook discusses the various issues (apart from wind resource) that should be taken into consideration in siting a community wind project, including:

- ✓ Land use
- ✓ Aesthetics
- ✓ Property values
- ✓ Sound
- ✓ Public safety
- ✓ Liability prevention
- ✓ Environmental impacts
- ✓ Construction impacts

Many of these issues are addressed as part of the permitting process, but permit requirements vary widely from one jurisdiction to another. (See the following section of the Handbook for more on ***Permitting and Zoning***.) Prudent and responsible wind developers start by familiarizing themselves with how wind energy projects are viewed and regulated in a given location, and are prepared to address any of the siting issues that are likely to arise.

The second part of this section touches on other aspects of site layout, design and planning that warrant consideration. Here are the main topics covered in this section:

Siting Issues

Land Use

Although wind turbines themselves have a relatively small footprint (roughly one quarter acre for a large turbine), they require large open spaces, both because the turbines must maintain access to the wind resource, and because even a project consisting of a single commercial-scale turbine can impact surrounding areas through such things aesthetics, sound and safety.

The need to maintain wind access means that turbines must be sited away from tall buildings, other wind turbines, and trees, as well as any topographic obstacles. Wind projects are best sited in areas where the winds are not turbulent (in other words, the winds are clean and undisturbed). Even if a site has high average wind speeds, turbulent wind is not good for creating lift on wind turbine blades which is responsible for causing the machine to spin, and creates much stress on the machine. For further information about wind resource and siting a wind project visit the section of the Handbook on ***Wind Resource Assessment***.

In considering the impact of the wind system on the surrounding area, developers must consider not only the footprint of the turbines themselves, but also the size and placement of construction areas, guy wires for meteorological towers, power line corridors, access roads, and electrical equipment foundations. Developers should also talk to local citizens to find out what their concerns are. For example, one community considering a wind development was concerned about guy wires on or near snow mobile trails. In this case, the developer placed the met towers carefully to avoid conflicts with the trails.

In natural areas, this could mean working with the State Department of Natural Resources or U.S. Fish and Wildlife Service to minimize impacts on wildlife and habitat. On farmland, this means placing wind energy facilities with the farmer's needs in mind. For example, roads should be placed along fence lines or other natural barriers whenever possible to avoid carving up fields. The developers should include the landowners in the siting process to make sure turbines and roads will minimally interfere with farm operations or other activities on the land and to protect the wind resource available to the project. Acquiring a wind easement for a buffer zone around your project also has the affect of protecting your wind resource from other wind projects that may be constructed in your area. For more information about wind energy easements visit the ***Leases and Easements*** section of the Community Wind Handbook.

Where setbacks are required by local zoning laws, the site must be large enough to accommodate setbacks from a neighbor's property or buildings. (See "Addressing Siting Issues," below, as well as the section on ***Permitting and Zoning*** for more about setbacks.) Even where setbacks are not required, it is a good idea to place your turbine well away from property lines, in case your neighbors later build obstructions that affect the flow of wind or wish to place turbines on their own land.

Aesthetics

People have varied reactions to seeing wind turbines on the landscape. Where some people see graceful symbols of economic development and environmental progress or sleek icons of modern technology, others might see industrial encroachment on natural or rural landscapes. Many factors influence these perceptions, but it has been found that observers are more likely to forgive any visual intrusion if the wind turbines are seen as serving a beneficial purpose. Turbines that are stationary too often can give the impression that the technology is unreliable. If a turbine stops working for any reason, it should be fixed as soon as possible both

for economic reasons and to convey a good image to the public. In addition, a visual simulation to show what the project will look like after it is constructed can help if there is a significant concern about a site or particular view. Developers should take care to locate substations and other electrical infrastructure in a less visible areas if possible.

Signage. Billboards, like any other extraneous structure, add visual clutter to the landscape. Developers should avoid using wind turbines as a means for elevating advertising billboards. It may be helpful to install an appropriately-scaled sign or visitor kiosk at or near the project site that informs the public about the wind turbines and their place on the landscape.

Lighting. Large wind turbines are often well over 200 feet tall and cannot help but be visible. While project and turbine design may seek to minimize visual impact, aircraft obstruction marking, by intent, seeks to increase contrast with the landscape. Federal Aviation Administration (FAA) recommendations should be strictly adhered to for legal and safety reasons. Man-made objects taller than 200 feet are required to file for an FAA permit. Permits typically require red and white lights to be installed on the nacelle. Nighttime security lights are non-essential and can be activated as needed by motion detectors. On-site lights should be minimized to avoid bothering neighbors or attracting wildlife such as birds.

Shadow flicker. Shadow flicker occurs when the blades of the turbine rotor cast shadows that move rapidly across the ground and nearby structures. These moving shadows can be unpleasant if they fall across occupied buildings, especially when windows face a turbine. They often occur when the sun is at low angles in the winter sky, and typically happen only a few dozen minutes per year. This issue can be mitigated by properly siting projects so as to minimize or eliminate flicker all together.

Property Values

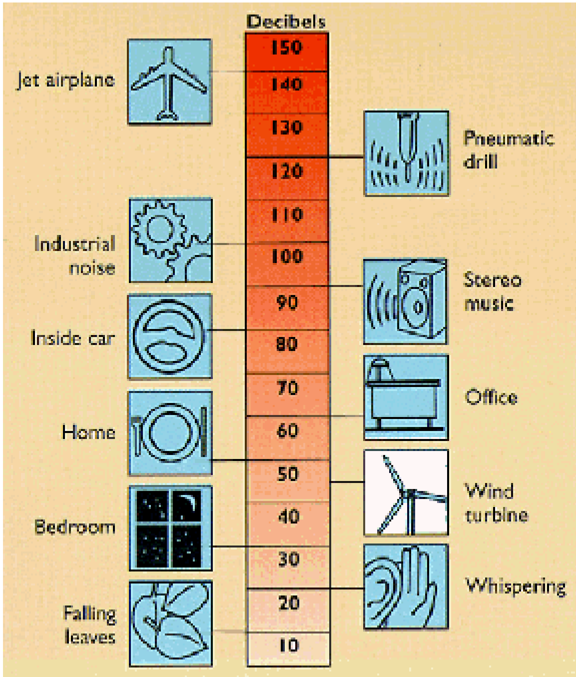
According to a national study published in 2003 by the Renewable Energy Policy Project (REPP), commercial-scale wind turbines do not harm "viewshed" property values. *The Effect of Wind Development on Local Property Values* systematically analyzed property values data, including over 25,000 transactions of properties in view of wind projects over 10 MW in size from 1998 to 2001. REPP found no evidence that property values are harmed by wind installations. In fact, for the great majority of wind projects, property values in the viewshed actually rose faster than in the comparable community with the pace increasing after the turbines came online. The full study is available at www.repp.org. Another study from New York analyzed home sales from 1996 to 2005 near a 30MW wind farm. It found no measurable effect of wind farm visibility on property values. This study can be found at http://www.aceny.org/pdfs/misc/effects_windmill_vis_on_prop_values_hoen2006.pdf.

Sound

Next to aesthetics, sound emissions are a commonly-raised issue for wind projects. Whether rotating wind turbines are "noisy" is a subjective matter; people who perceive wind turbines as an intrusion on an otherwise rural setting are more likely to find them noisier than do people who perceive them as beneficial and useful. Sound emissions are, however, objectively measurable.

Table 1 shows how sound emissions about 1000 feet from operational wind turbines compare with other sounds in terms of decibel output. The sounds of wind turbines do not interfere with normal activities any more than the sounds common in any suburban or rural setting. Moreover, they are likely to be masked to some extent by the background sound of the wind itself.

Table 1: Turbine Sound Chart



Source: The American Wind Energy Association

You might need to perform a study for your project to comply with sound regulations. In Illinois, for example, consult Title 35: Environmental Protection Subtitle H: Noise Chapter I: Pollution Control Board, Part 901- Sound Emission Standards and Limitations for Property Line-Noise-Sources to learn more. Full text is available online at: http://www.ipcb.state.il.us/Archive/dscgi/ds.py/Get/File-12260. The National Wind Coordinating Committee's Permitting of Wind Energy Facilities Handbook also addresses noise issues and can help you determine if unwanted sound will be an issue at your site. It is available at www.nationalwind.org.

The Minnesota Pollution Control Agency (MNPCA) has created a Guide to help the public understand how noise is measured and how to understand what those measurements mean entitled *A Guide To Noise Control in Minnesota* which can be found on the MNPCA website:

http://www.pca.state.mn.us/programs/pubs/noise.pdf

For a more detailed discussion of technical siting issues related to the impact of sound from wind turbines, see the Proceedings of the NWCC Siting Technical Meeting (Washington, DC. December 2005, proceedings published March 2006), which may be downloaded from:

http://www.nationalwind.org/events/siting/default.html

Public Safety

Safety is important around tall towers, moving parts and high voltage electrical equipment. If an unauthorized person climbs a turbine or wind instrument tower, it may be viewed as an "attractive nuisance" for which the owner may be held liable. Other safety concerns arise from falling ice, guy wires, turbine breakage and accessibility to electrical equipment and interiors of tubular towers. Standard safeguards include locking the turbine tower doors, placing information kiosks a good distance away from the turbines, and cautioning people from being under the machine during icing events. Federal Aviation Administration lighting requirements for aircraft safety are site specific.

You will also need to contact local law enforcement to set up a 911 address for the project. This allows emergency personnel to plan out best ways to approach the site should a medical or other emergency take place while the project is under construction or after it is commissioned. Local fire fighting and other emergency response officials will also want to know the layout of the projects as well set up procedures should they have to climb a turbine tower to rescue a technician who might be having a medical emergency while performing maintenance on the project.

Liability Prevention

From the outset of project planning, and throughout decision-making and implementation with regard to project location, design, installation, operation, and decommissioning, liability prevention is essential. Depending on insurance as a substitute for solid planning is a poor practice and could be costly in a number of ways. The key is diligence throughout planning and implementation of your project.

As the project is under construction, you should prominently post "Danger: High Voltage" or "Danger: Authorized Personnel Only" warning signs at eye level.

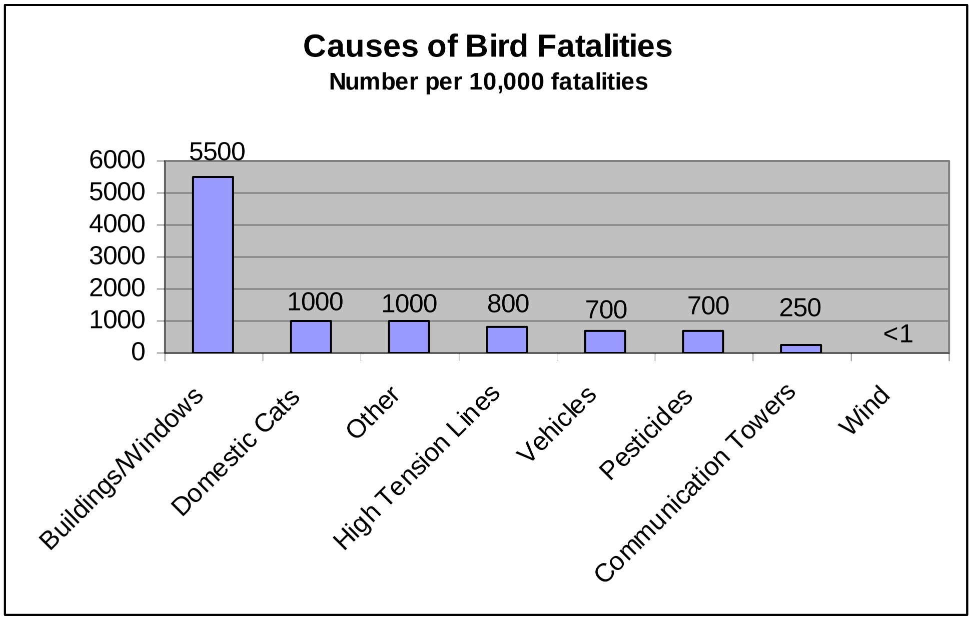
Environmental Impacts

As with any construction project or large structure, wind turbines can impact plants and animals, with the significance of those impacts depending on the sensitivity of the area. A windy site over a wetland is not likely to be "developable," and projects on native prairie or other delicate ecosystems may raise special concerns. Among the concerns associated with wind energy development are wildlife fatalities from collisions and loss of wildlife habitat and natural vegetation.

Before applying for permits you should consult with the state Department of Natural Resources and the U.S. Fish and Wildlife Service to obtain an inventory of threatened and endangered species and habitat that may be affected by the project. Working with these agencies early in the process will allow you to take appropriate measures to minimize or eliminate the impacts on sensitive plants and animals in the area.

Collision fatalities. Avian fatalities due to collision with wind turbines have raised considerable concern, as have recent incidents of collision-related bat fatalities, particularly on forested ridges in the eastern United States. Almost all large structures (buildings, cellular towers, smoke stacks, lighthouses, transmission lines, monuments, and so on) kill some number of birds. The table below ("Causes of Bird Fatalities") helps to put the risk to birds posed by wind turbines in perspective.

Evidence from the growing body of research on bird/bat-wind turbine collisions suggests that the risk to birds and bats is greater at some sites than at others.



Source: Erickson et al., 2002. Summary of Anthropogenic Causes of Bird Mortality.

Full results from *Avian Monitoring Studies at the Buffalo Ridge, Minnesota Wind Resource Area Results of a 4-Year Study*, are available at http://energyfacilities.puc.state.mn.us/documents/AvianMonitoringBuffaloRidge.pdf.

Mitigating avian collision impact. A number of steps are commonly required of new wind projects to help mitigate impacts on birds. How intensively they are performed depends on the scale of the project and its location. Mitigation steps commonly include a preconstruction review of whether and what species use the site and immediate area. For larger projects or projects in sensitive avian areas, this may include an expensive year-long field study, or spring and fall migration studies. Many smaller projects simply need to review existing information with state wildlife officials. If a single turbine project is proposed to be located "in harm's way," a greater degree of concern and scrutiny would arise. State officials estimate the likely impact on birds and issue a ruling: proceed as planned; proceed with modifications to the plan; or do not build. Building permits may include ongoing impact monitoring requirements and periodic reviews of actual results.

For further discussion of wind energy's impact on birds and bats, see the National Wind Coordinating Committee's Avian/Wind publications at http://www.nationalwind.org/publications/wildlife.htm. The GAO report on the impacts of wind power on wildlife can be found by searching the GAO reports website: http://www.gpoaccess.gov/gaoreports/index.html for "GAO-05-906".

An "Avian Risk Assessment" was performed for the Crescent Ridge Wind Power Project in Bureau County, Illinois, in 2002 using information about known bird risks from North America and Europe and observations of the proposed wind farm's site. It concluded that installing wind turbines at that location would have no significant adverse impact on bird populations. The complete study is available on the Crescent Ridge Wind Farm's website: http://www.crescentridgewind.com/avianstudy.pdf.

Wildlife and habitat loss. Wind project developers must also be sensitive to other kinds of wildlife and wildlife habitat when choosing sites for wind turbines. Although wind farms in agricultural areas are unlikely to have significant impacts on wildlife or habitat, it is still necessary to consider the issue.

Wind developers should also be mindful of endangered or threatened species in the proposed project area, both to be responsible stewards of the environment as well as to prevent being levied hefty fines by the state or federal government from impacts from your project. Before applying for your permits you should contact the state Department of Natural Resources or Fish and Wildlife office to obtain an inventory of threatened and endangered species and habitat in the area of the project. Working with these agencies will help you to understand the impacts your project will have on local wildlife and what measures you can take to mitigate these.

The U.S. Fish and Wildlife released a set of voluntary guidelines in June 2003 for wind developers to follow for the purpose of minimizing impacts on wildlife. The guidelines address three key areas: proper evaluation and selection of potential sites for wind energy facilities, proper location and design of turbines and associated structures within the site areas, and research and monitoring to assess impacts of the project on wildlife. The guidelines are available online at www.fws.gov/r9dhcbfa/windenergy.htm or by contacting the USFWS at 1-800-344-WILD. These guidelines will soon be revised through a Federal Advisory Committee process taking into account current research on wildlife impacts on wind turbines as well as current wind turbine technology and siting guidelines that have shown to significantly reduce wildlife impacts. You can find out more information about many of the issues to be revised by reading the American Wind Energy Association's comments on the guidelines here: http://www.awea.org/policy/#EnvironmentalImpactsofWindEnergy

Protecting Native American Historical and Cultural Resources

Tribal governments in the area should be consulted before beginning any excavation work. This will help you to understand if there are any known sites that are important to the history and culture of native peoples as well as how to handle delicate remains or artifacts that might be unintentionally disturbed during the construction process. This should be considered best practice for every project. For projects that are receiving federal funds it is a requirement to consult with tribal governments.

Historical Sites

When undertaking any construction project there is the potential that you may unearth or disturb something from the distant past that has important cultural and/or historical significance to people that used to or currently inhabit the area. While investigating potential sites you should have conversations with the State Historical Preservation Office, the National Register of Historic Places (http://www.cr.nps.gov/nr/research/index.htm) to determine if there are any known sensitive artifacts in the area of the project, whether a more detailed study needs to be performed, and what is the proper protocol to follow should the construction team disturb cultural artifacts that were previously unknown. Agricultural land that has been in production for many years typically should pose little chance of this happening but it is always a good idea to check well before you dig to reassure yourself and members of the community that your project will have as minimal impact as possible. You may also be required to assess the impact of the turbines on the viewshed from historical buildings or sites.

Construction Impacts

Wind turbine construction involves the transportation of large and heavy equipment, including cement mixing trucks and large cranes. These vehicles can compact soils and damage roadways not built to handle their weights. Unpaved public roads are likely to have weight restrictions during rainy seasons and spring thaws, but frozen roads are good for carrying high loads. Wind developers may need to improve roads before construction begins, or repair any damage to existing roads. Turbine components need to be placed close enough to the tower for a crane to reach while the project is being built, when major rebuilding or large component replacements occur and when the turbine is being dismantled. This can cause a large temporarily disturbed area near the turbines. Soil excavated for foundations and construction waste must also be stored, recycled, or disposed of properly.

Erosion is another potential environmental problem that can stem from construction projects. Erosion impacts can include increased siltation of streambeds, alteration of stream courses, and increased flooding, leaving scars on the land. Wind developers can reduce the risk of serious erosion by minimizing the amount of earth disturbed during construction, principally by eliminating unnecessary roads, avoiding construction on steep slopes, allowing buffers of undisturbed soil near drainages and at the edge of plateaus, assuring re-vegetation of disturbed soils, and designing erosion-control structures adequate to the task.

The single most reliable technique for limiting erosion is to avoid grading roads in the first place. The Bureau of Land Management's Ridgecrest, California office suggests that driving overland to install and service turbines, rather than grading roads, will significantly lessen erosion damage. Instead of using wide roads graded to bare earth, British, German, and Danish wind plant operators use farm tracks to service their wind turbines as a "tread lightly" practice to minimize erosion. However, compacted topsoil on farms makes it difficult for crops to grow. You should have a plan to separate and return topsoil from construction areas on farms.

Most state or local agencies will require that you attain an Industrial National Pollutant Discharge Elimination (NPDES) permit before building and other permits are issued. The permit assures local and state agencies that you have a plan in place to minimize erosion from the site and potential harmful affects on water quality in local lakes and streams from runoff or oil and other chemicals that might be spilled during the construction process.

Dismantling and Restoration

Once a wind project reaches the end of its useful life, the turbines and ancillary structures and equipment must be dismantled and the project site restored to usable condition. This is an aesthetic as well as an environmental and safety issue. A common issue is determining how much of the foundation will be removed in the end. Developers often commit to removing foundations to several feet below the ground. Dismantling and restoration (sometimes called "decommissioning") costs should be budgeted from the outset. Some jurisdictions require that that an escrow account be set up that is accessible to the land owner should the project need to be removed from the property before the end of its useful lifetime. Agreements with the town and landowners should include decommissioning provisions.

Site Layout, Design, and Planning

Once a site is selected, there are a number of other issues to consider when planning the layout and design of the project within that site.

Setbacks

Maintaining distances from various features and environmentally sensitive areas can address several issues. Turbines can be located away from residences to reduce sound emissions and shadow flicker impacts, and away from public rights-of-way and locations frequented by people for safety reasons. Space is also required between turbines and other wind obstructions. Lastly, turbines may need to be located away from aesthetic vistas, landmarks and cultural or historic sites. Setbacks might be dictated in local zoning ordinances, so it is important to check whether your community has setback regulations in the early stages of designing your project.

Turbine Layout

A common question about siting wind energy projects is "how much space is needed?" The answer depends on many factors, including not only setback requirements but also: how many turbines the wind farm will contain, the surrounding topography, as well as the prevailing wind direction.

