COMMUNITY WIND:

An Oregon Guidebook

Prepared for the Energy Trust of Oregon by Northwest Sustainable Energy for Economic Development

Oregon has abundant sources of clean, renewable energy and the Energy Trust is helping Oregon to use these sustainable, local resources. This includes developing a portfolio of solutions relying on a mosaic of renewable energy technologies and sizes, from solar on rooftops to larger geothermal projects. In the middle of this range falls community wind, which we define as wind projects up to 10 MW that are primarily owned and operated locally.

While we do not claim that community wind is always the most appropriate solution, in many situations it provides unique and direct local and system benefits. This guidebook investigates the opportunities, tools, challenges and necessary steps for the development of community wind projects in Oregon. We are not offering the definitive text on developing local wind projects. Approaches, costs, regulations and laws will change. Project proponents will need to update the general information provided in this guide.

We knew as we started this that we could not do it alone. The issues can be multiple and complex. Fortunately, the community of interest in this area is strong, deep and talented. This guidebook is the product of the generous support of these dedicated people. Northwest Sustainable Energy for Economic Development deserves particular credit for their tireless efforts to drive this guidebook to completion, as does Alan Cowan of the Energy Trust for all his excellent contributions. We could not have asked for more.

Our hope is that this tool allows community members to be better prepared to consider community wind and potentially journey down the path of project development.

Peter West

Energy Trust of Oregon

ACKNOWLEDGMENTS

Community Wind: an Oregon Guidebook was developed by Northwest Sustainable Energy for Economic Development (SEED) in partnership with the Energy Trust of Oregon. This guidebook compiles and summarizes a significant amount of excellent work. We are indebted to the foresighted sponsors of these studies, policies and projects.

Northwest Sustainable Energy for Economic Development works with rural communities, college campuses, Tribes, utilities and businesses to maximize local benefits of renewable energy generation. Through strategic partnerships and collaborative efforts, Northwest SEED supports and develops creative programs, policies and financing approaches to build rural economies and diversify the region's energy supply.

Energy Trust of Oregon, Inc., is a non-profit organization dedicated to changing how Oregonians use energy by promoting energy efficiency and clean renewable energy for Oregon customers of Pacific Power, Portland General Electric, and NW Natural. Energy Trust offers Oregonians incentives and services for new renewable resources and energy-efficient improvements for homes and businesses. The Energy Trust also offers programs to assist with the generation of electricity using wind, biopower, geothermal, solar and other renewable resources for supply to utilities.

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The authors are solely responsible for errors and omissions.

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Credit: Henry DuPont

PURPOSE OF GUIDEBOOK

The Energy Trust of Oregon prepared this Guidebook to facilitate successful, cost-effective community wind development that provides measurable benefits for Oregon's environment and local economies. Wind energy is an increasingly affordable source of clean, renewable power for our region, and its development provides unique benefits both for the communities where wind development takes place, and for the region as a whole.

What is Community Wind Energy?

The Energy Trust of Oregon recently commissioned a study, "A Comparative Analysis of Community Wind Power Development Options in Oregon," which was completed in July 2004. This document explored in detail a variety of different ownership and financing structures for community-scale wind development. For the purposes of this Guidebook, we define community wind using the same definition used for community wind in that Energy Trust document:

> "We define community wind power development to mean locally owned projects, consisting of one or more utility-scale turbines that are interconnected on either the customer or utility side of the meter . . . . We define 'locally owned' to mean that one or more members of the local community have a significant direct financial stake in the project, other than through land lease payments, tax revenue, or other payments in lieu of taxes. For new projects, as will be the case in Oregon, we define 'utility-scale' to mean projects consisting of one or more turbines of 600 kW (currently the smallest turbine sizes offered by the major wind turbine manufacturers) or greater in nameplate capacity." (Bolinger, et al. 2004)

Credit: Mackinaw City

Limiting the definition of community wind to projects using turbines over 600 kW necessarily excludes some projects which may by other measures constitute “community wind.” Nonetheless, the focus of this Guidebook is on projects using at least one utility-scale turbine for simple economic reasons. It is challenging for grid-connected projects smaller than this to recover costs in the Northwest, given the current hardware costs for small wind turbine installations.