Single turbine projects. For a single turbine project the amount of space needed will depend upon the local permitting agencies' requirements for setbacks from easement and/or property lines, and setbacks from buildings or dwellings. This can vary a fair amount from community to community. Sometimes mandatory setbacks are defined in terms of the height of the tower. Other communities may require setbacks of a certain number of feet, either from property lines or from other structures, and some communities may not have any standards set for this at all. The key is to start conversations with the local permitting authority early on in the process so that you can understand if the proposed site has enough space or if you need to attain control of more of the area or a larger site.

Multi-turbine projects. For multi-turbine projects, siting becomes a bit more complicated. The prevailing wind in relation to the point of interconnection is a strong factor in determining the final configuration of your project. Turbine siting consulting firms generally begin laying out a project using the following rule-of-thumb:

> In the direction of the prevailing wind, the turbines should be spaced 8 rotor diameters apart. In the direction perpendicular to the prevailing wind, the machines should be 4 rotor diameters apart.

This means that a four-generator project that uses 82 meter-diameter rotors may be expected to require a little over 200 acres of land. Taking into account the space requirements of the turbines as well as required setbacks from easement and property lines, a project this size will need more than a quarter-section.

Optimizing turbine layout. Turbines can be placed closer together, but will incur higher wake losses, which occur when the power of the wind is reduced as it flows around and through other turbines. Machines that are placed farther apart will produce more electricity but will cost more in terms of land lease, buried underground cable and construction costs. These costs and benefits should be weighed when determining the layout of a wind farm. For sites where the wind does not come from a single predominant direction, or that have complex topography, optimal placement of turbines becomes more complicated. There are computer software packages that turbine siting companies and consultants can use which help to perform these calculations to determine the optimum layout for a project.

Project Design

Many aspects of turbine and project design are intended to minimize the impact and improve safety:

- Turbines are usually painted a neutral or subdued color and are free of advertising. New FAA recommendations recommend turbines be bright white or light off-white. Read their new Advisory Circular at: https://www.oeaaa.faa.gov/oeaaaEXT/content/AC70_7460_1K.pdf
- Projects typically have minimal signage but post appropriate warnings and emergency contacts.
- Turbines can be selected for low sound emissions.
- Tubular towers have become common due to aesthetics, easy winter maintenance access, and diminished opportunity for birds to perch.
- Appropriate steps are taken to prevent fluids from being spilled on the ground. Fluids can be used in turbines and electrical equipment that will not be hazardous in case there is a spill.
- Appropriate fencing, gates, locks, warning signs, equipment enclosures, anti-climb provisions, and guy wire markings are common features contributing to safety.
- Use of proper erosion and

> ***Best Practice!***
>
> Projects should be designed to minimize impact on other uses of the land. Roads should be placed along property or fence lines to avoid isolating small portions of land. Project developers should work with landowners throughout the project design phase to better minimize the affect the wind turbines, associated equipment, and access roads will have on farming or ranching operations.

drainage controls is common as well.
- The project footprint can be minimized by using preexisting roadways and rights-of-way, putting turbine foundations next to roads, placing electric lines underground, and using existing rights-of-way for electrical wiring.

Project Plans

Wind developers and permitting authorities use plans to organize activities and assure that they are done properly. While small (single-turbine) projects may require little more than informal discussions and coordination with the people/agencies involved, a commercial-scale, multi turbine wind energy project typically requires preparation of detailed planning documents that must be formally approved and monitored for compliance. Detailed plans cover a wide variety of activities, including:

- Transportation routing
- Roadway maintenance and repair
- Temporary construction area definition
- How and when to conduct avian impact surveys during operations;
- Erosion control
- Routine maintenance procedures, including how to dispose of used lubricants and bad parts and protocols incase of fluid spills
- Restoration of vegetation and prevention of noxious weeds
- How to handle historical or archaeological artifacts which may be found
- Project dismantling and site restoration procedures.

A detailed project plan essentially organizes all aspects of project development, operation, maintenance and decommissioning. Project planning is discussed in more detail in the Project Management and Planning section.

Additional Resources

State Siting and the Permitting of Wind Energy Facilities:
http://www.nationalwind.org/publications/siting/Siting_Factsheets.pdf

National Wind Coordinating Committee's Permitting of Wind Energy Facilities Handbook (2002): http://www.nationalwind.org/pubs/permit/permitting2002.pdf

"Acoustic Noise Impact Assessment," a study that was commissioned by Illinois Wind Energy, LLC and Tomen Power Corporation for the 51 MW Crescent Ridge Wind Farm in Bureau County, Illinois. http://www.crescentridgewind.com/noisereport.pdf.

Proceedings of the NWCC Siting Technical Meeting. Washington, DC. December 1-2, 2005. Proceedings (ed. March 2006) may be downloaded from:
http://www.nationalwind.org/events/siting/default.html

Bureau of Land Management Programmatic Environmental Impact Statement
http://www.windeis.anl.gov/

Permitting Basics

If you have a good wind resource and land that is well-suited for wind turbines, you still must consider how your community views and regulates wind power. Communities around the country are working to find the best ways to permit and tax wind generation facilities. Their decisions are vital to windy areas because they determine the impacts and benefits of wind energy projects for the broader community. Some states, like Minnesota, have developed statewide policies but still involve local agencies in the process, while most states leave it to the counties or other local permitting agencies to create regulations and issue permits.

Good project planning means knowing early on what the local requirements are and designing the project to be consistent with those requirements. Investigating zoning laws early in the development of your wind project can help avoid unnecessary delays. This section is intended to give you a quick overview of permitting and zoning regulations in several Midwest states.

Topics covered in this section include:

Permitting Authorities

You can learn about the local zoning laws affecting your wind project by consulting your local county officials or a lawyer familiar with your jurisdiction. The National Wind Coordinating Collaborative (NWCC) has published a handbook, Permitting of Wind Energy Facilities, which is an excellent resource for more specific information on state by state guidelines and case studies, available online at: http://www.nationalwind.org/publications/siting.htm

Additionally, when wind energy expands into a new region, cities, counties and even states may formulate new zoning and permitting laws specifically to address the siting of wind turbines. These laws can significantly influence the pace and practicality of wind energy development, as well as determine how the broader community will benefit from wind energy investment. Overly restrictive permitting and zoning laws can discourage development even in areas with good wind resources, while a law intended to encourage wind energy development can backfire if its effect is to reduce tax revenue for the community or diminish protections for neighbors of wind projects.

Local Permitting Authorities

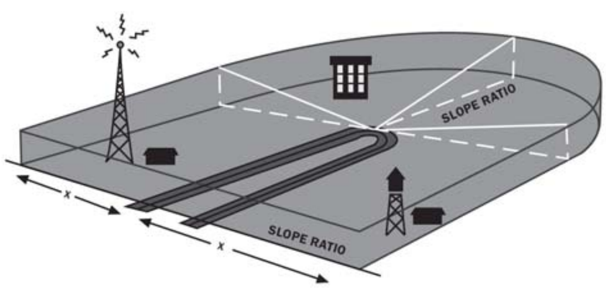
In many states, the primary permitting jurisdiction for wind facilities is the local planning commission, zoning board, city council, or county board of supervisors or commissioners. These local entities typically regulate through zoning ordinances. In addition to local zoning approval, permitting under local jurisdiction may require a developer to obtain some form of local grading or building permit to assure compliance with structural, mechanical, and electrical codes.

State Permitting Authorities

In some states, one or more state agencies have siting responsibilities for wind developments. These may include: natural resource and environmental protection agencies, state historic preservation offices, industrial development and regulation agencies, public utility commissions, or siting boards. Depending on the state where the wind development is proposed, state permits may be needed in addition to local permits. In other states, state law may supersede some or all local permitting authorities. In some cases there may be a coordinating or lead agency, or a "one-stop" siting process housed under one agency. Depending on whether the permitting jurisdiction is state or local, wind projects may also be subject to local and state environmental policy acts. These laws generally adhere closely to the language of the National Environmental Policy Act (NEPA), described below. The content requirements of these laws parallel those of federal law, except where specific language narrows the scope of the impact statements.

Federal Permitting Authorities

There are a number of federal agencies which are likely to be involved in permitting any wind project. In some cases (notably in the West), federal land management agencies such as the Bureau of Land Management (BLM) or the United States Forest Service (USFS) may be both the manager of the land and the permitting authority. Additionally, agencies such as the Bonneville Power Administration (BPA) or Western Area Power Administration (WAPA) may be either a wind project host or the customer for the power. Additionally, if property is part of a land trust through the Conservation Reserve Program (CRP) or Forestry Stewardship Counsel (FSC), this status will affect what land use is allowed.



Antenna penetrates surface. FAA notice required.

Airports with one runway more than 3,200 ft long, X=20,000 ft. Slope ratio 100:1

Airports with no runway over 3,200 ft. long X = 10,000 ft. Slope ratio 50:1

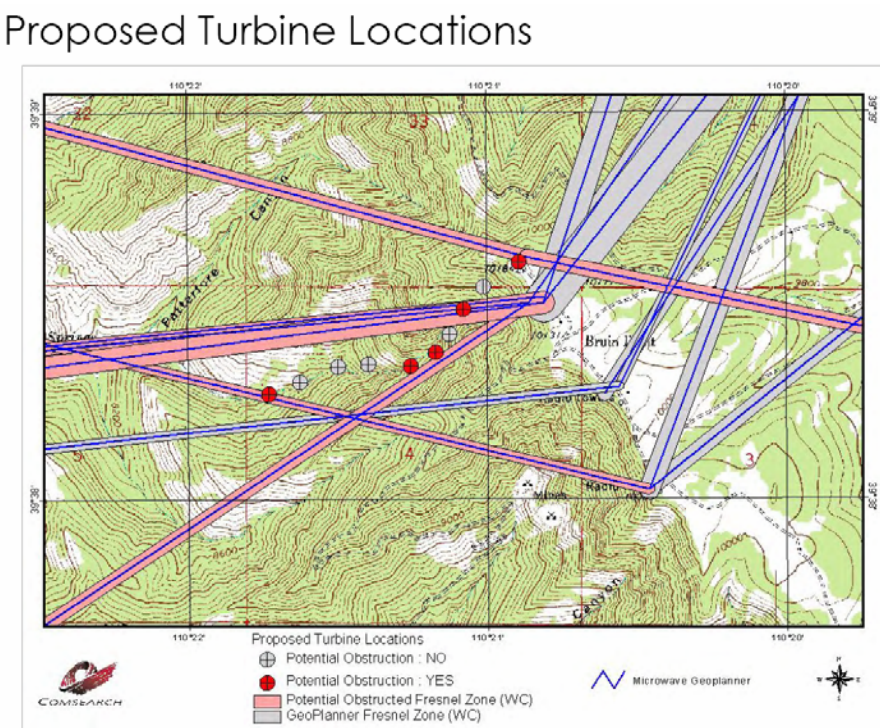
Source: Federal Aviation Administration

The Federal Aviation Administration (FAA) is another federal entity that is almost always involved in permitting a wind project, because every structure over 200 feet tall, within a certain radius of an airport, or within critical flight paths must be permitted by the FAA. Projects must meet FAA lighting requirements and regulations for siting. To determine these factors for your project you must fill out FAA forms 7460-1 and 7460-2. Tall cranes used during construction will also require FAA permits.

If the project poses potential impacts on wildlife habitat or species protected under the Endangered Species Act, the Bald and Golden Eagle Protection Act, or the Migratory Bird Treaty Act, wind project permitting will most likely involve coordination and consultation with the United States Fish and Wildlife Service (USFWS).

When federal agencies or federally managed lands and resources (monetary or otherwise) are involved, the requirements of the National Environmental Policy Act (NEPA) will apply. Compliance with NEPA will be required if the wind development or authorization to develop is a federal action, qualifies as "major," and has potential for a significant environmental impact. If a wind project is proposed on federal land, a federal agency has the power to control the authorization of the wind project (e.g., a federal permit or lease is required). Where multiple federal agencies have NEPA responsibilities, a lead agency will be appointed to coordinate NEPA compliance.

If wetlands are nearby, you should consult with the Army Corps of Engineers to determine if the construction of your project has the potential to have adverse impacts and how best to deal with them. Before beginning construction, your project will also need to obtain a National Pollutant Discharge Elimination System (NPDES) permit. As part of the application process for this document, the project must create a storm water pollution prevention plan (SWPPP) that explains how you will control storm water. Contact the state pollution control agency to figure out the process for formulating the SWPPP and obtaining a NPDES.



Topo map of wind project with proposed turbine locations, and microwave beam paths superimposed over site to determine where potential communications interference may occur.
Source: Lester E. Polisky, Identifying and Avoiding Radio Frequency Interference (RFI) to Microwave Systems, TV Reception, Telephone Operations from Wind Turbines, American Wind Energy Association 2005 Conference Proceedings, Denver, CO.

Wind projects have the potential to create problems with microwave beam communications that are used by emergency response agencies, the Department of Transportation and AM radio signals. The fiberglass blades can partially or completely block these signals, interfering with communication abilities. Before acquiring local and state building permits, it will be necessary to perform a radar beam path study. You can contact the Federal Communication Commission (FCC) to perform a communications tower search, which can identify potential interference from your wind turbines. Negative results from this study generally will not stop a project from moving forward. However, the study may dictate that you move some of the turbines in your project so that they are not within a beam's path. There are also professionals who specialize in performing these studies. Hiring a consultant to perform the study will ensure that it is performed up to the standards required by state and local permitting agencies.

Involving the General Public

As wind energy grows in the U.S., permitting of wind turbines has become a highly controversial and emotionally charged issue in some areas. Community wind developers can help assure a timely permit decision and reduce the possibility of protracted litigation by actively promoting general public involvement early in the permitting process. The general public includes residents and members of communities near the wind development and community officials and representatives of various interests, including economic development, conservation and environmental groups.

Helpful hint: The time for educating the public and permitting agencies is not at your permit hearing. You should show that your project has addressed as many concerns that may be brought up by the community as early as possible. It should be your goal to have done enough work engaging community members and mitigating potential issues to make the permit hearing for your project a formality.

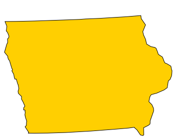
Permitting - State by State

Permitting and zoning policies and procedures vary greatly from state to state. This section provides basic information on wind turbine permitting in Midwestern states and includes useful links to more information in each state. These state-by-state descriptions are not a comprehensive list of permitting requirements within each state, but rather a starting point for your own research into your state. For information on states not included here, visit the Regulatory Requirements Database for Small Electric Generators (http://www.eea-inc.com/rrdb/DGRegProject/).

Illinois

A number of counties in Illinois have adopted ordinances specifically pertaining to wind energy facilities. In many cases, these counties have made wind turbines and meteorological data collection towers (met towers) "Special Uses" in areas zoned for agriculture. You should consult your county planning office to determine what kind of zoning applies to the property you are interested in and to inquire about any other relevant ordinances.

Iowa

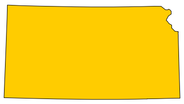


Local zoning boards within each city council have authority over permitting wind turbines in Iowa. Most cities and towns have ordinances to ensure that structures and activities are safe, proper, and compatible with existing or planned development. Few ordinances specifically pertain to wind systems. Most municipalities either use existing ordinances regarding structure heights or require that an exemption from an existing zoning ordinance (a variance) be obtained from the zoning board. Some towns, particularly those in rural areas, have few or no codes to restrict the use of a wind turbine. Most restrictions occur in populated areas where height, safety, or aesthetics are issues.

Mason City has a specific zoning ordinance for wind turbines within the city limits: www.windustry.org/SmallWind/documents/MasonCityIAWindOrdinance.pdf.

To find out about permit requirements in a specific area within the state, contact the zoning/permitting board that is local to the project with the legal description of the project site and they will work with you to determine what regulations your project will need to follow.

Kansas



Wind energy siting and permitting requirements in Kansas vary from county to county, based largely on whether or not the county is zoned. Statewide regulations for siting wind projects do not yet exist.

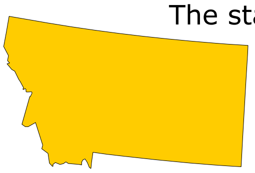
The Kansas Renewable Energy Working Group released a handbook on siting and permitting wind projects in Kansas: Siting Guidelines for Wind Power Projects in Kansas.

Minnesota

(updated January 2008)

Minnesota has a statewide policy for permitting commercial-scale wind projects that is one of the most user-friendly in the nation. The Public Utilities Commission (PUC) has permitting authority over Large Wind Energy Conversion Systems (LWECS) (systems over 5 megawatts), whereas smaller systems are subject to local jurisdiction. Starting in 2008, Minnesota counties will have the option to assume permitting authority for wind facilities with a combined nameplate capacity less than 25 MW. The PUC states, "It is state policy to site LWECS in an orderly manner compatible with environmental preservation, sustainable development, and the efficient use of resources." Visit the MNPUC's wind siting page (http://energyfacilities.puc.state.mn.us/wind.html) for state siting and permitting rules and application processing schema.

Montana

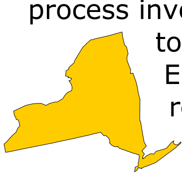


The state of Montana has no ordinances specifically for wind turbines. However, at least one county (Madison County) has an ordinance covering tall structures, including wind turbines.

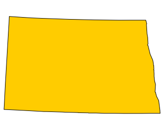
The Montana Department of Environmental Quality has links to information on the permits that a wind project might require. The Montana State Legislature also maintains this index of Environmental Permits.

New York

In New York, most wind projects will have to go through some sort of local review process involving the municipal permitting authority. In general, the project will have



to comply with local zoning ordinances and comply with the State Environmental Quality Review Act (SEQRA). Because New York State has relatively few wind projects installed to date, most municipal authorities will not have much experience with permitting wind projects. For more background on the permitting process in New York State, visit the New York State Energy Research and Development Authority's (NYSERDA) Wind Energy Toolkit section on The Roll of Government Agencies in the Approval Process: http://www.powernaturally.org/Programs/Wind/toolkit/16_rolegovernmentagencies.pdf



North Dakota

North Dakota has no specific process or governing authority for zoning and permitting wind projects. This has begun to cause problems with wind access rights in the state. However, there are likely to be other local zoning and permitting regulations that will apply to a wind project.

Ohio

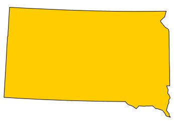
In Ohio, the Ohio Power Siting Board has authority over any new generation facilities 50 MW or larger, including wind. Smaller developments are regulated by local governments and zoning boards.

Oklahoma

Wind energy siting and permitting requirements vary in Oklahoma from county to county, and local building codes and ordinances may also apply. On a statewide basis, there are no regulations specific to wind development, but storm water permits and zero-emission facility permits from the Oklahoma Department of Environmental Quality are needed.

South Dakota

The state Public Utilities Commission gained authority over permitting of wind energy



facilities through the South Dakota Energy Facilities Permit Act of 2005. To read the statute, click here. Visit the South Dakota Public Utilities Commission website for more information.

Wisconsin

The Public Service Commission of Wisconsin has permitting authority over wind turbines, and a new state law prohibits local blockage of a wind project unless it poses a threat to residents' health or safety. Nevertheless, the zoning process in Wisconsin is not as smooth as it could be. Read about trials and tribulations of wind developers in Wisconsin on AWEA's website. For more information on permitting in Wisconsin, visit the Public Service Commission's website.

Conclusion

Permitting can seem daunting because of the wide variation in regulations from place to place and range of agencies and governmental bodies who may have regulatory authority over your project. However, researching and understanding the permitting requirements for your wind project is a critical part of the development process. Be sure to research permitting issues early in order to avoid unnecessary delays and obstacles throughout your development process.

Financing Community Wind Projects

Most commercial-scale community wind projects are multi-million dollar investment endeavors that require outside financing assistance. This section will give you some background on how to approach a bank or other financing entity. Loan terms will affect the bottom line of your wind energy project revenue, so understanding the requirements and options for financing your wind development are critical. Getting organized in the beginning will put your project in a much better negotiating position for acquiring favorable financing. With enough "**due diligence**" documentation, your project will be less risky and more attractive to a financing entity.

Elements of Wind Energy Finance

Community wind development offers substantial new economic opportunities for rural landowners and communities, with considerable environmental benefits. Although wind power can be lucrative, markets can also be competitive and the margins can be tight. The process for securing financing can be much more challenging for local communities than for a large wind development firm.

As with any investment, wind energy projects require research and a fundamental understanding of the risks, costs, and benefits involved. A community wind developer needs to have a working knowledge of how this investment will translate throughout the entire project, from the initial resource assessment through operation and maintenance at year 20 and beyond. Windustry's "Know Your Economics" fact sheet (online at: http://www.windustry.org/basics/07-economics.htm) provides a good introduction to economic issues with commercial-scale wind development.

Financial Viability

The cost to buy, install, and operate the wind turbine must be able to be offset by the value of energy that can be produced at a particular site. Key variables that can impact the financial viability of a wind farm include:

- Quality of the wind resource (see section of the Handbook on **Wind Resource Assessment**)
- Price and availability of the turbines
- Installation costs
- Availability of incentives and other forms of support for your project
- Distance the power needs to be transported
- Selling price of the power and renewable energy credits
- Cost of financing

Equity and Debt

In many cases, developing a community wind project necessitates requesting a loan from a bank, much as building a new ethanol production facility does. Loan terms for the debt vary, but typically are 10-15 years for conventional bank loans and up to 20 years for bond financings. The equity investment in a project is the amount of capital that is not borrowed, but is invested directly into the project upfront. This may come from private savings or direct investment by members of a cooperative, partnership, or LLC that is interested in obtaining a desired rate of return from the project's ongoing revenues.

"Financing Community Wind: A Handbook by the Environmental Law and Policy Center" (http://www.elpc.org/documents/WindHandbook2004.pdf) is a good resource on the ins-and-outs of financing wind development. It includes a comprehensive section on "Sourcing Equity and Debt" that covers:

- Finding an Equity Partner
- Arranging Debt Financing (Local Lenders, Regional Agricultural Lenders, and Commercial Banks, Commercial Finance, and Vendor Financing)
- Debt Structuring
- Getting the Project Financed

Getting a Bank Loan: What will the bank want to know?

Some banks and financial institutions in the Midwest have experience with the wind industry and are comfortable financing wind projects. However, if wind energy is new to your area, local banks might be wary or have a lot questions about your plans. This section outlines the basic information you should have available before approaching a bank for a loan.

Detailed Cost and Production Estimates

A lender will want an overview of your project, including detailed cost estimates (written quotes for equipment, interconnection, installation, operation, etc.) and a legal description of the proposed project site, including aerial photos and plat drawings if possible. You also will need detailed budgets of project expenses and income (monthly for at least 24 months, and annually for 10-20 years). See the section above on **Wind Resource Assessment** as well as the section entitled **Costs Associated with Community Wind Development**, for more detailed discussion.

Other "**due diligence**" documentation requirements could include:

- Existing and pro forma financial statements
- How and to what level the project will be capitalized
- Plans for using state and federal incentives
- Legal ownership structure
- Background information on majority owners
- Personal financial statements (based on capitalization)
- Listing of all required contracts, permits & easements and your progress toward obtaining them
- Copy of proposed power purchase agreement
- Risk mitigation plans
- Construction management plans
- Ongoing management and extended warranties plans
- Insurance coverage including property/casualty liability and business interruption

At-a-Glance: Third Party Certification

If your lender is not familiar with wind energy business ventures, it is advisable to obtain a third party project feasibility certification. A third party certification will also provide you with peace of mind that the assumptions and projections in your business plan

The sample proforma below shows the some of the information your lender is likely to request in order to consider your loan.

Alice in Windyland Pro Forma

Year	0	1	2	3	4	5	6	7	8	9	10
CAPITAL EXPENDITURES											
Equity Investment (Project Cost Less Debt & Grants)	(3,500,000)										
REVENUES											
kWh/yr		7,884,000	7,884,000	7,884,000	7,884,000	7,884,000	7,884,000	7,884,000	7,884,000	7,884,000	7,805,160
PPA Rate ($/kWh)		0.060	0.061	0.062	0.064	0.065	0.066	0.068	0.069	0.070	0.072
C-BED Rate ($/kWh)		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Electricity Sales Revenue per PPA		473,040	482,501	492,151	501,994	512,034	522,274	532,720	543,374	554,242	559,873
Electricity Sales Revenue per C-BED		0	0	0	0	0	0	0	0	0	0
Green Tag Rate ($/kWh)		0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040
Green Tag Sales Revenue		315,360	315,360	315,360	315,360	315,360	315,360	315,360	315,360	315,360	312,206
Other Tax Credit (Installment Payments)		5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000
Other Tax Credit (Lump Sum)		0	0	0	0	0	0	0	0	0	0
Production Incentive Payments ($/kWh)		0	0	0	0	0	0	0	0	0	0
Total Revenues - Annual		793,400	802,861	812,511	822,354	832,394	842,634	853,080	863,734	874,602	876,880
EXPENSES											
Operations & Maintenance		40,000	40,800	41,616	42,448	43,297	44,163	45,046	45,947	46,866	47,804
Project Management Fee		15,000	15,300	15,606	15,918	16,236	16,561	16,892	17,230	17,575	17,926
Insurance		21,000	21,420	21,848	22,285	22,731	23,186	23,649	24,122	24,605	25,097
Property Tax		115,000	117,300	119,646	122,039	124,480	126,969	129,509	132,099	134,741	137,436
Leaseholder Payments		12,000	12,240	12,485	12,734	12,989	0	0	0	0	0
Admin/Financial/Legal Management		0	0	0	0	4,330	4,416	4,505	4,595	4,687	4,780
Production Tax Expense		9,461	9,650	9,843	10,040	10,241	10,445	10,654	10,867	11,085	11,193
Decomm. Fund Pre-Warranty Expiration		1,000	1,020	1,040	1,061	1,082	0	0	0	0	0
Decomm. Fund Post-Warranty Expiration		0	0	0	0	0	6,624	6,757	6,892	7,030	7,171
Other		5,000	5,050	5,101	5,152	5,203	5,255	5,308	5,361	5,414	5,468
Debt Interest Payment		98,000	90,907	83,317	75,197	66,508	57,210	47,262	36,617	25,227	13,040
Debt Principal Payment		101,329	108,421	116,011	124,132	132,821	142,118	152,067	162,711	174,101	186,288
Depreciation		980,000	1,568,000	940,800	564,480	564,480	282,240	0	0	0	0
Total Operating Expenses - Annual		1,397,789	1,990,109	1,367,314	995,486	1,004,398	719,189	441,649	446,442	451,331	456,204
Taxable Income	(3,500,000)	(604,389)	(1,187,248)	(554,803)	(173,132)	(172,004)	123,445	411,431	417,292	423,271	420,676
TAXES											
Local Owner Income Tax Benefit/(Liability)		21,154	41,554	19,418	6,080	6,020	(4,321)	(14,400)	(14,605)	(14,814)	(14,724)
Equity Investor Income Tax Benefit (Liability)		190,383	373,983	174,763	54,537	54,181	(38,885)	(129,601)	(131,447)	(133,330)	(132,513)
Federal PTC Value		132,507	131,602	130,539	129,308	127,901	126,307	124,516	122,518	120,303	116,726
Other PTC Value		118,260	120,625	123,038	125,498	128,008	130,569	133,180	135,844	138,560	139,918
Other Tax Credit (Installment Payments)		0	0	0	0	0	0	0	0	0	0
Other Tax Credit (Lump Sum)		0	0	0	0	0	0	0	0	0	0
Total Tax Benefit/(Liability)		462,303	667,764	447,758	315,403	316,111	213,669	113,695	112,310	110,719	109,407
CASH FLOWS											
Add Back Depreciation		980,000	1,568,000	940,800	564,480	564,480	282,240	0	0	0	0
Net After-Tax Project Cash Flow	(3,500,000)	837,914	1,648,517	833,755	706,751	708,586	619,355	525,126	529,602	533,989	530,083
Local Owner Return	(1,500,000)	83,791	164,852	83,376	70,675	70,859	61,935	52,513	52,960	53,399	53,008
Equity Investor Return	(2,000,000)	754,122	943,665	750,380	636,076	637,728	557,419	472,613	476,642	480,590	477,075

Year	11	12	13	14	15	16	17	18	19	20
REVENUES										
kWh/yr	7,727,108	7,649,837	7,573,339	7,497,606	7,422,629	7,348,403	7,274,919	7,202,170	7,130,148	7,058,847
PPA Rate ($/kWh)	0.073	0.075	0.076	0.078	0.079	0.081	0.082	0.084	0.086	0.087
C-BED Rate ($/kWh)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Electricity Sales Revenue per PPA	565,158	570,697	576,289	581,937	587,640	593,399	599,214	605,087	611,016	617,004
Electricity Sales Revenue per C-BED	0	0	0	0	0	0	0	0	0	0
Green Tag Rate ($/kWh)	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040
Green Tag Sales Revenue	309,084	305,993	302,934	299,904	296,905	293,936	290,997	288,087	285,206	282,354
Other Tax Credit (Installment Payments)	0	0	0	0	0	0	0	0	0	0
Other Tax Credit (Lump Sum)	0	0	0	0	0	0	0	0	0	0
Production Incentive Payments ($/kWh)	0	0	0	0	0	0	0	0	0	0
Total Revenues - Annual	874,242	876,690	879,223	881,841	884,545	887,335	890,211	893,173	896,222	899,358
EXPENSES										
Operations & Maintenance	48,760	49,735	50,730	51,744	52,779	53,835	54,911	56,010	57,130	58,272
Project Management Fee	18,285	18,651	19,024	19,404	19,792	20,188	20,592	21,004	21,424	21,852
Insurance	25,599	26,111	26,633	27,166	27,709	28,263	28,828	29,405	29,993	30,593
Property Tax	140,184	142,988	145,848	148,765	151,740	154,775	157,870	161,028	164,248	167,533
Leaseholder Payments	0	0	0	0	0	0	0	0	0	0
Admin/Financial/Legal Management	4,876	4,973	5,073	5,174	5,278	5,383	5,491	5,601	5,713	5,827
Production Tax Expense	11,303	11,414	11,526	11,639	11,753	0	0	0	0	0
Decomm. Fund Pre-Warranty Expiration	0	0	0	0	0	0	0	0	0	0
Decomm. Fund Post-Warranty Expiration	7,314	7,460	7,609	7,762	7,917	8,075	8,237	8,401	8,569	8,741
Other	5,523	5,578	5,634	5,690	5,747	5,805	5,863	5,922	5,981	6,041
Debt Interest Payment	0	0	0	0	0	0	0	0	0	0
Debt Principal Payment	0	0	0	0	0	0	0	0	0	0
Depreciation	0	0	0	0	0	0	0	0	0	0
Total Operating Expenses - Annual	261,844	266,911	272,077	277,344	282,715	276,324	281,793	287,370	293,058	298,860
Taxable Income	612,398	609,780	607,147	604,497	601,830	611,011	608,418	605,803	603,164	600,498
TAXES										
Local Owner Income Tax Benefit/(Liability)	(192,905)	(192,081)	(191,251)	(190,417)	(189,578)	(192,488)	(191,652)	(190,828)	(189,997)	(189,157)
Equity Investor Income Tax Benefit (Liability)	(192,905)	(21,342)	(21,250)	(21,157)	(21,064)	(21,385)	(21,295)	(21,203)	(21,111)	(21,017)
Federal PTC Value	0	0	0	0	0	0	0	0	0	0
Other PTC Value	141,290	142,674	144,072	145,484	146,910	148,350	149,804	151,272	152,754	154,251
Other Tax Credit (Installment Payments)	0	0	0	0	0	0	0	0	0	0
Other Tax Credit (Lump Sum)	0	0	0	0	0	0	0	0	0	0
Total Tax Benefit/(Liability)	(244,521)	(70,749)	(68,429)	(66,090)	(63,730)	(65,504)	(63,143)	(60,760)	(58,353)	(55,923)
CASH FLOWS										
Add Back Depreciation	0	0	0	0	0	0	0	0	0	0
Net After-Tax Project Cash Flow	367,877	539,031	538,718	538,407	538,099	545,507	545,275	545,044	544,811	544,575
Local Owner Return	331,089	485,128	484,846	484,567	484,290	490,956	490,748	490,539	490,330	490,118
Equity Investor Return	36,788	53,903	53,872	53,841	53,810	54,551	54,528	54,504	54,481	54,458

PROJECT RESULTS	
O & M Rate (% of revenues)	5.0%
Capital Cost per kWhr	$1,800
IRR (Years 1-20)	20%
Net Present Value (Years 1-20)	$661,327

LOCAL OWNER RESULTS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Running IRR	-94%	-71%	-54%	-42%	-33%	-27%	-22%	-18%	-16%	-13%	-5%	0%	3%	5%	7%	8%	9%	9%	10%	10%

Credit Guidelines
Many lenders require a minimum equity contribution of 30 percent of the project costs. The term note is typically amortized over 10 years with quarterly or yearly payments. The interest rate on the loan is important and can make the difference between a project that makes a profit and one that simply breaks even. It is important to know what rate of return is foregone by investing the money in the turbine project to determine changes in tax payments.

Evaluation
The lender will evaluate your loan application based on the following criteria:

- thoroughness and accuracy of your business plan;
- the validity and strength of your cash flow and financial statements;
- qualifications of your governing board
- adequate capital secured for the project; and
- a legal review of contracts, permits, and easements.

Concerns a lender might have about financing wind projects include:

- the availability of equity capital;
- the certainty and stability of power purchase contracts and power purchasing entity;
- the stability and availability of state and national incentives;
- the stability of the market for wind energy; and,
- the availability of proven expertise in wind project design.

Individuals and groups who are interested in developing a wind project are strongly advised to seek expert financial advice as they evaluate potential sites and financial scenarios.

Other means of obtaining debt financing such as bond financing are starting to be used in the wind industry as a low-cost and longer term financing alternative. Bond financing requires due diligence documentation similar to that required by conventional banks.

Public Project Financing – Clean Renewable Energy Bonds (CREBs)

Clean Renewable Energy Bonds are available to entities that are not eligible for the production tax credit (PTC) due to their non-taxable status, including state and local governments, rural electric cooperatives, Native American tribal governments, and public and private non-profit organizations. After the bonds are issued, their interest is paid by the federal government in the form of tax credits, creating an interest-free source of financing. The IRS received over $2 billion in applications for the initial $800 million available. An additional $400 million in financing authority was issued in late 2006 with a deadline of July 13th 2007 for applications. Considering the popularity of the program, there is serious discussion at the national level for future allocations for the program. More information on CREBs is available on Windustry's website: www.windustry.org/community/crebs.htm. CREBs and other tax incentives are discussed further in the Tax Incentives section of this Handbook.

Example of Financing Terms for a Community Wind Project (supplied by AgStar Financial Services)

This example should not be construed as typical terms. Different financing companies will have different terms for lending to a wind energy project. To find out specific terms for various lending institutions, you should contact them directly.

Proposed Term Sheet

This is a proposal for a possible lending relationship with AgStar Financial Services. This is not a loan commitment; this proposal is subject to loan underwriting. The proposal is valid for 30 days from the date below.

Generic Wind Project
Generic County, MN

PROPOSAL OF TERMS AND CONDITIONS

Borrower:	**To be determined**
Loans:	**Construction loan** - There will be a single construction loan for up to 100% of the total estimated project cost of approximately $23,000,000 based on the final borrower sources and uses of funds and the final underwriting outcome. **Term loan** - The construction loan will convert to a 12 year term loan with a 12 year amortization. Conversion to the term loan will occur within 30 days post construction upon applicable certification of completion of the project. There will be a term loan which will refinance not more than XX% of the total construction loan.
Maturity Date:	Maturity dates will be based on the closing date subject to the above terms. The length of the term loan is 12 years.
Purpose:	The purpose of the loan(s) is for the construction of seven individual wind farm companies building 7 – 1.65 MW turbines.
Availability Period:	The loan is available from the day of formal loan closing until 30 days post construction. A third party engineer or similar representative must certify the turbines prior to the end of the construction period.
Interest Rates:	Variable Rate: The construction loan facility will carry a variable interest rate of the Wall Street prime less 100 bps; the construction period is defined as 10 months from loan closing. Fixed Rate: Upon conversion of the construction loan to the term loan facility the variable interest rate will convert to a fixed rate

that will carry XXX basis points net margin to AgStar over their cost of funds for a 12 year fixed rate. **This rate will contain a three year principal pre-payment lock out provision.**

The cost of the fixed rate product is subject to change on a daily basis until actually committed to by the borrower; then the appropriate loan must be flipped to that rate with in one business day.

Rate example: …

Interest Payments:	Interest shall be calculated on the actual number of days each loan is outstanding on the basis of a year consisting of 360 days. Accrued construction interest is due when the construction loan is refinanced by the term loan.
Fees:	There will be a XX basis point underwriting and origination fee on the entire term credit facility due at construction loan closing. Portions of this fee may be shared pro rata with any senior debt participants.
Costs:	**AgStar** will bear all internal costs associated with underwriting, loan document preparation, and appraisal. **Borrower** will pay costs associated with recording and filing collateral documents and mortgage registry fees, their own legal fees, and lenders title policy without survey coverage. **AgStar escrow and title insurance** services are available for an additional cost to the borrower.
Principal Payments:	All principal payments are due quarterly along with interest as will be described in the term loan facilities. The term loan amortization will be equal payments of combined principal and interest fully amortized on a 12 year schedule. The first payment is due 90 days from "live production". **This loan will contain a three year principal payment lock out starting when the fixed rate is initiated (construction loan is flipped to the term loan).**
Security:	First security interest covering all real estate or appropriate assignment of the real estate lease or any leasehold mortgage; equipment, facilities; assignments of the PPA, turbine supply agreement and warranty and operating and maintenance agreement; assignment of the transmission and interconnection agreement.
Documentation:	The Loans will be subject to the negotiation, execution and delivery of a definitive Master Loan Agreement (including schedules, exhibits and ancillary documentation) and all such other documentation ("Loan Documents"). The terms, conditions and definitions in this Term Sheet are set forth in relative detail not for the purpose of establishing precise terminology for the Loan Documents, but for the purpose of establishing the basic elements of the offered financing package.

Representations and Warranties, Conditions Precedent, Affirmative and Negative Covenants:	Documentation will contain representations, warranties, conditions precedent, affirmative (including, without limitation, the Financial Covenants) and negative covenants, reporting requirements that are reasonable and customary for Loans of this type. **This is a non-recourse loan to the borrower and further contains no guarantees, actual or implied from the borrower or equity contributor.**

CONDITIONS PRECEDENT:

1. Borrower to provide AgStar with copies and assignments of all agreements with third parties, including but not limited to: easements to property and wind easements, management agreements, marketing agreements – including the Power Purchase Agreement, and other contracts used in the normal operations of borrower.
2. Borrower will provide AgStar with copies of all necessary permits; including but not limited to: local construction permit, conditional use permit and/or appropriate zoning, Federal Aviation Administration permit, environmental assessment (or E.I.S. – if required), and all other required permits.
3. Borrower will provide AgStar with proof of property/casualty insurance naming AgStar as loss payable for at least the loan amount.
4. Borrower will provide AgStar with proof of business interruption insurance for an amount equal to $XX,XXX per month, naming AgStar as loss payable.
5. All appropriate equity funds must be committed with evidence (equity term sheet) of such commitment provided to AgStar prior to document closing.
6. A resume of the construction contractor indicating prior experience in wind tower construction must be provided to AgStar prior to document closing. Borrower will provide proof to AgStar that a qualified project manager is overseeing the project on behalf of the borrower.
7. Borrower will provide to AgStar three months payment in an escrow account managed by AgStar and accessible by AgStar in the event of payment default. **This is an evergreen account.**

Additional Resources for Financing Community Wind

- U.S. Department of Agriculture – State Office Rural Energy Coordinators: http://www.rurdev.usda.gov/rbs/farmbill/contacts.html
- AgStar Financial Services (Mankato, Minnesota): www.agstar.com
- Fishback Financial Corporation/First National Bank of Pipestone (Minnesota): http://www.fnbpipe.com/index.htm
- Community Wind Financing Handbook, by Charles Kubert, Environmental Law and Policy Center, 2004: http://www.elpc.org/documents/WindHandbook2004.pdf

Tax Incentives

In order to be financially competitive, most wind projects need to take advantage of federal and, where available, state tax incentives. It is critical to understand the role and mechanics of tax incentives while developing a commercial-scale community wind project because these incentives can represent one half to two thirds of the total revenue stream over the first 10 years of operation due to the Federal Production Tax Credit (PTC) and Modified Accelerated Cost-Recovery System (MACRS) or other type of depreciation that can be applied to wind energy assets. ***You will need to consult a tax professional in the early stages of project planning to ensure that your financial projections are valid and accurately take into account the project's tax burden and benefits.***

Different tax incentives apply to different projects based on location, project size, and other tax liability delimiters, so you will need to explore what is currently available and applicable to your project.

This section provides information on currently available (as of spring 2007) tax incentives that have significantly contributed to wind energy development. It also explains mechanisms for utilizing them to improve your project's bottom line. The application of many of these tax benefits is also outlined in the Business Models, Financing, and Project Calculator sections. The role of the tax consultant is covered in further detail in the Project Development section.