On the high end, this Guidebook assumes a community wind project would be no larger than approximately 10 MW of nameplate capacity. There is, by all means, the good possibility that a larger project could be successfully developed at the community level. However, projects exceeding this size can’t realize the price and standardization benefits of the new Oregon PURPA rules (Order 05-584). Larger projects also begin to encounter a set of development, financing, design, permitting, and construction challenges that closely resemble those encountered by larger, commercial projects.

This Guidebook, therefore, is primarily tailored for individuals or communities pursuing development of a community-based wind project around 600 kW to 10 MW in size. Keep this scale of project in mind while considering the information and suggestions in the sections that follow. If considering a project whose scale is much smaller or larger than the range targeted in this Guidebook, consult the excellent sources on small wind and/or commercial wind development listed in Section 8: References and Resources.

The Benefits of Wind Energy

The **economic** benefits of wind energy can be significant, especially for the communities in which wind projects are sited. Building a wind energy project results in investment in local businesses and infrastructure, creates construction and operations jobs at the wind project site, and increases local tax revenues. Because the fuel used to produce energy is the wind, a wind project developer will pay local landowners for the right to harness the wind that flows across their property. This stands in stark contrast to the local economic drain that results when payments for oil, gas, or coal end up out of the region or country.

When the landowner is also involved as an owner of the project, the flow of benefits from the project into the immediate community may be even more direct and significant.

In addition to local communities, utilities and energy consumers throughout the state benefit from investments in wind power. Utilities that include wind power as part of their collective energy portfolio recognize that investing in wind helps hedge against volatile fossil fuel prices and the uncertain cost of complying with future environmental regulation. Utilities often sign power purchase agreements (PPA) for wind power for long periods—up to 30 years—giving them a long-term power source at a fixed, known price. Meanwhile, fossil fuels can dramatically increase in cost over time. The fixed, low-cost wind energy purchased by utilities translates to lower, more stable power bills for consumers.

The **environmental** benefits of wind energy give it another significant advantage over fossil fuel energy sources. Wind is a renewable resource, meaning it cannot be depleted. Wind turbines do not emit pollutants during operation; because it does not involve combustion of any fuel, the production of energy with a wind turbine does not produce harmful emissions. While some wind turbines have had avian, bat, and aesthetic issues, careful siting often mitigates these concerns. Communities where wind energy projects are built enjoy the economic development benefits of a new local industry without the negative impacts of pollution that accompany fossil-fuel power plants. These environmental benefits can translate directly into economic benefits through the sale of premium-priced "green" power or Renewable Energy Credits.

The economic benefits of wind energy development flow primarily to the local communities where the development takes place; that is, to the windy rural areas of our state. This means that wind energy projects can provide a critical infusion of cash, tax revenues, and jobs to economically distressed communities struggling with fluctuating agricultural markets, loss of traditional resource-based jobs, and other external factors.

Wind energy production is compatible with agricultural activities, and in fact can help keep farmland in production. Participating landowners gain a new source of revenue—either by receiving payments for wind turbines sited on their land or by owning some or all of the project and reaping a share of its power output and revenues. This supplemental income can help diversify farm earnings and keep farms financially solvent. Unlike some types of development, such as housing, wind projects operate in tandem with existing farm activities, with crops growing and livestock grazing right up to the base of each turbine.

Unique Advantages of Community Wind

In addition to the benefits common to wind energy development of all kinds, community wind projects may have additional, unique benefits:

- Community wind projects can further concentrate the economic benefits of wind development in the local community, as local investors harvest the profits from power sales.
- A small-scale community wind project can be a useful tool to gauge whether a site has potential for future expansion. A successful community wind project can be a launchpad

for streamlined future expansion of wind development on a given site. The ability to rapidly scale up a site from a few turbines to several hundred is valuable in today's political environment where policies facilitating wind development change dramatically from year to year.

- Community-based wind projects may be feasible in certain areas where large-scale utility wind development would be inappropriate due to environmental or community sensitivities. As suggested in the 2004 Energy Trust report, "With local investment dollars at stake, community wind projects may benefit from increased community support, which might translate into a smoother permitting process relative to commercially owned projects."