Federal Tax Incentives
State Level Tax Incentives
Taxation of Wind Energy Property
Additional Resources for Taxes and other Incentives

Federal Tax Incentives

The Federal Production Tax Credit

The Federal Production Tax Credit (PTC) is a 1.9¢/kWh credit (adjusted annually for inflation) that projects can earn during the first ten years of production. This credit, found in section 45 of the IRS tax code, has been the single largest driver of wind energy development in the United States to date, despite its continual need for renewal by Congress. Currently, the PTC is extended through the end of 2008, and advocates are pushing for further extension.

In order to qualify, an individual taxpayer must own the wind project and either materially participate[3] in the project or have tax liability from passive income that the PTCs can be credited against.[4] For individuals who do not materially participate, they must receive enough passive income (such as rental income or income from businesses in which they participate only as an investor) to produce a tax liability against which the credit can be applied.

[3] See Internal Revenue Service Publication 925.
[4] United States Government Accountability Office, *Renewable Energy: Wind Power's Contribution to Electric Power Generation and Impact on Farms and Rural Communities*, 42 (September 2004), available at: http://www.gao.gov/new.items/d04756.pdf

Fully utilizing the PTC is a difficult hurdle for most farmers.[5] If a farmer, rancher, or landowner does not materially participate in a wind project, the credits cannot be applied against the farmers' income from active farming businesses, wage income, or interest and dividend income. Even when a farmer materially participates, the value of the tax credit usually exceeds an individual's tax liability from the wind project plus any other sources.

Community wind developers need to be aware that the PTC amount for an individual project may be reduced by the use of other federal or state funding, such as U.S. Department of Agriculture Farm Bill grants. For example: if your community project receives a 25% USDA grant to help with project costs, the project will be eligible for only 75% of the PTC.

At-a-Glance: Passive Tax Appetite

Income from certain types of investments, such as rental activities or business and trade activities that you do not materially participate in, qualifies as passive income. Tax paid on this income is considered passive tax. To take advantage of the Federal Production Tax Credit (the PTC), you or a project partner must be paying taxes that fit into this category of tax liability if you are an investor in the project but do not materially participate in its operation.

For more information on PTC utilization and its interaction with other incentives see:

"Avoiding the Haircut: Potential Ways to Enhance the Value of the USDA's Section 9006 Program" written by Mark Bolinger of Lawrence Berkeley National Laboratory: http://eetd.lbl.gov/ea/ems/reports/61076.pdf.

"Publication 925: Passive Activity and At-Risk Rules" a publication by the Department of Treasury: Internal Revenue Service: http://www.irs.gov/publications/p925/ar02.html

PTC & the "Flip." Many locally owned, for-profit entities are eligible for the PTC, but their modest tax appetites limit the amount of the tax credit they can utilize. The "Minnesota Flip" is a business model designed to help local wind project owners with minimal tax credit appetite pair up with a larger entity that has a more substantial tax burden. Because the tax credits available to project owners are typically proportional to their level of ownership in the project, the tax-motivated entity is the majority owner in the first ten years of production and often pays a "management fee" to the local owner in lieu of power sales revenue. Once the tax incentive period ends after year 10, the majority ownership of the project "flips" to the local owner, and the tax-motivated investor takes a minority share in the project. For more information, see the The Minnesota Flip section.

Clean Renewable Energy Bonds (CREBs)

Clean Renewable Energy Bonds are available to entities that are not eligible for the PTC due to their non-taxable status, including state and local governments, municipalities, rural electric cooperatives, Native American tribal governments, and public and private non-profit organizations to finance renewable energy projects. After the bonds are issued, their interest is paid by the federal government in the form of tax credits, creating an interest-free source of financing. The IRS received over $2 billion in applications for the initial $800 million available, which led to about the expansion of the program to an additional $400 Million for 2007. With the popularity of the program there are serious discussions about expanding the

[5] GAO, 41.

program to include more allocations in the future for more than one funding cycle at a time. For more information on CREBs visit: www.windustry.org/community/crebs.htm

Modified Accelerated Cost-Recovery System (MACRS or Accelerated Depreciation)

With accelerated depreciation, wind projects can write off the value of their equipment on their financial balance sheets over 5 years rather than the typical 20-year projected lifetime of a project. While accelerated depreciation is available to all wind energy projects, the level at which a project can take advantage of this program is, like the PTC, limited to the project owners' applicable tax burden. Community wind project owners that typically have a small tax burden may not be able to take advantage of accelerated depreciation without taking on a tax-motivated investor with a sufficient tax appetite to claim the entire incentive.

Example: Modified Accelerated Cost Recovery System

The depreciation of wind projects is based on a table which calculates the depreciation of wind energy assets taken at the midpoint of the calendar year. This causes the five year accelerated depreciation to actually continue into year six.

For a $10 million wind energy investment, the loss due to depreciation in years one through six becomes:

Year	Depreciation	Year-end Value	% Depreciation of Initial Assessed Value
1	$2,000,000	$8,000,000	20%
2	$3,200,000	$4,800,000	32%
3	$1,192,000	$2,880,000	19.2%
4	$1,152,000	$1,728,000	11.52%
5	$1,152,000	$576,000	11.52%
6	$576,000	$0	5.76%

This is a simplified example to give a flavor of the benefits possible if you are able to structure it to efficiently capture tax incentives. It should not be used to make financial projections. Like any large investment, you should consult a tax professional with experience in corporate tax law to accurately develop your assumptions. For more information, see: http://www.dsireusa.org/documents/Incentives/US06F.htm

Alternative Minimum Tax

The Alternative Minimum Tax (AMT) is confounding for many Americans who find themselves suddenly beholden to the IRS for taxes they thought they didn't owe. AMT can be thought of as a different tax system with different rules and deductions; taxpayers must compute their taxes under both the regular tax and AMT rules and then pay the greater of the two. The purpose of the AMT is to prevent those in the highest tax bracket from getting by from year to year tax free. A consequence is that many unsuspecting taxpayers who make less than $100,000 a year with certain kinds of investments and deductions end up having to pay AMT. Investing in certain types of businesses can trigger the AMT.

The only way to determine if your investment in a wind project will trigger the AMT is to work with a tax professional to fill out IRS Form 6251. If it turns out that your AMT is higher than what you would pay normally, then your investment in a wind project will limit your ability to utilize the PTC and other tax credits available to wind energy investors. Form 6251 can be found on the IRS's website by searching for the form by number: www.irs.gov.

State Level Tax Incentives

Production Tax Credits

In 2005 the state of Iowa instituted both a corporate and individual income tax credit for wind energy projects. Sections 476C (individual) and 476B (corporate) afford for a 1.5 cent/kWh and a 1.0 cent/kWh production credit respectively for qualifying projects with the idea that projects that were owned by Iowa individuals and businesses could compete with wind projects that could more easily capture the PTC. These sections of the tax code authorized 90 MW (476C) and 450 MW (476B) of wind projects to receive the payments.

To qualify for the personal tax credit the wind energy facility must be at least 51% owned by qualifying Iowa entities as defined in the statute.

To qualify for the corporate tax credit the project must only be approved by the Iowa Utility Board.

Two months after the credit was created the allocations were completely filled up with waiting lists of projects.[6]

Sales Tax Exemption

Several states have exempted sales tax on equipment, infrastructure, supplies and replacement parts for wind systems. To see if your state has an exemption on sales tax on wind energy systems visit the Database of State Incentives for Renewable Energy: www.dsireusa.org.

Taxation of Wind Energy Property

Property Taxes and Payments-In-Lieu-of-Taxes (PILOT)

Several states and localities have exempted renewable energy systems from property tax in order to promote development. This has a favorable impact on the economics of a project because the addition of a several million dollar wind project to

[6] For more information about Iowa Renewable Energy Production Tax Credits visit the Database of State Incentives for Renewable Energy's page on Iowa Incentives for Renewables and Efficiency: www.dsireusa.org

a parcel of land could send the assessed property value through the roof, greatly increasing the tax burden to the landowner or project developer.

Many communities in areas where wind development is prevalent and renewable energy systems are exempt from property taxes negotiate payments (PILOTs) between the local taxing authority and the project. These payments compensate for excessive use of infrastructure in the area while developing the project and allow the local community to benefit from wind energy development. Property taxes and PILOTs contribute a great deal to the tax revenue of many windy rural areas and aid in the development of new schools, community centers, and other local programs. Project developers opt to enter into PILOT contracts in order to be good neighbors to the community, while other areas may require these payments before local authorities grant permission to build.

The New York State Energy Research & Development Authority (NYSERDA) has developed detailed information on property tax exemptions and payments-in-lieu-of-taxes as part of their Wind Energy Tool Kit. Much of the information is specific to the state of New York, but the descriptions of the different types of payments may be transferable to other parts of the country. For more information, see: http://www.powernaturally.org/Programs/Wind/toolkit/19_propertytaxexemptions.pdf.

Taxation based on production

Some states tax energy facilities based on the energy produced. Minnesota, for example, has a tiered tax structure on energy production. The tax rate is determined by the size of the project.

- Large-Scale Wind Energy Conversion Systems: Projects with installed capacities of 12 MW or greater will make payments of 0.12¢/kWh.
- Medium-Scale Wind Energy Conversion Systems: Projects with installed capacities between 2 and 12 MW will make payments of 0.036¢/kWh.
- Small-Scale Wind Energy Conversion Systems: Projects with installed capacities between 250 kW and 2 MW will make payments of 0.012¢/kWh.
- Systems with installed capacities less than 250 kW are exempt from the production tax.

The tax structure was set up this way to level the tax playing field between small projects and large projects, as well as to promote smaller locally-owned projects by not placing undue burden on them. It is important to consult with the local tax authority to determine how the project will be taxed. More information on taxation of wind energy facilities in Minnesota: http://www.windustry.org/resources/tax.htm.

Additional Resources for Taxes and other Incentives

- **Database of State Incentives for Renewable Energy (DSIRE)** – DSIRE is a comprehensive source of information on state, local, utility, and federal regulations and incentives that promote renewable energy and energy efficiency. www.dsireusa.org

- **"Avoiding the Haircut: Potential Ways to Enhance the Value of the USDA's**

Section 9006 Program." Prepared by Mark Bolinger of Lawrence Berkley National Laboratory to address concerns regarding the interaction between the USDA Farm Bill and the federal Production Tax Credits for wind energy projects. http://eetd.lbl.gov/ea/ems/reports/61076.pdf.

- ***"A Comparative Analysis of Community Wind Power Development Options in Oregon****,"* prepared for the Energy Trust of Oregon by Mark Bolinger, Ryan Wiser, Tom Wind, Dan Juhl, and Robert Grace, published August 2004. An examination of potential community wind project ownership structures in the Northwest and the types of support needed to make them viable. www.energytrust.org/RR/wind/OR_Community_Wind_Report.pdf.

  A version of this report was adapted for applicability beyond Oregon by Mark Bolinger for Lawrence Berkeley National Laboratory in November 2004. http://www-library.lbl.gov/docs/LBNL/567/03/PDF/LBNL-56703.pdf.

- ***The IRS*** – Look up information on various tax codes, forms, and agencies to contact for tax advice. www.irs.gov

Choosing a Business Model

There are several options for structuring a community wind energy project. Business structure options should be evaluated based on their ability to deliver low-cost wind energy and local benefits, as well as on their profitability. In general terms, business arrangements are best when they:

- Make optimal use of state and federal incentives (tax credits, production payments, accelerated depreciation, and grants);
- Attract lenders offering low interest rates and long financing periods;
- Provide an acceptable rate of return for investors; and
- Facilitate local investment.

The structure you choose for your wind energy business will depend on three main factors: 1) tax credit appetite and legal feasibility; 2) risk and return; and 3) time and effort.

1) Tax Credit Appetite and Legal Feasibility. Your ability to use tax incentives will be the primary indicator of your business model. Depending on the laws and incentives in your state and county, some forms of ownership may be difficult to pursue. Others will be more advantageous. Sound financial and legal advice is imperative before you choose a business structure. It is critical that your business is structured to take advantage of as many federal and state incentives as possible to be competitive. In most states, an LLC will be better able to use tax incentives than a cooperative business.

Windustry recommends consulting with both an accountant and an attorney experienced in wind development and able to understand your particular situation to help you apply the most favorable business structure for your community wind energy project.

2) Risk and Return. As with most business ventures, this rule holds true: The greater the risk, the greater the potential return. How much risk are you willing to undertake, and how great a return are you looking for? You should consider the amount of risk you can take with your wind project in light of your other financial commitments.

3) Time and Effort. You need to determine how much of your own time and effort you are willing to put into this venture and whether you are able and prefer to serve in an "active" role or as a "passive" investor. Some business structures will require more participation from you than others. Material participation is the primary driver of business structure with respect to time and effort. For example, if you decide to own your own turbine, you will be responsible for repairs and maintenance. So you must either contract for maintenance or become an expert in wind turbine electronics and find yourself regularly climbing your turbine towers. Farmers who materially participate in the project by assisting with construction, performing operations and maintenance (O&M), or providing other services is able to take the federal Production Tax Credit (PTC) against their active income, and may not need outside equity. In contrast, a farmer who does not materially participate probably will not be able to take the PTC and may instead decide to purse a "Minnesota Flip" structure, described below.

An individual farmer planning to put up one or two large turbines should expect to spend at least 10-20 hours per week for two years participating in the development of the project, whether the business is structured based on sole ownership or with outside investors in a Flip structure. An equity drive and other phases of project development may require full-time effort, somewhat independent of the business model selected.

This chapter includes discussion on:

Business Model Options

As with any business venture, there is more than one way to structure your involvement. Do you want to own a wind turbine by yourself, or join forces with a partner? Or do you want to lease your land to someone else? You can financially participate in wind energy development in three basic ways.

1) Contract with a wind developer or investors to own the project
2) Form a joint venture with others
3) Own the turbine or turbines yourself

Contracting with Developers

A wind developer is an individual or company that develops, constructs, owns, operates, and/or manages wind projects. Many developers perform several but not all of these roles. Developers essentially act as "middlemen" between landowners who have good wind resources and power suppliers or power marketers who buy electricity. Electric companies sometimes own the wind project and contract directly with landowners to host the turbines.

Under this model, landowners hosting turbines can enjoy a fairly hands-off or involvement-free method of harvesting wind energy, as the developer assumes all financial obligations and liabilities. Developers usually sign contracts with landowners for either fixed yearly payments, a percentage of the annual revenue, or a combination of the two.

Contracting with a wind developer involves the least time, least effort, least risk, and, of course, the least reward and lowest amount of control over a project. Developers typically approach property owners with specific projects in mind. Once you sign a contract to allow wind turbines on your land, you are not obligated to do any more work. This business structure is currently the most common form of large-scale wind ownership, mainly because turbines are so capital intensive. For more information about wind energy leases and easements, visit the Leases and Easements section of this Handbook.

Investing with Others

Developers make their money by selling wind projects in various stages of development to the ultimate project owners who earn favorable returns through tax incentives and sales of wind-generated electricity to power suppliers or power marketers. In order to maximize their profit, they must build projects that produce that electricity at the lowest cost possible. If you can take advantage of tax incentives and sell your wind energy yourself, perhaps with other partners but without a developer as a middleman, you will likely earn greater revenue than with a fixed lease payment. However, you will also assume greater risk and responsibility.

If you decide to build a partnership or pursue a joint venture to retain equity in wind turbines, you may choose to form a cooperative or create a pass-through entity, of which there are several types.

Cooperative. In this form of business organization, the business is owned and controlled by those who use its services. Returns are based on patronage, not investment. Your cooperative can be either tax-exempt or non-tax-exempt. Cooperatives have a long tradition in the rural U.S., including farm-based energy enterprises such as ethanol cooperatives. However, the development of wind cooperatives has been hampered by their inability to take advantage of the federal production tax credit.

In 2003, Minnesota passed a law allowing a new way to form cooperatives with investor members. This new structure might prove to be more beneficial for using wind energy incentives and raising capital. If successful, it can serve as a model for other states interested in providing more opportunities for wind power cooperatives. (A summary of the new Minnesota law is available from the Minnesota Association of Cooperatives: www.wfcmac.coop/coops/mac/billsf679/Ch308Bsummary.pdf.)

Pass-through entities. A pass-through entity business structure allows tax credits and operating gains and losses to be allocated to the members of the entities rather than remaining with the entity itself. Some examples of pass-through entities that would qualify for the federal production tax credit include: limited liability companies, partnerships, limited liability partnerships, and sub-chapter "S" Corporations.

Limited Liability Company (LLC)

For several reasons, limited liability companies (LLCs) have become the structure of choice for farmer-owned wind projects. The characteristic factor of an LLC is that individual owners are not liable for debts and other claims incurred by the business (i.e., the owners' personal liability is limited to the amount invested in the LLC – personal assets are shielded from risk). This also offers owners some legal protection in case of accidents and disasters. In this type of structure, gains and losses are most commonly allocated to the individual investors in the LLC, who pay personal income taxes on them.

LLCs have several advantages over the other pass-through entities. An LLC can elect to be treated as a partnership, both for federal and state tax purposes. This means that if a LLC makes or loses money, the income or loss is allocated to each individual investor (i.e., member) of the LLC, who pays any taxes on a personal income basis. In other words, the LLC itself (unlike a corporation) pays no taxes.

An LLC is also eligible for the federal production tax credit (PTC), which again is passed through to each member, usually in proportion to each member's level of investment in the LLC. In some cases, locally-based wind projects must find a large equity partner with enough tax liability to fully use the PTC. In other cases, a group of local investors may have sufficient tax liability to take their share (or at least enough of their share to make the project viable) of the PTC, thereby obviating the need for large corporate equity partners. For example, the case study section includes a case study of Minwind I & II, two farmer-owned LLC wind projects in Luverne, Minnesota that have succeeded without partnering with a tax-motivated equity partner.

Partnership

Partnerships are a little more risky than LLCs. In most partnerships, liability for the partnership's debts and liability for personal debt are considered to be "joint-and-several." This means that each partner's personal assets are at risk for any debts or obligations incurred by the partnership. So if only one partner has money, he or she is going to pay if anything goes wrong. Investors in partnerships can mitigate this risk by prohibiting the partnership from taking on debt.

Limited Liability Partnership

The main characteristic of a Limited Liability Partnership (LLP) is that liability is limited for at least one class of partners. LLPs, in many instances, consist of at least one general partner (whose liability is unlimited) and one or more limited partners (whose liability is limited). As with LLCs and other corporate structures, Limited Liability Partnerships have limits on the number of accredited and non-accredited investors; if you have over a certain number, you are required to file with the Securities and Exchange Commission (SEC) and follow procedures that could be costly. Also, if anyone dies or leaves the partnership, then you have to re-form it every time. LLPs are generally not used for wind energy businesses because in many states they are limited to certain professions and generally partners can be held responsible for liability from negligence. In the case of a wind energy business this liability can run into the hundreds of thousands of dollars or millions, exposing investors to significant risk.

"S" Corporation

An "S" Corporation may be advisable in certain specified situations; however, for this discussion, we should assume that there are too many rules and regulations that may prevent application here. For example, you can have only a limited number of members in an "S" Corporation, and you have only one class of stock, which may prohibit allocation of tax credits on anything other than a pro rata basis.

Own the Turbines Yourself

Local and community ownership are additional emerging models of wind power development. If private interests can benefit from wind, why can't local landowners and public groups do the same? A community-based project is perhaps the best way for the broadest group of people to participate in and benefit from harvesting the wind.

The most common example of this kind of project to date has been municipal utility-owned wind turbines. A number of projects in Minnesota, Iowa and around the country show how community interest in wind power has driven the local utility to build small commercial-scale wind plants. Wind turbines at schools are also gaining popularity as another model for community-based ownership, especially in Iowa where several school districts have discovered that wind energy can bring a new revenue stream for the school while providing an innovative tool for class projects and hands-on learning. The Case Study section of the Handbook contains a number of examples of community-owned wind projects.

Models in Practice

Minnesota Flip

The Minnesota Flip is a business model, typically in the form of a Limited Liability Company (LLC), that was created to provide a mechanism for local investors with limited tax liability to partner with corporate equity investors to take advantage of the Federal Production Tax Credit (PTC). Local investors contribute some startup capitol to perform much of the pre-development and development work, and an outside (tax-motivated) investor with a significant tax liability contributes much of the construction capitol. Typically, allocation of the PTC to participants in the LLC is proportional to the level of ownership in the LLC. The tax-motivated investor typically owns a significant portion of the LLC, 99% or more, during the first ten years of the project's operation, when the PTC is available. When the PTC expires the tax motivated investor "flips" or sells the majority of their portion of the business over to the local owner. The amount of ownership that is transferred to the local owner after year ten is generally calibrated to the level acceptable to the IRS so as not to trigger an audit. Many projects have been developed in this manner in the state of Minnesota and the model is easily transferable to other states. For more in depth information visit the section of the Handbook about the Minnesota Flip .

Cooperative

To date there have not been any wind projects that have been developed under the cooperative model. Cooperatives, as they are defined in law, provide benefits to cooperative members proportional to their level of involvement. A farmer's dividend from a corn-based ethanol cooperative, in general, is defined by the number of bushels of corn that the farmer sells to the cooperative. After the initial contribution of capitol to a wind project, for most farmers, there is little direct participation in the project aside from electing board members and attending quarterly or annual meetings making it difficult to justify participation and dividend payments. Cooperatives are pass-through entities making it difficult to take advantage of the Federal Production Tax Credit due to little or no passive tax appetite on the part of most investors.

That said, several states, such as Minnesota and Wyoming, have enacted changes to cooperative law to allow for a larger percentage of outside equity investment, increasing the project's ability to utilize tax credits as well as making it easier to acquire significant equity to satisfy lenders, without having to file with the Securities and Exchange Commission.

The National Counsel of Farmer Cooperatives has developed a useful guide that explains cooperatives and how and why they are formed, and provides sample legal documents associated with cooperative ventures: http://www.ncfc.org/info/start/

Minwind or non-PTC reliant

Although most commercial wind projects in the U.S. are in one way or another reliant on sales of Renewable Energy Credits (RECs), either as an additional source of income (if not bundled with power) or as an inducement for a utility to purchase the power (if bundled), several farmer-owned projects have moved forward without relying on the Production Tax Credit, allowing them to use 100% local equity when developing the project. Each Minwind investor uses the PTC to the extent he or she can, in some cases utilizing passive investments in ethanol projects to provide passive income against which the wind project investors can claim the PTC. This keeps the projects in control of the local owners and significantly increases returns for investors. Various incentives, sites with a great wind resource, well-thought-out business plans, and experience in developing other large energy facilities led to the success of these projects. Business models that are not dependent upon the PTC in some cases allow projects to move forward when other projects are stagnating or waiting for Congress to renew the PTC, which makes acquiring equipment, construction teams, expertise, and PPAs much easier. For in-depth information about structuring these types of projects see the Minwind Case Study.

Which Business Model is Right for You?

When creating the structure of your business and determining your participation level in order to maximize the wind energy incentives for which you may qualify, you will want to consider many factors including:

- Your financial goals and the costs and availability of capital, and their influence on the size and structure of the project.
- Your overall return on investment and the expected cash flow in good wind years as well as bad wind years.
- The availability of strategically located sites and your confidence level in the wind resource assessment.

The business model or ownership structure you choose will depend on your current financial situation, your goals, and possibly the enthusiasm or availability of others. Talking with other turbine owners about their business structures can be enormously helpful.

It will take careful and creative thought to harvest your wind "crop". A similar background and skills used for marketing and risk assessment of corn as a commodity can be used for marketing this new renewable energy commodity. There is not one "best" or "only" business structure for a wind energy project, as what works in one situation may not in another. The success of any wind energy endeavor depends on the ability of the owners to maximize the benefits from wind energy incentives. Once again, it is best to consult an attorney and an accountant in order to determine the best business structure for your project.

Additional Resources for Business Models

- A Comparative Analysis of Community Wind Power Development Options in Oregon: http://www.energytrust.org/RR/wind/OR_Community_Wind_Report.pdf
- Stoel Rives LLP - "The Law of Wind – A Guide to Business and Legal Issues," http://www.stoel.com/webfiles/LawOfWind_FINAL_6-19-06.pdf

- Cooperative Development Services of Wisconsin recently published a paper on the LLC model for wind projects. The paper, titled Wisconsin Community Based Windpower Business Plan, is available by contacting:
    - Mary E. Myers
      Cooperative Development Services
      131 West Wilson St., Suite 400
      Madison, WI 53703
      608-244-0118
      memyers@merr.com

Minnesota Flip Business Model

The Minnesota-flip business model was developed in response to a unique combination of federal incentives for wind development and state policies (including a state production incentive) that encouraged development of community-owned wind projects. The structure has proven a successful model for local owners, including land owners and equity investors interested in partnering in the development of wind projects. This partnership allows the equity investor to take advantage of federal tax credits, while providing local owners the economic benefits of ownership.

Over 100 megawatts ("MW") of the 794 MW of installed wind capacity in Minnesota has been developed using the Minnesota-flip business model.[7] Given the recent announcements by Governor Pawlenty supporting the development of an additional 800 MW of community-based energy development and the supporting pledge by the state's largest electric utility, Xcel Energy, to develop 500 MW of wind energy pursuant to Minnesota's Community-Based Energy Development ("C-BED") tariff, it is likely that the number of projects structured under the Minnesota-flip model will increase significantly in future years.

Wind projects can involve a sophisticated and complex set of interrelated decisions and agreements between all participants, and the decision to use the Minnesota-flip business model is just one of many important decisions affecting the financing and legal structure of a wind project. The purpose of this article is to provide a basic understanding of how the Minnesota-flip model works, with a specific focus on the terms of the wind project limited liability company agreement between local owners and the equity investor.

Basic elements of the "Minnesota-flip" business model

The Minnesota-flip model is a business structure developed to allow local owners, including landowners, to own a significant portion of a wind project, while partnering with an equity investor that can use the federal production tax credits ("PTCs") generated from the operation of a qualifying wind project. Under this model, a project limited liability company ("LLC") is formed to own and operate the wind project. The LLC owners include the tax equity investor and another LLC that is made up of local owners. In many cases, the equity investor will reimburse the local owners for their expenses incurred in completing pre-development activities, including permits, wind studies, interconnection and transmission studies, and finance the acquisition of wind turbines and construction of the project. The LLC agreement will allocate the wind project's governance and financial rights between the equity investor and local owners. The project is often structured so that the equity investor has a controlling interest in the project for at least the first 10 years to enable the equity investor to utilize all of the PTCs. Then, at a date determined by all the participants, ownership "flips" so that local owners have a controlling interest in the project for the remainder of the project's life.

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[7] Phone conversation with Jeremy Defiebre, Minnesota Department of Commerce. August 7, 2006.

LLC structure and purpose

In order to set up a Minnesota-flip wind project, the local owners and equity investor must form a LLC to own and operate the wind project.[8] Forming a LLC allows the participants to shield their personal and other business assets from liabilities of the project. At the same time, the LLC can elect to be treated like a partnership for tax purposes. This tax treatment facilitates use of the PTCs and allows each member of the LLC to be taxed separately on income from the project. Forming a LLC also allows the members to separate governance and financial ownership rights, in a manner discussed below.

All of the terms related to contribution of capital, ownership rights, distributions, and allocations of risk are found in the LLC operating agreement. This document is the key contract between participants. The participants negotiate and sign a LLC agreement early in the project development process to allow the equity investor to finance the acquisition of wind turbines and construction of the project.

Ownership rights

"Membership interest" is the term used to describe each member's ownership interest in the LLC. Under the Minnesota-flip model, membership interests are divided into financial rights and governance rights. Some wind projects elect to issue different classes of membership interests. One class may be issued only to the equity investor, while the other class is issued to local owners. The percentage of financial and governance rights held by each member often depends, in part, on their capital contributions.

Financial rights include the members' rights to gross sales, income, state incentive payments, gain, receipt, loss, expenses, deductions, and tax credits. Under most agreements, financial rights also include the right to assign those rights to another individual or entity in a manner agreed upon by the parties. Possessing financial rights allows a member to receive net revenue from the project according to a member's percentage ownership.

Governance rights include all rights, other than financial rights, associated with a membership interest in the LLC. Under most agreements, governance rights also include the right to assign those rights to another individual or entity in a manner agreed upon by the parties. Possessing governance rights allows a member to vote on key decisions according to the member's percentage ownership interest.

The "Flip"

In the LLC agreement, the parties negotiate when the project will "flip," or the date when the members' percentage ownership interests will change. The flip date may be at the conclusion of the 10-year period in which the equity investor receives all the

[8] The participants may choose to form more than one LLC. In some cases, the local landowners may form a LLC ("landowner LLC") during the predevelopment stages. Once they have found an equity investor, the equity investor and the landowner LLC form a new LLC ("project LLC") to own and operate the project. In this example, the project LLC has two just members—the landowner LLC and the equity investor. Alternatively, a separate LLC may be formed for each turbine ("turbine LLCs"). These turbine LLCs would then form one umbrella transmission LLC ("transmission LLC") to operate the entire project and enter into a PPA with a utility.

tax credits that may be produced from the project. More often, the "flip" date is based on the point at which the equity investor has received enough revenue to produce an internal rate of return that the equity investor was looking for from its investment in the project. The internal rate of return necessary to cause a project to flip is a number negotiated by the participants at the time the LLC agreement is created. If the equity investor invests capital to finance the acquisition of wind turbines and construction of the project, it will require a higher IRR in order to compensate the equity investor for the risk it takes in completing the project. In addition, the IRR will be affected if the project incurs debt to pay development costs. The IRR may range between 9 percent to 14 percent depending upon the wind project.

> "Internal rate of return" (IRR) is a financial calculation that compares the present value of a project's expected revenues with the present value of its costs. The IRR is the discount rate, expressed as a percentage, that makes the net present value of the project's capital costs and income, including cash, depreciation, and PTCs, to the equity investor equal to zero. By doing this calculation, investors are able to see the project's expected rate of return.

Prior to the flip date, the equity investor usually retains a majority interest in the financial rights in the project, usually 99 percent of the LLC's financial rights. This means that most of the net revenue from the project will be allocated to the equity partner to repay the capital contribution made by the equity investor. The equity investor will also receive all of the PTCs and accelerated depreciation. In addition to having a majority interest in the financial rights, the equity investor may hold a majority interest in the governance rights of the project as well, usually 99 percent of the LLC's financial rights. With these governance rights, the equity investor is able to control management of the project and the return on its investment in the project.

When the project reaches the flip date, the members' percentage ownership interest in the financial and governance rights of the project change based on the terms of the LLC agreement. For example, if the equity investor held 99 percent of the financial rights and the local owners owned 1 percent in the first 10 years, after the flip date, the equity investor might own just 1 percent of the financial rights and the local owners would then own 99 percent.

The change in percentage ownership interest after the flip date varies from project to project. In some projects, the financial rights may be split so that the equity investor owns 99 percent in the first 10 years and retains 20 percent in the last 10 years. In this case, the local owners go from a 1 percent interest in the first 10 years to an 80 percent interest in the second 10 years. Majority interest in the project's governance rights may also take a variety of forms. The percentage may remain constant, with the local owners retaining a 51 percent interest in the governance rights throughout the life of the project. Alternatively, the majority interest in the governance rights may also flip, so that the equity investor has 99 percent of the governance rights in the first 10 years and only 1 percent in the second 10 years.

Capital contributions

Securing capital contributions is a primary reason that the Minnesota-flip is attractive to local owners. Under the Minnesota-flip, local owners contribute start-up capital to the project in order to secure initial regulatory permits, assess the wind resource, apply for interconnection of the project to the transmission system, and begin the predevelopment work on the project. These local owners may also lease their property to the project. The equity investor then contributes the cash necessary to acquire turbines and construct and operate the wind project.

Many LLC agreements also include provisions stating that if a project needs additional capital during its lifetime, the LLC may ask the members to make a loan to the LLC according to each member's percentage ownership interest. If the loan occurs before the end of the first 10 years, the loan's principal and accrued interest may be due and payable before the project can flip.

Distributions and allocations

The designation of distributions and allocations determines when the participants receive revenue from the project and the amount of revenue that each receives. The formula for determining this arrangement is included in the LLC operating agreement.

1. Distributions

Distributions to the members are made from the net revenues of the project. Costs related to operation and maintenance reserve accounts, scheduled and unscheduled maintenance, taxes, lease payments, insurance, and other expenses are subtracted from the wind project's total revenues before distributions are made. Members receive distributions in proportion to their membership interests. Distributions are made at the discretion of the project manager or upon approval by a management committee. In addition to regular distributions, local owners also receive lease payments for any land leased to the project. In addition, local owners may receive service and management fees from the project during the first 10 years when they are only eligible to receive a small share of the net revenues.

2. Tax allocations

a. Production tax credit

A significant portion of the value of a wind project comes from PTCs. Congress authorized the PTC in the Energy Policy Act of 1992 and has amended it several times. Section 45 of the Internal Revenue Code provides PTCs for certain types of renewable power generation, including wind projects. The PTC provides an inflation-adjusted 1.5¢/kWh credit for a 10-year period. During calendar year 2005, the credit equaled 1.9¢/kWh[9] and the credit currently is scheduled to expire on December 31, 2008.

The value of the PTC is equal to between one-third and one-half of the revenue that can be earned from the project through a long-term power purchase agreement.[10] However, the credits are difficult for most individual taxpayers to use. In order to qualify, the taxpayer must own the wind project and either materially participate in the project or have tax liability from passive income that the PTCs can be credited

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[9] IRS Form 8835 (2005).

[10] Bolinger, Mark, *Avoiding the Haircut: Potential Ways to Enhance the Value of the USDA's Section 9006 Program*, Ernest Orlando Lawrence Berkeley National Laboratory, 6 (July 2006), available at: http://eetd.lbl.gov/EA/EMP.

against.[11] In order to "materially participate" in a wind project, an individual must participate more than 500 hours during the tax year.[12] For individuals who do not materially participate, they must receive enough passive income (such as rental income or income from businesses in which they participate only as an investor) to produce a tax liability against which the credit can be applied.

Fully utilizing the PTCs is a difficult hurdle for most local owners.[13] Many local owners do not materially participate in the wind projects; therefore, the PTCs cannot be applied against the local owner's income from active farming businesses, wage income, or interest and dividend income. Even when a local owner materially participates, the value of the tax credit usually exceeds the local owner's income from the wind project as well as other sources.[14] In addition, application of the alternative minimum tax may prohibit a person from utilizing the PTCs. Local owners should consult with a tax expert before they invest in a wind project to determine whether they can utilize any PTCs.

One of the benefits of the Minnesota-flip structure is that it allows farmers and other project organizers to partner with an investor that can utilize the PTCs. Therefore, PTCs credits are often allocated solely to the equity investor for the 10-year period that they are available.

b. Accelerated depreciation

Under the Minnesota-flip structure, accelerated depreciation is allocated to each member according to members' percentage ownership interest. Generally the depreciation expense is allocated to the equity investor during the first 10 years. Section 168 of the Internal Revenue Code provides a Modified Accelerated Cost Recovery System that allows certain wind project equipment including turbines, generators, power conditioning equipment, transfer equipment, and related parts, to be recovered through an accelerated income tax deduction for deprecation. Under this provision, a portion of the total project costs qualify for 5-year, double declining-balance depreciation.

Project management

Projects may be managed by a management committee made up of a specified number of members of the LLC, or by a general manager named in the LLC agreement. When management is conducted by a committee, representation on the management committee is divided between the local owners and equity investor. Voting rights of the members of the management committee may reflect the members' percentage ownership interest held by each member. For example, if equity investor holds 99 percent of the governance rights, management committee members representing the equity investor can be assigned collective voting power equal to 99 percent.

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[11] United States Government Accountability Office, *Renewable Energy: Wind Power's Contribution to Electric Power Generation and Impact on Farms and Rural Communities*, 42 (September 2004), available at: http://www.gao.gov/new.items/d04756.pdf
[12] See Internal Revenue Service Publication 925.
[13] GAO, 41.
[14] Id.

The LLC agreement will often include a provision stating that the management committee must unanimously approve certain matters. This provision is important to protect the member who lacks sufficient governance rights from company actions that could adversely affect their financial interest in the project. These matters may include: issuing membership interests to a third party; amending, repealing, or altering the LLC agreement or articles of organization; securing a loan; approval of annual capital and operating budgets; and merging, consolidating, or reorganizing the LLC.

1. Who manages the project

When negotiating the LLC agreement, the parties will determine who will manage the project and how the managers will be selected. Project management may switch from the equity investor to the local owners when the majority interest in the financial and governance rights of the project flip. Alternatively, the participants may designate a third party to manage the project.

2. Responsibilities of managers

Managers are responsible for the day-to-day operations of the project and receive an annual salary and reimbursement for expenses incurred on behalf of the project. Managers will often serve as the chief manager and treasurer of the project LLC.

Managers are responsible for making sure the project operates within a budget, meets the requirements of the power purchase agreement, interconnection agreement, and any applicable state and federal laws. In addition, managers prepare information for the management committee and staff all management committee meetings.

Managers are prohibited from unilaterally engaging in transactions that require a vote of approval from all members with governing rights. Therefore, managers may need the approval of the members owning governing rights in order to establish annual budgets, approve loans or financing, amend regulatory contracts or agreements, purchase or sell turbines, or other material transactions. These restrictions on the manager’s authority ensure that members with a minority interest retain certain rights in the project.

3. Other issues

- **Leases**

During the life of the project, local owners who lease land to the project receive lease payments for the use of their land. These payments are often made annually. In some arrangements, each landowner receives an equal lease payment. Often, landowners receive higher lease payments for turbines actually located on their property than if their land is simply needed for other purposes. Any other distributions made to the local owners over the life of the project are in addition to these standard lease payments.

- **Transfer, sales, and redemption**

Each participant may transfer his or her rights in the project to another party without forcing the LLC to undergo any reorganization. It is typical that the other members must approve any transfer, especially a transfer of governance rights, before it takes place. This provision helps ensure that the new parties will be able to work together during the remainder of the project's lifetime. Depending on the LLC agreement terms, it can also create difficulty, in some cases, if a member's estate plan calls for a transfer of interest to children or other heirs.

After the flip date, the local owner members often may have the option of redeeming the equity investor members' interest in the LLC. The equity investor's interest can be redeemed at fair market value, leaving the local owners owning 100 percent of all financial and governance rights in the wind project. It is important that the redemption occur after the flip date, so that the local owners are purchasing only a minor share (usually 1 percent) of the project.

- **Indemnification and limited liability**

When members act in good faith on behalf of the LLC, they are typically protected against any loss, expense, or injury they might incur. The LLC itself will cover expenses related to defending against most lawsuits as long as the member is acting in an official capacity.

Creating a LLC also allows the parties to limit the personal liability of participating members. This legal framework is important, especially when members hold interests in several wind projects. By setting up a LLC, the individual member's liability can be limited to their investment in that project. Under the limited liability provisions, a member's risk is usually limited to the amount of the member's capital contributions and percentage ownership interest in the project assets.

Conclusion

The Minnesota-flip structure was developed in response to a unique combination of federal incentives for wind development and state laws that encouraged development of community-owned projects. The structure has proven a successful model for local owners and equity investors interested in partnering in the development of wind projects. This partnership allows the equity investor to take advantage of federal tax incentives, while providing local owners and other landowners the economic benefits of ownership. Understanding the key terms of the Minnesota-flip structure is essential to constructing a successful project using this model.

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Interconnection – Getting Energy to Market

The electrical generation, transmission, and distribution system has been labeled the most complex machine ever created by humans. There are many rules and regulations to ensure that it runs reliably, and as a result the process for interconnecting your energy project with this system involves dealing with regulatory agencies at the state and regional level as well as utility personnel, engineering consultants, and lawyers with experience with interconnection contracts. It can take over a year to complete the required interconnection studies and can cost your project up into the hundreds of thousands of dollars. You will need to weigh the results of conversations and studies to determine if it is worth moving on to the next phase of studies or if the cost of interconnection will not allow your site to be profitable.

This section of Windustry's Community Wind Handbook is designed to help you through the process by breaking it down into stages and defining the key concepts and vocabulary you will need to understand while moving through the process. Below is a summary of the process:

1. The first step is to have conversations with those who have an understanding of the system in the area where you propose to connect your project. Keep in mind:
   - ✓ Your commercial-scale wind site requires three-phase transmission (typically 69 kilovolts (kV) or higher for larger projects, above about 10 MW in size) or distribution lines (under 69 kV for smaller projects from 0-10 MW in size)[15].
   - ✓ These lines need to have enough available capacity to carry your power output, or you will have to pay to have the lines rebuilt or reconductored to a larger size which can handle the power from your project.

230 kV transmission line. Notice the three wires or conductors hanging from each tower. Three or four wires generally will signify a three phase transmission line. **Picture source: U.S. Department of Labor: Occupational Safety and Health Administration**

2. If applicable, the next step is to go through the Midwest Independent System Operator (MISO) or other regional transmission operator (RTO) process if you are connecting to a power line owned by a utility who participates in an RTO. Some utilities are still independent and will study

[15] These power line ratings and project sizes are general guidelines. The size of project that can connect to a particular area of the power grid is dependent on many other factors, including feeder loading, substation capacity or MVA rating, existing protection scheme of the power system, and conductor size. Depending on these factors, smaller projects may not be able to connect to lower voltage lines.

the interconnect with their own staff and process. In most cases you will likely need to complete a MISO or RTO study, which includes the following:

- ✓ Interconnection Application
- ✓ Feasibility Study
- ✓ System Impact Study
- ✓ Facility Study
- ✓ Optional Study (for example, a transmission deliverability study is one option)
- ✓ Interconnection Agreement

3. The final step is executing the agreements and constructing the additional infrastructure needed to get your energy on the grid.