- Community wind projects can, according to the Energy Trust report, "tap into a latent and potentially lower-cost source of capital to fund utility-scale wind development. Community-based investors may settle for a lower return on equity than commercial investors would be willing to accept, thereby improving project economics." In addition, "individual investors may be more tolerant than commercial investors of annual variability in revenues."

- In certain cases, community wind development may offer another, strategic benefit: distributed generation is less vulnerable to disruption than large, centralized power plants. Distributed generation may also help stabilize the electricity grid and meet localized power demand, delaying or eliminating the need for construction of large new transmission lines.

- Community wind projects "may be able to utilize existing infrastructure (e.g. roads, distribution lines, etc.), and if interconnected directly to the distribution grid may avoid the need to build a substation. These factors could offset some or all of any diseconomies of scale associated with smaller projects."

- Widespread geographic distribution of community wind projects can offset the variable production of each individual project and maintain a steadier level of productivity overall. When the wind is calm at one project site, it is likely blowing at others.

Using This Guidebook

Credit: Gretz, Warren

An abundance of information on wind energy project development already exists [see Section 8: Resources]; so much that the sheer volume and complexity of this information can be overwhelming. This Guidebook is not intended to duplicate existing resources for information about community wind financing, permitting, or project development.

Rather, the purpose of this Guidebook is to introduce the basic concepts behind community wind development in plain, user-friendly terms. The Guidebook should provide the reader with the conceptual framework for understanding the process of community wind project development.

Each community wind project is unique, and the proponents for each project will have varied experience levels, capacities, and priorities. For example, the specific goals and project development skills of a group of individual landowners will be different from those of a municipal agency or local economic development nonprofit. However, the critical elements that must be thoughtfully considered and successfully executed—selecting a good site, securing financing, obtaining permits, effectively managing construction, etc.—remain the same for all projects.

This Guidebook is intended as a starting point. If the resources for and interest in community wind are present, project coordinators can use the Guidebook to gain an understanding of each step in the process of project development, understand which project components they can accomplish themselves, and be knowledgeable about where to look for further information or technical assistance. This Guidebook is not, however, a substitute for professional guidance and should not be a project coordinator's sole resource for technical, legal and financial information. Laws and technical requirements can change, so local project coordinators should consult with professional technical, legal and financial advisors with project development, and when they do the information contained in this document should help guide the search for a professional project manager with the necessary skills, knowledge, and experience to successfully develop the proposed project.

Credit: AWEA

Section Summaries

Section 2—Project Design and Management:

This section is intended to convey the importance of assembling the right

project team and developing a comprehensive project plan. Specific elements of project plans and details about the various phases of community wind
projects are provided. This section should give a solid overview of the types of questions and issues that a project team will likely face.

Section 3—Resource Assessment and Siting:

An accurate assessment of the wind resource at a site is an integral part of the decision to begin a wind project. This section discusses tools for accomplishing the initial assessment necessary to choose a site as well as the in-depth assessment necessary to estimate annual production and receive financial support. It also describes some of the other factors in choosing a site and placing wind turbines within that site.

Section 4—Site Control:

Establishing site control ensures the exclusive rights to develop a wind project at the proposed site. There are a few different options for controlling the land on which the project is to be built, as well as securing unfettered access to the wind resource itself. This section discusses these options.

Section 5—Permitting:

Once an appropriate site for a community wind project is identified and secured, project coordinators must obtain permits to build the project at the chosen site. Obtaining the necessary permits can take anywhere from a few months to over a year. This section describes the permits that may be required for a community wind project and when and how to apply for them.

Section 6—Interconnection:

Transferring the electricity produced by a wind project to the utility purchasing the power can be done in several ways. This section discusses these options and the process through which an agreement can be reached with the utility.

Section 7—Financing and Ownership:

Securing financing and determining how ownership of the project will be allocated requires consideration of several primary issues and a host of other variables. Current best-fit ownership models are described in this section, along with discussion of a wide range of potential sources of funding, tax effects, and state and federal incentives. Included is an Expense Example Spreadsheet.

Section 8—Resources:

This section provides tools to the reader who would like to explore a topic from the Guidebook in greater detail. Resources include brief descriptions of useful publications and contact information for public agencies, organizations, distributors of turbines, permitting offices, and utility companies.