Most wind project developers choose to hire an engineering consultant to help them properly fill out the required forms, interpret study results, and to act as a liaison between the project, MISO or your RTO, and the interconnecting utility. Here are some quick links to the major topics covered in this section of the Handbook:

Understanding the Transmission and Distribution System
The MISO Process
Interconnection Agreement
Additional Resources for Interconnection

Understanding the Transmission and Distribution System

Site Selection

Look for three-phase power lines. Access to electric power lines is just as important as having a great wind resource in order to bring your energy to market. Just as a farmer cannot bring his 100 bushels of soy beans to market without roads and railways, your community wind project cannot deliver its energy to market without access to the electricity transmission and distribution system.

You should begin the process of selecting a site for your project by looking for three-phase power lines in windy areas. If you cannot find available land for lease to develop wind energy that is close to transmission or distribution lines, it will probably be too expensive to interconnect your project. Depending on the capacity required, new power lines can cost anywhere from $50,000 to $200,000 per mile, a cost that will be added to your project budget. The U.S. Department of Labor: Occupational Safety & Health Administration has a great online guide illustrating generation, transmission, and distribution equipment in an easy to understand format: http://www.osha.gov/SLTC/etools/electric_power/illustrated_glossary/index.html

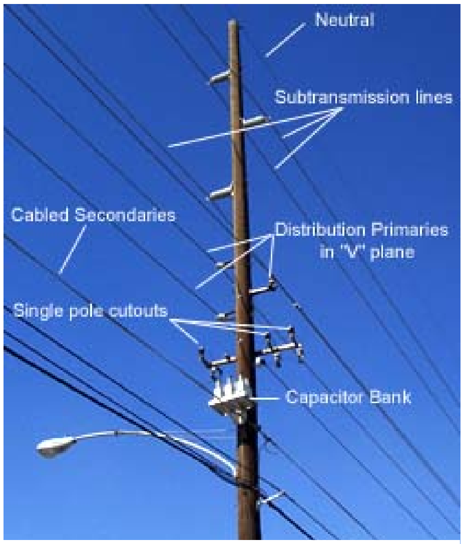
For one or two turbine projects it is advisable to connect the project at distribution level voltages, which generally does not require the construction of a substation for the project. Connecting to the transmission system requires building a substation which can cost $1 million dollars or more. This added expense is often much too large for a smaller project to stay profitable. Larger projects will most likely have to connect to higher voltage lines because they require more electrical capacity than distribution voltage lines can provide.

Is there space on the lines? Observing the location of three-phase power lines is very easy. Determining if the lines have enough capacity to handle your power, however, is not clear from visual observation and comprises the lengthy and expensive part of the interconnection process.

At-a-Glance:
Power Line Capacity

Think of the capacity of a power line to transmit power as a river's ability to hold water. A river can only handle so much water before it overflows its banks, just like a power line can only handle so much power before it over-heats, sags and creates a short circuit in a power system. Short circuits in power systems are very expensive to fix, often costing millions of dollars. This is why each proposed commercial-scale wind project must be studied extensively before being allowed to connect to the larger electrical system.

Once you have several sites picked out, talk with the local distribution utility to determine what voltage the lines are and who owns them. If the lines belong to the local distribution utility, often the distribution planning manager will have a good sense of how much energy is on the lines currently and may be willing to provide you with an initial indication on how much potential there is for adding your project to the local grid. Having early conversations with the utility about the size and type of project you are wanting to develop can help them advise you if there may be space for your project's energy on the power lines in your area and can serve as a helpful litmus test for how receptive they will be to your request. Smaller projects in the 0 to 10 MW size range will likely connect to distribution or sub transmission level voltage (12.5 to 41 kV, if one is near by) lines with simpler interconnection studies and technical criteria. Generally projects that are larger than 10 MW will need to connect to the higher voltage (above 69 kV) transmission system because there generally is not enough space on distribution lines to handle power from larger projects.



Subtransmission lines with distribution primaries and secondaries. **Picture source: U.S. Department of Labor: Occupational Safety and Health Administration**

It is important to contact the potential interconnecting utility and the regional Independent System Operator (ISO) early in the planning process. Early and open communication with these organizations is valuable for several reasons:

1. It can help you understand how the interconnection process works;
2. The utility can make recommendations based on their understanding of the grid where you wish to connect; and
3. It can help your project stay on the development track with minimal delays waiting for interconnection study results.

Currently thousands of megawatts of wind projects are in some stage of the MISO interconnection study queue. There may be many wind projects in other windy areas also applying for interconnection. This can result in delays in study results, and can also result in your project not being able to connect to the existing lines because they may have been filled by applicants that are ahead of your project in the queue.

Making contact early and being persistent lets the utility know that you are serious about developing your project, and that they should dedicate their stretched resources to aid in interconnecting your project.

Distributed Generation

In many cases, interconnecting a project at the distribution level can be much easier, and less expensive, for a one or two turbine project than interconnecting at the transmission level voltages. Several states (California, Michigan, Minnesota, New York, Texas, Washington, and Wisconsin) have encouraged distributed generation and co-generation with supportive legislation and regulation because, in many cases, these resources have a lesser impact on the power grid and are less costly to interconnect than larger projects. Generally, it takes less time to plan and requires a simpler interconnection process for smaller projects. This can be good news for smaller community wind projects. However it is important to note that in some instances projects have been stalled or prevented from moving forward because utilities have instituted costly charges for the use of their distribution system to sell electricity. These system usage charges eventually caused the projects to terminate because it was impossible to negotiate a power purchase agreement that would provide a positive cash flow for projects.

Photo Credit: Tom Wind

Case Study: Iowa Lakes Community College

Location: Estherville, Iowa
Ownership: Community College
Size: 1650 kW wind turbine
Year Installed: 2005

Interconnection: The 1650 kW turbine is interconnected to the Estherville Municipal Utility distribution system at 12.5 kV. When operating at rated capacity, the machine produces enough energy to power the entire industrial loop of the city.

Current status: The college has received no complaints from the municipal utility about reliability or power quality issues. The College also has a 3000 kW wind turbine nacelle without blades on a short tower. Both the 1650 kW and 3000 kW are used at the college to train future wind turbine technicians.

In the Midwest, every megawatt-scale wind project interconnecting to the MISO service territory has to begin the MISO process, but if your proposed project can meet state distributed generation interconnection standards and/or MISO small generator interconnection criteria, then much of the expense and time associated with interconnecting can be avoided. (To find out about expedited interconnection technical criteria and procedures visit the New Rules website on Distributed Generation Interconnection Standards.)

The Midwest Independent System Operator (MISO) Process

Through the act of deregulation of the utility industry, the Midwest Independent System Operator (MISO) was formed as a regulating agency over the electric grid that is "independent," as its name implies, from generation, transmission, and distribution companies. The MISO develops rules for the grid that comply with state and national regulations for power system safety, power quality, reliability, and operations, and performs studies for projects that wish to connect to the grid. These studies outline the impacts your project will have on grid power quality and contingency situations in case components in the power grid fail such as power lines, transformers, other generators, etc. The studies also outline what measures (installing new power lines, capacitor banks, fuses, switches, relays, breakers, etc.) must be taken to prevent your project from creating adverse impacts on the grid, and how much these actions will cost your project.

This section briefly touches on each stage of the MISO interconnection process, so that you can begin to understand how to navigate through it. A flow chart of the entire process can be found here:
http://www.midwestmarket.org/publish/Document/3b0cc0_10d1878f98a_-7e1a0a48324a/Visio-MISO%20GI%20Study%20%20Agreement%20Options_rev%20(2).pdf?action=download&_property=Attachment

Interconnection Application

A wind project enters the MISO interconnection queue by filling out the appropriate interconnection request form. Depending on the size of your project, you will follow one of two generator interconnection process tracks:

1. For generators less than 20 MW and are requesting energy resource status or
2. Generators that are greater than 20 MW in size ***OR*** generators that are requesting network resource status.

Projects 20 MW or smaller must:

- ✓ Complete the "Small Generator Interconnection Request Form" and
- ✓ Pay the $1,000 interconnection request fee, which will go towards the total cost of the Feasibility Study to be performed in the next step.

Projects greater than 20 MW must:

- ✓ Complete the "Interconnection Request for a Large Generating Facility Form"
- ✓ Pay the $10,000 interconnection request deposit, and
- ✓ Either demonstrate site control or pay an additional $10,000 if you do not yet have site control.

After you have submitted the interconnection request, you will need to arrange a scoping meeting with representatives from your project, MISO, and the affected transmission utilities. The purpose of this meeting is for the parties to discuss the details of the project; the estimated cost of the feasibility study; and schedules for payments, subsequent studies to be performed, reports to be filed, and agreements to be formed.

Larger projects will be required to choose to be a ***network resource*** or just an energy only generator. A network resource can receive additional revenues from capacity payments for "accredited" capacity with the transmission organization. Typically for wind projects the default capacity rating is 20% of nameplate capacity. Choosing to be a network resource is often a good choice, but it will cost more for studies as well as require deliverability studies into the MISO footprint. The utility that wishes to purchase the energy from your project may want it to be considered a network resource. MISO or other RTO staff will explain the option of network vs. energy resource in more detail, but it will be up to you do decide which route your project will take.

Feasibility Study

After the initial scoping meeting, the MISO Feasibility Study will identify potential adverse system impacts resulting from the interconnection of your project, including a short circuit, thermal, and voltage analysis. This is the point where an electrical engineer with large power system experience can help you understand and negotiate the process of interconnecting your project.

Next, a cost estimate and scope of the Feasibility Study is established, taking into account generator type, size, and potential larger system impacts based on technical interconnection standards and criteria. At this point, the community wind developer will be responsible for:

- Returning the executed agreement to MISO, including generator technical data, which you can obtain from the turbine manufacturer; and
- Making a deposit for the study.

The small generator interconnection study deposit is either another $1,000 or else the total good faith estimated cost of the proposed study, whichever is greater. For large generators the deposit for the Feasibility study is another $10,000. Since the study costs for large projects are often quite substantial, MISO allows them to be paid in several installments as various milestones are reached.

Examples of Feasibility Study Reports can be found on the MISO generator interconnection queue web page in the Feasibility Study Report column of the table: http://www.midwestmarket.org/publish/Document/2a74f7_108e84afbec_-74050a48324a/Queue_Active&Done.htm?action=download&_property=Attachment

System Impact Study

The system impact study will include a power flow, short circuit, voltage, stability, and system protection analysis. These analyses are similar to those brought forward in the feasibility study, but differ in that the results will include a preliminary indication of the cost and length of time that would be necessary to correct any problems identified in the analysis and implementation of the interconnection.

For small projects this study may not be required. If it is required, it may cost anywhere from $500 to $50,000. It is very project-specific, depending upon your project's potential for impacting the larger system as outlined in the feasibility study, and upon which study group your project is placed in. If the study is required the results will be made available to you within approximately 45 business days after the system impact study agreement is signed by all of the involved parties according to the MISO interconnection schedule. It may take longer to receive study results, if your project proposes to interconnect in highly congested areas where many other generator interconnection requests have been filed.

Large generator system impact studies have a similar time frame (45 calendar days according to the MISO schedule), but are likely to have a larger scope and be more expensive because a larger project has more significant potential impacts on the grid. The payment schedule for this study will be worked out in pre-study meetings that outline the details and costs of the study.

Examples of System Impact Study Reports can be found on the MISO generator interconnection queue web page in the Impact Study Report column of the table: http://www.midwestmarket.org/publish/Document/2a74f7_108e84afbec_-74050a48324a/Queue_Active&Done.htm?action=download&_property=Attachment

Facility Study

The Facility Study will specify and estimate the cost and time schedule for the modifications needed to implement the recommendations from the System Impact Study.

Small generators who want to interconnect may be required to deposit the entire estimated cost of the facility study. The time frame for returning results for this study is 30 calendar days if upgrades to the system are not required and 45 business days if upgrades are required.

For large projects, the cost and payment schedule for performing this study will be determined in a pre-study meeting with MISO, the affected utilities, and your project. The standard deposit amount is $100,000 for the facility study for projects above 20 MW in size. The time frame is not standard for large projects and will vary greatly depending on your project's system impacts and required upgrades. It is good to plan some extra time in the project's schedule in case this portion of the study takes longer than expected.

Examples of facility study reports can be found on the MISO generator interconnection queue web page in the Facility Study Report column of the table: http://www.midwestmarket.org/publish/Document/2a74f7_108e84afbec_-74050a48324a/Queue_Active&Done.htm?action=download&_property=Attachment

Optional Study

Interconnecting projects may opt to perform an additional study to determine impacts of alternate system configurations or additional system costs or benefits from the project. This, like all of the other studies, will involve a scoping meeting and a financial deposit for the study. The required deposit and the payment schedule will depend upon the scope and estimated costs of performing the study.

Interconnection Agreement

Executing the interconnection agreement is the final step, which involves agreeing to pay for system upgrades as outlined in the foregoing studies. Legal advice should be solicited as well as consultation from your project's engineer to make sure that the stipulations of the contract are acceptable. Generally, the interconnecting utility will be responsible for performing all of the work to modify the electric grid to accept the power from your project. Your project, however, will be responsible for the costs of these upgrades, which can be substantial (in the hundreds of thousands or even millions of dollars). It is vital to examine all of the proposed upgrades to the system to make sure that they are directly associated with your project and not part of a pre-existing system condition that your project did not create.

It should be noted that an interconnection agreement is not a power purchase agreement. A power purchase agreement is a contract signed between the power purchasing utility and qualifying generator for the sale of energy. Projects can move through the interconnection queue without a signed power purchase agreement. Some wind projects are currently being developed in deregulated power markets as merchant plants. Merchant plants sell their power into the spot electricity market at current market rates. This type of arrangement has the benefit of not having to negotiate a long term price for electricity that will make a project economically feasible, but has the risk of exposing the project to the sometimes volatile fluctuations of electricity market prices.

Interconnection agreements in the MISO service territory for large generators/network resources are standardized, with the appendices filled in with information from the Facilities Study results. The standard agreement for large generators (greater than 20 MW) or generators requesting network resource status can be found at the MISO website:

http://www.midwestiso.org/publish/Document/2a74f7_108e84afbec_-73000a48324a/LGIA_8-11-06.pdf?action=download&_property=Attachment

Additionally if your project cannot demonstrate control of the project site, there is a $250,000 deposit due before the interconnection agreement can be executed.

Currently, no standard small generator interconnection agreement exists. The agreement will typically be simpler than the Large Generator Interconnection Agreement but will cover many of the same stipulations. Contact the MISO or your RTO for more information about small generator interconnection requirements.

Once this process is complete, and your endurance has been tested, you are through with one of the most complex pieces of developing your wind project. Congratulations!

Additional Resources for Interconnection

- Midwest Independent System Operator (MISO): **http://www.midwestiso.org/page/Generator%20Interconnection**
- The U.S. Department of Labor: Occupational Safety & Health Administration showing pictures of electrical transmission and distribution system equipment: **http://www.osha.gov/SLTC/etools/electric_power/illustrated_glossary/index.html**
- New Rules website on Distributed Generation Interconnection Standards: **http://www.newrules.org/electricity/interconnect.html**

Power Purchase Agreements

One of the most formidable tasks in developing a community wind project is attaining the power purchase agreement (PPA). PPAs are lengthy legal documents which define the financial obligations between your wind project and the utility purchasing your energy. They contain language defining when your project can and can not produce energy, payment schedules, reporting obligations, and indemnity clauses in addition to the rate or rates at which the utility will purchase your energy.

It is strongly advisable to enlist the help of an attorney with experience in power purchase agreements. This will be a significant but worthwhile expense that can keep your project out of legal and financial trouble after your project begins producing energy.

Summary of Public Information

Securing a long-term Power Purchase Agreement (at least 10 years and preferably 15-20+ years) with a creditworthy utility that will purchase your wind generated electricity at specified prices is a critical step for establishing project revenue. In a recent review of actual power sales/purchase agreements for 39 wind power projects totaling 2800 MW of capacity, Lawrence Berkeley Lab (LBL) found that PPA terms range from 10 to 33 years with expected wind project capacity factors ranging from 23% to 44%. The projects represented in the sample have commercial on-line dates of September 1998 through December 2005 and account for over 60% of all wind project installed during the 6-year period with project sizes ranging from 9 MW to 297 MW.

Typical Terms

PPA terms can include renewal options, such as in the attached sample PPA for Badger Windpower LLC selling to Wisconsin Electric Power Company found in Appendix A of the Handbook. While the initial contract term is only 10 years, the utility has the option to extend the term twice, for five years and then for at least five and no more than 10 years at the prices listed in Schedule I, for a total possible term of 25 years.

Securing a favorable PPA is a key component in arranging project financing as it guarantees a revenue stream for the electricity output of a project. The rate and terms negotiated will reflect the project size, the quality of the wind resource, existing renewable power mandates or demand for green power in the area and the cost of conventional power generation. LBL found that contract prices, in levelized nominal dollars, range from a low of 1.88¢ per kWh to a high of 8.9¢ per kWh, with an average levelized nominal contact price of 3.7¢ per kWh. A project in Illinois is selling under ComEd's published Rate Rider 4, with prices ranging from 2.88¢ per kWh during the non-summer off-peak period to 5.7¢ per kWh during the summer peak.

LBL's sample includes two wind projects in Minnesota, five in Iowa, and two in Wisconsin, totaling 600 MW. The Minnesota projects, installed in 1998 and 199, have contract costs in the low 3¢ per kWh range. The Iowa projects, installed from 1999 to 2002, have contract costs as low as 2.5¢ per kWh for the most recent project, and as high as 5.2¢ per kWh for an older project. The two Wisconsin projects show the highest contract costs, 5.9-8.9¢ per kWh, well above the average for the other projects included in the dataset and not representative of typical current contracts. However, the contracts with higher prices also typically have lower expected capacity factors, such as the attached sample PPA for Badger Windpower LLC. As defined in Section 1.1(l) and (m) and described in Section 2.4, the contract rate is provided only for the equivalent of a 23% capacity factor, with any excess power purchased at the utility's avoided cost rate. The escalation showing in

LBL found that PPA prices have tended to decline somewhat over the past six years, but with steel prices and turbine supply shortages increasing costs, sale prices for new projects may be somewhat higher than those represented in the contract sample.

In addition to the power purchase rate itself, investors and lenders will be looking at the duration of the agreement (15 or more years is optimal), the creditworthiness of the utility purchasing the power, and the costs of breaching the contract. For example, if a project does not generate as much power as the purchaser anticipates, the project owner may have to purchase power on the open market to make up the shortfall. As described in Section 4.3 of the attached sample PPA, delays in commercial operations can also result in payments for liquidated damages or contract default and termination.

Conclusion

PPAs can be long, complex documents. In recognition of this and in support of community wind projects, some utilities are beginning to standardize and simplify their PPAs for small distributed projects.

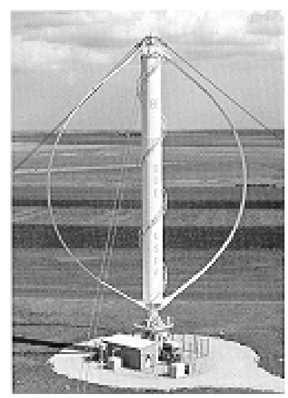
Turbine Selection and Purchase

Even after you have determined that you have a good wind resource and a viable site, putting a down payment on a turbine is a huge commitment. How do you choose the right wind turbine from a reliable manufacturer? The turbine that you choose for your project will depend on your wind resource, the goals of your project, and the price and availability of turbines (many turbines have long waiting lists), as well as the reliability of the machine and availability of spare parts and expertise to fix the machine if it breaks. This section is intended to give you some idea of what to look for when choosing a turbine and to provide you with information on turbine manufacturers and turbine specifications.

Turbine Basics

Types of Wind Turbines

Almost all wind turbines in use today are horizontal axis with three blades rotating upwind of the tower. Vertical axis designs represented approximately 5 percent of the market in the late 1990's, but have been phased out due to various problems such as blade fatigue, difficulty with mounting on high towers to capture the best wind, and other design issues.

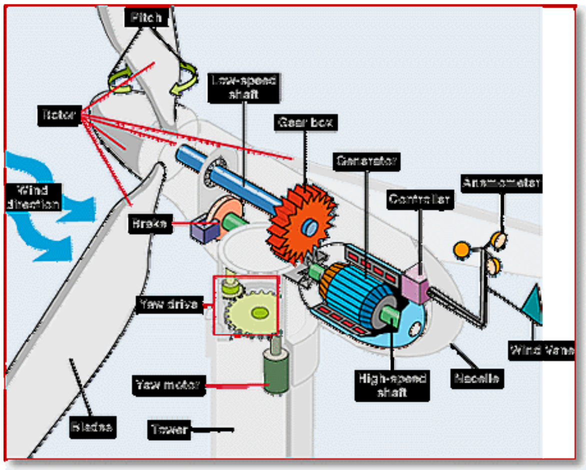


U.S. D.O.E.'s 500-kW variable speed vertical axis Darrieus wind turbine

Wind turbines come in many different sizes for different applications. The nameplate capacity rating refers to a turbine's peak energy output. Turbines in use today range from less than 1 kW to 3 MW or more in nameplate capacity. Many wind turbine manufacturers are rapidly developing even larger machines, especially for offshore applications.

How Wind Turbines Work

Most large wind turbines are induction generators. They are similar to many motors that are used in industrial processes (many blowers, elevators, pumps and other devices use this design). The generators are essentially motors that are run in reverse, generating power instead of consuming it. When enough torque (force from the wind) is applied to the blades of the machine to create a high enough speed, the turbine connects to the grid and begins to produce energy. The frequency of the grid in the United States is 60 Hz. That means that the generator itself is running at a slightly faster speed than 3600 revolutions per minute (although it may run at 1800 or 1200 rpm depending on the electrical wiring of the machine). The blades rotate at approximately 15 to 25 RPM (for a 1.5 to 2.0 MW turbine), and a gear box increases the RPM to that of the generator. This is the predominant design for wind generators because it is very simple and based on a motor and generator design that has been around for many years.



Inside of a wind turbine. Source U.S. Department of Energy

The other type of wind generator is one that operates similar to a direct current (DC) machine, or uses an alternator to produce energy. The generator can vary its speed based on existing wind and grid conditions to produce energy. The energy is then conditioned for the grid using power electronics and computer control systems. These machines can be made to be more efficient than the induction type, but can carry added cost from the power electronic systems.

Most modern machines, regardless of type, now have power electronics and computer control systems to optimize their energy capture from the wind. The computers and control systems can change the pitch of the blades for braking and added energy capture, control current and voltage wave forms to help improve power quality on the grid, and sense conditions of the grid to provide **reactive power support**. They are highly sophisticated machines that have evolved from numerous preceding generations of wind turbine technology.

Choosing a Turbine

The turbine you decide to purchase must fit your needs for size, wind resource, availability, reliability, warranty, spare parts availability, and proximity of operation and maintenance teams.

Size

In general, wind projects are modular energy facilities and can consist of one to one hundred turbines or more. The overall size of a wind project is a function of many variables, including the amount of land available, the number of investors and size of each investor's contribution, the financing available to the project, the ability of the transmission or distribution grid to handle the additional energy from the project without substantial system upgrades, and the number of turbines available to the project. Often one or several of these factors combined will determine the size of the project.

Small cluster of turbines Connected to distribution level voltage. Southwest Minnesota

For instance, a project might be developed initially at 10 MW. After going through part of the interconnection process, you may find out that a project larger than 8 MW will cause the project to incur significant interconnection costs. In this case, it might be prudent to only develop an 8 MW project. In other instances, there might be significant interconnection costs regardless of the size of the project.

In these cases, it may be advantageous to construct a much larger project to help spread out the interconnection and other associated costs over as many turbines as possible. The key factor here is economics. The size and number of turbines should be based on obtaining the best possible return while taking into account constraining factors.

The size of the turbine model to be used at a project will be based on available models, the wind resource at a site, and the ability to perform maintenance. Larger machines on taller towers can cause added expense and delays in replacing major components because there are relatively few cranes that have the ability to lift heavy loads to the top of tall towers. Smaller turbine models may make maintenance easier, but could provide lower production revenue because of a shorter tower or a less efficient machine.

Large wind farm requiring high voltage transmission for interconnection and delivery of power. Southwest Minnesota

Keep in mind that determination of project size and turbine size should be based on the options that will provide the best economic return for investors and the practicality of acquiring equipment and maintaining it.

Wind Resource and Climate

Wind turbines are designed for specific wind resource and environmental criteria, summarized by four International Electrotechnical Commission (IEC) classes (I-IV). IEC class I is the highest wind and turbulence criteria and class IV describes the lowest wind speeds and turbulence criteria. In general, turbines designed for high energy capture in low wind regimes will have larger rotors. On the other hand, turbines designed for high wind regions tend to have larger nameplate generator ratings and smaller rotors. You will need to obtain accurate information about the 50- or 100- year 3-second gust data in order to determine which turbine is right for your site. Consider a wind turbine model with a good track record in areas with a wind resource and climate similar to those at your site.

Availability for Purchase

The turbine you select must not only fit your project and site requirements, it also must be available for purchase within your time frame. Many large wind turbine manufacturers are based in Europe, making transportation and timing important considerations. Also, it is more cost effective for manufacturers to serve customers seeking large numbers of turbines, which can make it difficult for the customer looking for a single turbine or small numbers of turbines.

Used Wind Turbines

Used wind turbines are showing up more frequently on the market. It is advisable to approach the purchase of used wind turbines with extreme caution. They may be less expensive upfront but may be fraught with operational problems. Lenders may not be willing to finance used equipment because of the perceived higher risk. In general, if you are considering purchasing used you need to make sure that you understand:

- The operational history of the machine;

- Why it was taken out of commission;
- What has been done to bring the machine back to operational status;
- If the machine comes with a warranty;
- What the availability of spare parts is; and
- What is the availability of skilled labor to fix the machine.

You need to consider these issues as well as all of the other issues turbine issues if you go down this path. A clear awareness of the risks associated with used equipment should be central in the consideration of your project.

Reliability

Turbines that are not producing energy are losing money, and a machine that breaks down regularly will quickly eat away at your bottom line. Consider that most projects are designed to be operational 98 percent of the time ("98% availability"). This only allows approximately 7 days per year that each turbine can be shut down for regular and non-scheduled maintenance. Picking a machine that has a good track record in the field as well as a manufacturer with a reputation for quality equipment and quick response when problems do arise will help to keep your project in the black. Talk to as many different developers, maintenance company representatives, people who are investors in projects and others in the industry as you can to learn who is selling the best machines and which models to avoid. If you have to wait a little longer for a quality machine and can build this into your project timeline, it may be a worthwhile consideration.

Warranty

Most wind turbine manufacturers offer a standard 2-year parts and labor warranty, which may include a power curve and availability warranty. It is also common for turbine manufacturers to offer to extend the warranty to 5 years at an additional cost. These warranties will address design and manufacturing flaws and provide replacement parts and labor. Extending the warranty on the machines for smaller projects is generally a good idea, and financing institutions may require this before lending money to the project. An extended warranty will provide insurance against major failure while the project accrues a contingency fund for any major equipment failures after the warranty period expires. A contingency fund is money that is set aside in a separate reserve account for the project to access after the warranty has expired to pay for major repairs or component replacement above and beyond scheduled maintenance, and is an important item to include in the business plan for your project. The turbine sales agreement will cover delivery schedule of the machine (important due to tight construction and interconnection schedules), parts, and labor. It may also cover the power curve, ensuring that the machine will generate as much electricity (and revenue) as you had planned for in your business prospectus, although the technical requirements for measuring the power curve can prove very expensive and are not generally affordable for smaller projects.

Proximity of Operation and Maintenance Teams

Your operations and maintenance costs will be significantly reduced if your turbine supplier or other qualified vendor has active O&M teams in your area. This reduces the cost of travel and reduced availability resulting from unscheduled maintenance requirements.

Service Contracts

Service contracts are available through the major turbine manufacturers and numerous qualified third party vendors. The terms and costs of these contracts will vary with the size and proximity of your project in relation to existing projects using the same manufacturers. Some turbine manufacturers will not offer service contracts if your project is small and/or far away from existing projects or may offer inflated costs to deter you from entering into a contract. Third party O&M companies may be retained for service on machines, but may void the manufacturer's warranty if they are not approved by the manufacturer.

Pictured: Al Zeitz, Instructor/Engineer at the Wind Energy and Turbine Technology Program at Iowa Lakes Community College, in Estherville, Iowa.

Negotiating a Turbine Deal

There is currently a limited supply of turbines available to meet the growing demand for wind energy in the United States and worldwide. As of early 2007, if you were able to pay for a turbine today, most manufacturers could not deliver one to you for more than a year. The process of acquiring turbines is further complicated for smaller projects because turbine manufacturers prefer to deal with firms that can commit to large volume orders for several years. Most community developers are smaller and do not have the resources to construct sizeable projects every year. The three P's that will help you get those turbines in the ground are *planning*, *patience*, and *persistence*.

Planning. Turbine manufacturers generally require a 10-25% down payment for machines well in advance (1-2 years or more) of when the turbines are to be delivered. It goes without saying that you should have a plan for financing your wind project prior to entering discussions with any wind turbine manufacturer. You need to plan for this well in advance, so that you can initiate discussions with turbine manufacturers early on in the development process, and have funds readily available for all turbine payments when required. This will allow you to better position your project in the turbine acquisition queue so that you can get a machine delivered in the time frame your project needs to be successful.

Patience. Negotiation of a turbine purchase can be time-consuming and may be complicated by ever-changing market, financial, and policy conditions which are beyond your control. Equipment prices, the global supply of turbine components, raw materials, and transportation costs and schedules all affect your project's bottom line. These factors can change on a daily basis. Public policy decisions determine the incentives available to your project. Acquiring a turbine purchase agreement that will keep your project in the black requires patience to cope with all these changing factors and rapid growth of the industry.

Persistence. Turbine manufacturers in today's market are interested in high volume transactions and repeat business to keep overhead costs low and certainty in future orders high. As a new developer with little or no history in the wind industry, you may have to approach many different manufacturers and continually contact them to keep your project moving forward. There are also equity investment firms that have access to particular turbines in exchange for a financial stake in the project. This may make the turbine acquisition process easier but may also dilute the project in terms of financial return and governance, so the positives and negatives of these types of arrangements should be weighed carefully.

Purchasing Strategies for Community Projects

Aggregation. Community wind developers in the Midwest are well aware of the difficulties in negotiating turbine purchase deals. Many community developers are exploring the prospects of negotiating turbine purchase agreements for several projects at the same time, reducing transaction overhead costs, as well as increasing ability of the community wind developers to garner manufacturers' attention from higher volume orders.

Negotiating with investment firms. Several investment firms have cornered the wind turbine market and have reserved machines for several years in advance. These companies have made machines available to community wind projects in exchange for a significant financial and governance stake in projects. When deciding to work with these firms, you may have to give up some or most of your control of the project or take on additional risk. It is up to you, your board of directors, investors and other key project team members to understand the terms and risks involved before deciding to move forward with a turbine deal involving these companies. It is advisable to work with a lawyer to truly understand the terms of these partnerships.

Getting Started

Most wind turbine manufacturers will require some basic information about your project before sitting down to the negotiating table. Generally, you as a developer will fill out a project information sheet including: project location and size, information about the wind resource in the area (including 50- or 100-year 3-second gust data), turbulence intensity, site layout, and interconnection plan. The manufacturer may also require you to identify various sources of funding for the project to make sure that you are serious and have made significant progress on developing the project. The application form in most cases does not have to be complete, but should provide enough information to show your understanding and ability to develop the project.

Before sitting down at the negotiating table, gather as much information as you can about the current state of the market and other deals that have been negotiated with the company and with other turbine manufacturers. It is also helpful to assemble a team that includes at least legal support, but it is better to also include engineering and accounting support, so that you can respond effectively to any issues that may arise during the negotiation process.

Commercial-Scale Turbine Manufacturers

This is a comprehensive list of companies who manufacturer commercial-scale turbines that are available in the United States. Click on the company name to go directly to its website to look at its turbine models and specifications.

- **Siemens**
  Location: Denmark and numerous United States offices
  Turbine sizes: 250 kW, 400 kW, 1.3, 2.3, and 3.6 MW
- **Clipper Windpower**
  Location: California
  Turbine size: 2.675 MW
- **Dewind**
  Location: Germany and United States offices.
  Turbine size: 2.675 MW
- **Fuhrlaender**
  Location: Germany. Lorax Energy in New York
  Turbine sizes: 250 kW, 600 kW, 1.25, 1.5, and 2.5 MW
- **Gamesa Eólica**
  Location: Spain and Pennsylvania
  Turbine sizes: 850 kW and 2 MW
- **GE Wind Energy**
  Location: California and South Carolina
  Turbine sizes: 1.5 MW, 2.5 MW, and 3.6 MW
- **Mitsubishi**
  Location: Japan, Florida, and California
  Turbine sizes: 600 kW, 1 MW, and 2.4 MW
- **REPower Systems**
  Location: Germany
  Turbine Sizes: 1.5 MW, 2.0 MW, 5.0 MW
- **Suzlon**
  Location: India and Illinois
  Turbine sizes: 1.250 MW and 2.1 MW
- **Vestas**
  Location: Denmark and California
  Turbine sizes: 850 kW, 1.65, 1.8, 2, 2.75, 3, and 4.5 MW

Additional Resources For Turbine Selection and Purchase

- Community Wind Energy 2006: Wind Industry Forum: Turbine Supply, Technology, Operations and Maintenance
  http://www.windustry.org/ConferenceProceedings2006/SessionSheets/windforum/windforum.htm
- Wind Stats Newsletter: Provides international statistics on wind turbine production, reliability and news on current developments in wind turbine technology: www.windstats.com

Development Issues Specific to Minnesota

Minnesota is unique in the fact that it has historically favored local ownership of wind projects. The state has recently adopted a statewide goal of reaching 800 MW of community-based wind development by 2010, a three-fold increase in the state's current community wind portfolio. This initiative will more than double the total community wind capacity installed nationwide.

Minnesota has relied upon an evolving policy package that has includes production incentives and a special advanced tariff that has lead to the nation's first community wind successes. The state adopted a Renewable Energy Production Incentive (REPI) of 1.5 cents/kWh in 1997 designed to support locally owned wind projects up to 2 MW in size. At first, local wind developers had trouble using the state REPI because they had to individually negotiate with utilities for interconnection and power purchase agreements. It wasn't until 2001, when a special community wind tariff establishing a set power purchase rate and standard procedures for interconnection was created, that community wind projects became feasible in Minnesota. Then, the initial allocation for the state REPI was quickly fully subscribed, and a second round was fully subscribed within 6 months. It took the pairing of these complementary policies to launch the community wind market, resulting in today's statewide goal of 800 MW of community wind by 2010.

These two successful policies also prompted Minnesota to enact the new Community-Based Energy Development (C-BED) legislation, which requires all of the state's electric utilities with captive customers to offer front-end loaded advanced renewable energy tariffs for locally owned wind projects that meet new state standards. Utilities are not required to enter into these contracts, but the Minnesota Public Utilities Commission will periodically review and evaluate utility efforts to purchase electricity from these new community wind projects. In just over a year since its passage, several C-BED power purchase agreements have been awarded and many more projects are in negotiation stages. However, with its current price cap and other implementation challenges, it is too early to determine whether C-BED, combined with other existing local, state and federal polices, will provide the best long-term solution for sustaining the community wind market.

In addition to the history of support for community owned wind within the state there are other factors that have the potential to impact project planning that developers need to be aware of.

Wind Resource Documentation

In 1983 the state implemented one of the first wind resource documentation programs in the country. This has lead to one of the largest publicly available databases of wind resource data in the United States and Potentially the world. These data sets, if used properly by developers, can aid significantly in upfront feasibility studies before significant money is spent on a detailed site specific wind resource assessment. These data sets are not a substitute for taking data or sophisticated modeling techniques but can be extensively used for upfront rough production estimates and validating data that is collected at your site. The data from these meteriorlogical stations can be found on the University of North Dakota Energy and Environmental Research Center (UNDEERC) website: www.undeerc.org.

These sets of data, along with long term weather data from other sources were also used to create some very high resolution wind resource maps for various wind turbine hub heights. The maps were created for the Minnesota Department of Commerce (MNDOC) by WindLogics and can be found on the MNDOC website along with statistics about wind energy development and production and incentives for wind energy in the state of Minnesota: www.commerce.state.mn.us.

Cooperative Law

In this form of business organization, the business is owned and controlled by those who use its services. Returns are based on patronage, not investment. Your cooperative can be either tax-exempt or non-tax-exempt. Cooperatives have a long tradition in the rural U.S., including farm-based energy enterprises such as ethanol cooperatives. However, the development of wind cooperatives has been hampered by their inability to take advantage of the federal production tax credit. In 2003, Minnesota passed a law allowing a new way to form cooperatives with investor members. This new structure might prove to be more beneficial for using wind energy incentives and raising capital. If successful, it can serve as a model for other states interested in providing more opportunities for wind power cooperatives. (A summary of the new Minnesota law is available from the Minnesota Association of Cooperatives: www.wfcmac.coop/coops/mac/billsf679/Ch308Bsummary.pdf.)

Permitting *(updated January 2008)*

Minnesota has a statewide policy for permitting commercial-scale wind projects that is one of the most user-friendly in the nation. The Public Utilities Commission (PUC) has permitting authority over Large Wind Energy Conversion Systems (LWECS) (systems over five megawatts), and smaller systems are subject to local jurisdiction. Starting in 2008, Minnesota counties will have the option to assume permitting authority for wind facilities with a combined nameplate capacity less than 25 MW. The PUC states, "it is state policy to site LWECS in an orderly manner compatible with environmental preservation, sustainable development, and the efficient use of resources." Visit the MNPUC's wind siting page (http://energyfacilities.puc.state.mn.us/wind.html) for state siting and permitting rules and application processing schema.

Wind Energy Production Tax

Some states tax energy facilities based on the energy produced. Minnesota, for example, has a tiered tax structure on energy production. The tax rate is determined by the size of the project.

- Large-Scale Wind Energy Conversion Systems: Projects with installed capacities of 12 MW or greater will make payments of 0.012 cents per kWh.
- Medium-Scale Wind Energy Conversion Systems: Projects with installed capacities between 2 and 12 MW will make payments of 0.036 cents per kWh.
- Small-Scale Wind Energy Conversion Systems: Projects with installed capacities between 250 kW and 2 MW will make payments of 0.0012 cents per kWh.
- Systems with installed capacities less than 250 kW are exempt from the production tax.

not placing undue burden on them. It is important to consult with the local tax authority to determine how the project will be taxed. More information on taxation of wind energy facilities in Minnesota: http://www.windustry.org/resources/tax.htm.

Distributed Wind Generation in Minnesota

In Minnesota an effort has been undertaken to define where existing substations exist in relation to wind resource. These sites have the potential for interconnection of smaller wind projects at distribution level voltages with the potential to have less significant impacts on the transmission system. Less significant impacts on the transmission system could mean lower costs for a project to interconnect. Detailed information about these studies and links to maps in Minnesota with wind resource and transmission infrastructure can be found on Windustry's Distributed Wind Generation and Transmission web page: http://www.windustry.org/dg/

Glossary of Terms and Acronyms

Accelerated depreciation - With accelerated depreciation, wind projects can reduce the assessed value of their equipment on their financial balance sheets over 5 years rather than the typical 20 year projected lifetime of a project.

Aggregation – Bundling several wind energy projects together so that they are treated as one larger project (when purchasing turbines, for example), in order to achieve economies of scale.

Alternative Minimum Tax (AMT) – AMT can be thought of as a different tax system with different rules and deductions; taxpayers must compute their taxes under both the regular tax and AMT rules and then pay the greater of the two. The purpose of the AMT is to prevent those in the highest tax bracket from getting by from year to year tax free. A consequence is that many unsuspecting taxpayers who make less than $100,000 a year with certain kinds of investments and deductions end up having to pay AMT. Investing in certain types of businesses can trigger the AMT.

Anemometer – A device used to measure wind velocity as part of a wind resource assessment study. Cup anemometers are the standard type used today, with 4 cups spinning on a vertical axis. The anemometer typically is installed on a guyed tilt-up tower at the anticipated location and height of the potential wind turbine.

Anemometry Equipment – The set of meteorological measuring and logging devices used to collect wind data for a wind resource assessment study. Equipment set typically includes: tower, anemometer, wind vane, temperature sensors, heating device, and data logger.

Asset/Equity Ratio – Total assets divided by shareholder equity. Asset/equity ratio is often used as a measure of leverage.

Attractive nuisance – A hazard that is likely to attract children, who are unlikely to fully comprehend the danger posed by the hazard. A landowner may be liable for injuries to children caused by the hazard even if the children are trespassing.

Avoided Cost – The rate that utilities are required to pay independent power producers according to the Public Utilities Regulatory Policy Act (PURPA). Avoided cost is the simply the cost that the utility would have incurred for producing the same amount of power. This is not a favorable rate to receive as an independent power producer.

Business metrics – a system of parameters or other quantitative assessments of a business that can be measured periodically and systematically. Business metrics are often used to keep track of how well a business is meeting its objectives.

Clean Renewable Energy Bonds (CREBs) – A "CREB" is a special type of tax credit bond providing rural electric cooperatives, municipal electric utilities, and government entities (including tribal councils) the equivalent of an interest-free loan for financing qualified energy projects. CREBs were created in the Energy Policy Act of 2005, and are largely modeled on the Qualified Zone Academy Bond program that provides tax credit bonds for school renovation and upgrades in certain qualified school districts. They deliver an incentive comparable to the production tax credit that is available to private renewable energy project developers and investor-owned utilities.

Commercial Scale Wind – Refers to wind energy projects greater than 100 kW where the electricity is sold rather than used on-site. This category can include large arrays of 100 or more turbines owned by large corporations or a single locally-owned wind turbine greater than 100 kW in size.

Commissioning - the process of connecting the turbine to the transmission lines and making sure it is working correctly

Community-Based Energy Development (C-BED) – 2005 Minnesota law requiring Minnesota utilities to establish tariffs for wind energy projects meeting specific requirements for local ownership. The tariff sets a price for the electricity based on its net present value over a 20-year power purchase agreement. Utilities are not obligated to enter into C-BED contracts. In 2005, the Minnesota legislature passed an omnibus energy bill which included this new mechanism to support community wind, by requiring utilities to create a new tariff utilizing a net present value rate for electricity, and the option of front-loading the rate in the first half of the contract's lifespan. This is one flavor of community wind because it excludes public power.

Community Wind – Locally-owned, commercial-scale wind projects that optimize local benefits. Locally-owned means that one or more members of the local community has a significant direct financial stake in the project other than through land lease payments, tax revenue, or other payments in lieu of taxes. The term "community wind" refers to the method and intention of development rather than the size of the project. A 1,000 kW, commercial-scale wind turbine might cost $1-2 million.

Cost-of-Service Ratemaking – A system for establishing prices in which a utility is reimbursed for the legitimate costs it encounters in serving customers, plus a specific percentage for profit.

Covenant – A promise in an indenture, or any other formal debt agreement, that certain activities will or will not be carried out. The purpose of a covenant is to give the lender more security. Covenants can cover everything from minimum dividend payments to levels that must be maintained in working capital.

Coverage Ratio – A type of accounting ratio that helps measure a company's ability to meet its obligations satisfactorily. A coverage ratio encompasses many different types of financial ratios. Typically, these kinds of ratios involve a comparison of assets and liabilities. The better the assets "cover" the liabilities, the better off the company is.

Clean Renewable Energy Bonds (CREBs) – A CREB is a special type of tax credit bond providing rural electric cooperatives, municipal electric utilities, and government entities (including tribal councils) the equivalent of an interest-free loan for financing qualified energy projects. CREBs were created in the Energy Policy Act of 2005, and are largely modeled on the Qualified Zone Academy Bond program that provides tax credit bonds for school renovation and upgrades in certain qualified school districts. They deliver an incentive comparable to the production tax credit that is available to private renewable energy project developers and investor-owned utilities. $800 million of CREBs were allocated by the U.S. Treasury for 2006 and 2007 through an application process by qualified borrowers. The program was fully subscribed and has been renewed for 2008 for $400 million of bonds.

Decommissioning – the process of dismantling a turbine and restoring the site.

Debt-to-Capital Ratio – A measurement of a company's financial leverage, calculated as long-term debt divided by long-term capital. Total debt includes all short-term and long-term obligations. Total capital includes all common stock, preferred stock and long-term debt. This capital structure ratio can provide a more accurate view of a company's long-term leverage and risk, since it considers long-term debt and capital only. By excluding short-term financing in its calculation, the ratio provides an investor with a more accurate look into the capital structure a company will have if they were to own the stock over a long period of time.

Debt vs. Equity – An amount of money borrowed and owed by one party to another is considered debt, for example: bonds, loans and commercial paper. Equity is a term whose meaning depends very much on the context, but in general, it refers to ownership in any asset after all debts associated with that asset are paid off.

Demand – The amount of electricity drawn from an electric system at a given time, measured in kilowatts.

Demand-Side Management (DSM) – The process of managing the consumption of energy. DSM programs include, for instance, offering discounts on new, high-efficiency appliances so that consumers get rid of their older, less efficient models.

Depreciation - an accounting method used to attribute the cost of an asset over the span of its useful life.

Deregulation – The process of removing restrictive regulations on previously regulated companies.

Discount Rate – 1) The interest rate that an eligible depository institution is charged to borrow short-term funds directly from a Federal Reserve Bank. 2) The interest rate used in determining the present value of future cash flows.

Distributed Generation – A small-scale power generation technology that provides electric power at a site closer to customers than central station generation. The term is commonly used to indicate non-utility sources of electricity, including facilities for self-generation.

Distribution Cooperative – An electric cooperative that purchases wholesale power and delivers it to consumer members.

Distribution System - The poles, wire and transformers used to deliver electric energy from a bulk power supplier to the consumer.

Double declining-balance depreciation – A type of accelerated depreciation in which the value of an asset is depreciated faster than in a typical standard depreciation rate. It allows double the straight-line (or non-accelerated) depreciation amount to be taken the first year, with that same percentage of the remaining balance taken in the following years. The formula for determining the yearly Double Declining Balance Depreciation is defined by:

$$loss\ due\ to\ depreciation = \frac{2}{N} \times asset\ value$$

Where N=the number of years over which the asset is depreciated.

Dual line feed - A dual line is a second, redundant transmission line connecting turbine to the grid that allows your project to generate power even if the first line is taken out of service.

Due Diligence – Do your homework! Due diligence means that you have looked at a particular investment from as many angles as possible to best understand the risks, rewards, and opportunity costs. Lenders, investors, contractors and equipment suppliers will be much more willing to work with you if you can demonstrate that you know the lingo and understand the industry.

Electric Cooperative – A form of utility in which all users own shares. Electric cooperatives are common in rural areas that are expensive to serve because of the long distances between users. Frequently, the government contributes in various ways to rural cooperatives to reduce costs to individual owner/users.

Energy Policy Act of 1992 (EPAct) – A federal statute that, among other things, established additional forms of non-utility generators. It also permitted non-generator-owning municipalities to purchase wholesale electricity, thus opening the door to municipalization.

Energy Policy Act of 2005 – The first time since 1992 that the federal government revisited national energy policy. The Energy Policy Act of 2005 included an extension of the Production Tax Credit (PTC) through the end of 2007, CREBs, and many other provisions.

Environmental Impact Statement (EIS) – A thorough study of each proposed electric utility project with potential for significant environmental impacts. Includes evaluation of alternatives and impact mitigation.

Environmental Quality Board – State agency that adopts environmental rules, monitors their effectiveness, and revises as appropriate; provides technical assistance to interpret and apply rules. (This varies from state to state.)

Escrow – A financial instrument held by a third party on behalf of the other two parties in a transaction. The funds are held by the escrow service until it receives the appropriate written or oral instructions or until obligations have been fulfilled. Securities, funds and other assets can be held in escrow.

Farm Bill, Energy Title, Section 9006 – In a first for US agriculture policy, the 2002 Farm Bill included an energy title that established a variety of programs to support farm-based renewable energy. Most notable for wind energy is the renewable energy grant and loan guarantee program administered through the US Department of Agriculture – Rural Development.

Federal Energy Regulatory Commission (FERC) – An independent regulatory agency within the U.S. Department of Energy that has jurisdiction over interstate electricity sales, wholesale electricity rates, natural gas and oil pipeline rates, and gas pipeline certification. It also licenses and inspects private, municipal, and state hydroelectric projects and oversees related environmental matters.

Flip Models/ Flip Dynamics - One example of a business model structure which brings in a tax-motivated equity partner to effectively own the project during the period when the PTC and accelerated depreciation are available (i.e., the first 10 years of the project's life).

Generation and Transmission Cooperative (G&T) – A power supply cooperative owned by a group of distribution cooperatives. G&Ts generate power or purchase it from public or investor-owned utilities, or from both.

Green Energy – A popular term for energy produced from renewable energy resources or, sometimes, from clean (low-emitting) energy sources.

Green Marketing – Selling green energy.

Grid – A network of power lines or pipelines used to move energy.

Home and Farm Wind – Describes wind energy systems that are generally under 100kW and produce power for on-site use. Differing from commercial, or large-scale wind, home and farm wind can be considered for residential, small business, or farm applications. Wind turbines under 100 kilowatts cost roughly $3,000 to $5,000 per kilowatt of capacity. That means a 10 kilowatt machine (the size needed to power an average home) might cost $35,000-$40,000.

Independent Power Producer (IPP) – An electricity generator that sells power to others but is not owned by a utility.

Independent System Operator (ISO) – An impartial, independent third party responsible for maintaining secure and economic operation of an open access transmission system on a regional basis. An ISO provides availability and transmission pricing services to all users of the transmission grid.

Installation costs - all the expenses required to construct and get a turbine up and running once it arrives.

Internal Rate of Return (IRR) - A financial calculation that compares the present value of a project's expected revenues with the present value of its expected costs. The IRR calculation is used to determine the discount rate at which the two values are equal. By doing this calculation, investors are able to see the project's expected rate of return. The IRR will be a number where revenue exceeds the costs of financing the project. This means a surplus will remain after paying for the capital, and the investors will benefit from the investment. If the IRR is less than the cost of capital, the investors are not likely to participate in the project.

Investor-Owned Utility (IOU) – A utility with stock-based ownership.

Kilowatt (kW) – The basic unit of electric demand, equal to 1,000 watts; average household demand is 10 to 20 kilowatts.

Kilowatt-hour (kWh) – A unit of energy of work equal to 1,000 watt-hours. The basic measure of electric energy generation or use. A 100-watt light bulb burning for 10 hours uses one kilowatt-hour.

Limited liability company (LLC) – A type of business structure in which owners are not liable for things that go wrong that are not the owners' responsibility. This offers owners some legal protection in case of accidents and disasters.

Load – The amount of electric power drawn at a specific time from an electric system, or the total power drawn from the system. Peak load is the amount of power drawn at the time of highest demand.

Maintenance Reserve Account – The reserve account of cash balances set aside to cover a project's maintenance and repair expenses.

Material participation - In order to "materially participate" in a wind project, an individual must participate more than 500 hours during the tax year.

Megawatt (MW) – Equal to 1,000 kilowatts or 1 million watts.

Megawatt-hour (MWH) – Equal to 1,000 kilowatt-hours or 1 million watt-hours.

Merchant – Refers to projects where the private contractor builds a new facility without the government providing any revenue guarantee. In other words, the private contractor takes on the construction, operation, and market risk of the project.

Meteorological tower ("Met Tower") – Another term for the tower and wind resource assessment equipment.

Midwest Independent System Operator (MISO) – See independent system operator.

Minnesota flip - The "Minnesota Flip" is a business model designed to help local wind project owners with minimal tax appetite pair up with a larger entity that has a more substantial tax burden. Because the tax credits available to project owners are proportional to their level of ownership in the project, the tax motivated entity is the majority owner in the first ten years of production and pays a "management fee" to the local owner in lieu of production payments. Once the tax incentive period ends after year 10, the majority ownership of the project "flips" to the local owner, and the tax-motivated investor takes a minority share in the project. For more information, see "The Minnesota Flip" section..

Municipal Utility or Muni – A utility owned by a city. Generally, surpluses in revenues over expenditures are contributed to the city budget.

Net Metering and Net Billing – The concept of net metering programs is to allow utility customers to generate their own electricity from renewable resources, such as small wind turbines and rooftop solar systems. The customers send excess electricity back to the utility when their wind system, for example, produces more power than they need. Customers can then get power from the utility when their wind system doesn't produce enough power. In effect net metering allows the interconnected customer to use the electrical grid as a storage battery. This helps customers get higher (retail) value for more of their self-generated electricity.

Net present value – A common financial concept (and a critical component of Minnesota's C-BED tariff), reflecting the idea that having a given amount of money today is more valuable than receiving the same amount of money in the future. C-BED requires utilities to determine the net present value of their rate schedule using the standard discount factor that they apply to their other business decisions. That means calculating the expected payments over the life of the contract and applying the discount to find the net present value of the series of payments. The net present value is then divided by the total energy produced over the 20 years, resulting in the "net present value rate" – the present value of every kilowatt-hour the project will produce over its lifetime. C-BED requires that the utility establish a tariff that provides for a rate schedule resulting in a net present value rate of up to 2.7¢/kWh.

Off-peak Power – Electricity supplied during periods of low system demand**.**

Off-taker – The recipient of the end-product of a project, for example: a utility company.

O&M (Operations and Maintenance) Agreement – The contract for operating and maintaining a project.

Passive income – certain types of income, as defined by the IRS, such as rental income or income from businesses, in which the earner serves only as an investor.

Passive Tax Appetite – Income from certain types of investments qualifies as passive income. Tax paid on this income is considered passive tax. To take advantage of the Federal Production Tax Credit (the PTC) and Modified Accelerated Cost Recovery System (MACRS) you or a project partner must be paying taxes that fit into this category of tax liability. For more information about what qualifies as passive activity see IRS Publication 925: Passive Activity and At-Risk Rules: http://www.irs.gov/publications/p925/ar02.html

Pass-through entities - A pass-through entity business structure allows tax credits and operating gains and losses to be allocated to the members of the entities rather than remaining with the entity itself. Some examples of pass-through entities that would qualify for the federal production tax credit include: limited liability companies, partnerships, sub-chapter "S" Corporations, and limited liability partnerships.

Payments-In-Lieu-of-Taxes (PILOT) - Negotiated payments between the local taxing authority and a wind project. These payments compensate for excessive use of infrastructure in the area while developing the project and allow the local community to benefit from wind energy development. Property taxes and PILOTs contribute a great deal to the tax revenue of many windy rural areas and aid in the development of new schools, community centers, and other local programs. Project developers opt to enter into PILOT contracts in order to be good neighbors to the community, while other areas may require these payments before local authorities grant permission to build.

Peak Demand – The greatest demand placed on an electric system; measured in kilowatts or megawatts; also, the time of day or season of the year when that demand occurs.

Peak Load – The amount of electric power required by a consumer or a system during peak demand; measured in kilowatts or megawatts.

Power curve - the instantaneous power output of a specific turbine design at various wind speeds.

Power Purchase Agreement (PPA) – The off-take contract from a large customer to buy the electricity generated by a power plant. Securing a good PPA is often one of the most challenging elements of wind project development.

Production Tax Credit (PTC) – Provides the owner of a qualifying facility with an annual tax credit based on the amount of electricity that is generated. By focusing on the energy produced instead of capital invested, this type of tax incentive encourages projects that perform adequately. The current rate for the PTC is 1.9¢/kWh.

Pro forma – Comprehensive financial analysis of a project.

Public Utility Regulatory Policies Act (PURPA) – A 1978 federal law that requires electric utilities to purchase electricity produced from certain efficient power producers (frequently using renewable energy or natural gas). Utilities purchase power at a rate equal to the costs they avoid by not generating the power themselves. State regulatory agencies establish the rate based on local conditions.

Public Utility Commission (PUC) or Public Services Commission (PSC) – A state government agency responsible for the regulation of public utilities within a state or region. A state legislature oversees the PUC by reviewing changes to utility laws, rules and regulations and approving the PUC's budget. The commission usually has five Commissioners appointed by the governor or legislature. The PUC focuses on adequate, safe, universal utility service at reasonable rates while also trying to balance the interests of consumers, environmentalists, utilities, and stockholders.

Reactive power support – This is the production of reactive power to maintain stability on the transmission system. Power on the system comes in two main types: the first is the power that is actually delivered to end users, and the second is reactive power, which is power provided and maintained on the system for the maintenance of the system, rather than for end-use consumption.

Renewable Energy Production Incentive (REPI) – An incentive similar to the PTC that is made available to public utilities and non-profits (which do not pay taxes and therefore cannot benefit from a tax credit). REPI consists of a direct payment, made to a public utility installing a wind plant, that is equal to the PTC. However, since the REPI involves the actual spending of federal funds, money must be "appropriated" (voted) for it annually by Congress.

Renewable Portfolio Standard (RPS) – **Renewable Electricity Standard (RES) –** A minimum renewable energy requirement for a region's electricity mix. Under an RES, every electricity supplier would be required to provide some percentage of its supply from renewable energy sources. RPS proposals frequently ease that requirement by including a tradable credit system under which electricity suppliers can meet the requirement by buying and selling renewable generation credits.

Restructuring – The process of changing the structure of the electric power industry from one of guaranteed monopoly over service territories to one of open competition between power suppliers for customers.

Rural Electrification Administration (REA) – An agency of the U.S. Dept. of Agriculture that makes loans to states and territories in the U.S. for rural electrification and for providing electricity to persons in rural areas who do not receive central station service. It also furnishes and improves electric and telephone service in rural areas, fosters energy conservation and on-grid and off-grid renewable energy systems, and studies the condition and progress of rural electrification.

Shadow flicker - Shadow flicker occurs when the blades of the turbine rotor cast shadows that move rapidly across the ground and nearby structures.

Sound Power – Strength of sound source, measured in A-weighted decibels (L_{WA}). Typical sound *power* values for wind turbines (which can be obtained from the turbine manufacturer) are in the range of 90-105 dB(A), L_{WA}. (The measurement is A-weighted to account for the sensitivity of human hearing.)

Sound Pressure - Sound level measured at a receptor (e.g., a neighbor's house, a microphone). Sound pressure decreases exponentially as distance from the source of the sound emissions increases. Sound pressure, like sound power, is given in A-weighted measurements (L_{aeq}) to account for the sensitivity of human hearing.

Southern Minnesota Municipal Power Agency (SMMPA) – SMMPA is a company that generates and sells wholesale electricity, primarily for its eighteen member municipally-owned utilities. The member municipally-owned utilities are located mostly in southeastern and south-central Minnesota.

System benefits charge (SBC) – A required fee (also known as a public benefits charge) from all electricity customers to fund programs aimed at the public good that may no longer be feasible for the utility to provide in a competitive electricity market. These programs include energy conservation, support for renewable energy use, low-income assistance, and research and development.

Tariff – A rate paid for electricity per kilowatt-hour consumed, or in this case, generated. The term is commonly used in electric utility rate making in North America. The term is also commonly used in Europe. Tariffs are not taxes nor in this context customs duties on goods crossing international borders.

Tenor - The term or life of a contract. This is similar to maturity.

Three-phase distribution or transmission lines - Electrical power lines that carry electric energy from one point to another in an electric power system, using a type of current called three-phase. The U.S. Department of Labor: Occupational Safety & Health Administration has a great online guide illustrating generation, transmission, and distribution equipment in an easy to understand format: http://www.osha.gov/SLTC/etools/electric_power/illustrated_glossary/index.html

Transmission – The transfer of electric current from a power plant to a destination that could be hundreds of miles away.

Turbine – A device for converting the flow of a fluid (air, steam, water, or hot gases) into mechanical motion that in turn produces electricity.

Unbundling – The process of separating a service into component parts and permitting customers to buy each separately. Utility unbundling, overseen by regulators, generally requires utilities to ensure that the price of each service accurately reflects the cost of that service (plus a margin for profit). In this way, unbundling helps ensure that customers pay for what they receive and are not forced to subsidize services they do not use.

Wake losses – The space behind a wind turbine that is marked by decreased wind power capacity due to the fact that the turbine itself used the energy in turning the blades. The wind behind the turbine, in its wake, is essentially unavailable to generate energy for a certain distance in the downwind direction. Thus, when siting a wind farm, it is important to space the machines such that they do not negatively impact each others' power production capacity during different times of the year.

Wind rose - A wind rose shows the direction and the frequency of that direction that the wind blows at a particular location. Wind roses are used in wind projects to portray the amount of energy that comes into the wind project from various directions.

Wind shear – A term and calculation used to describe how wind speed increases with height above the surface of the earth. The degree of wind shear is a factor of the complexity of the terrain as well as the actual heights measured. Wind shear increases as friction between the wind and the ground becomes greater. Wind shear is not a measure of the wind speed at a site. It is an *extrapolation* of the *difference in wind speed between two different heights* above the ground. Thus, high wind shear at a site does not necessarily mean high wind speeds at the site.

Watt – A unit of electrical power: 1/1000 kW.

Wheeling – Transmitting bulk electricity from a generating plant to a distribution system across a third system's lines.

Glossary Information Sources

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