Credit: Henry DuPont

PROJECT DESIGN AND MANAGEMENT

This section is intended to convey the importance of project planning and provide useful tools to assist in managing a community-scale wind project. The elements of a project plan typically include scope, time, cost, human resources, communications, risk, financing, procurement, and construction management plans. The tools necessary to start a project, along with a narrative description of each project plan element, are described below.

Project Team and Team Management

As with any complex project, putting together the right team to execute a wind energy project can be as important as the original concept. In this Guidebook, we use the following terms and definitions when describing key players on the project team:

Owner: The owner(s) of the wind energy project is an individual or group with a financial stake in the project in the form of equity or debt.

Project Coordinator: The project coordinator, who in some cases may be the same as the owner, conceptualizes the project and takes the initial steps to pull together the appropriate team for execution of the idea.

Project Manager: The project manager is responsible for overseeing all necessary steps of project development. This role is typically filled by a professional wind energy developer.

The makeup of the project team will depend on the size and the complexity of the project. The project coordinator may have the initiative and vision to recognize an opportunity, but he or she may not have the skills needed to transform this vision into reality. A project manager's job is to do just that. The project manager organizes the budget, schedule, and the rest of the project team to ensure that the project is a success. Selection of a project manager is one of the first crucial steps necessary to begin a wind project. It is essential to find someone with the experience, skills, and knowledge necessary to implement a successful project.

Team management, one of the major responsibilities of the project manager, includes the processes required to make the most effective use of the people involved with the project. An organization chart can be used as a tool to identify and assign project roles, responsibilities, and reporting relationships. The organization chart may include project stakeholders, coordinators, customers, partners, individual contributors, and other members essential to completing the project. An example of a team organization chart is included below in Figure 2.1.

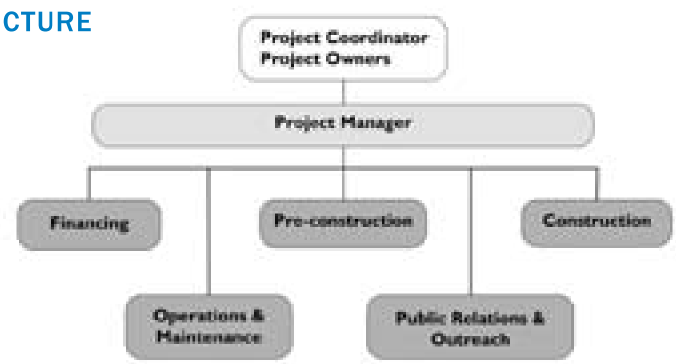
In addition to overseeing the team organizational structure, the project manager is responsible for ensuring successful communication between team members. It is important to track information flow to identify who will need what information, when they will need it, and how it will be given to them. Regular status or performance reports are essential for ensuring that all tasks are running on schedule and that the team members responsible for individual tasks have all of the necessary tools. The project manager should decide who will be responsible for gathering and disseminating this information.

Project Scope and Plan

The first steps taken to initiate a wind project are critical. There is a risk that the time, energy, and funds invested in these first steps will not result in a completed project, and will provide no return. A large range of possibilities must be methodically researched and evaluated until the most promising set of actions is determined. A project charter or project plan is a useful tool to

FIG. 2.1

COMMUNITY WIND PROJECT SAMPLE TEAM STRUCTURE



Team	Scope of Responsibility
Project Coordinator and Owners	Provide overall project guidance
Project Manager	Manage budget, schedule, communications and overall project development
Financing	Research & apply for funding opportunities, develop and maintain cash flow
Pre-construction Development	Permitting, environmental review, tribal relations, land use, interconnection and PPA agreements
Construction	Site prep, procurement, installation, commissioning, inspections
O&M	Perform routine inspections and maintenance
Public Relations	Contact for press, events, general outreach

formally initiate the project and take the first steps. A project plan typically includes the business needs that the project will address, a project description, scope definition, identification of the project manager and team, and list of constraints and assumptions. It may also include a scope change control process that identifies how changes will be evaluated, managed, and integrated into the project.

The project plan should be formulated and agreed upon by the project coordinator(s) and anyone underwriting the project through financial or other means. Initially, the plan will serve as a set of objectives and guidelines to focus efforts without basing too much on unverified information. As information is gathered and project design aspects are solidified, attention should also be paid to regulatory compliance, minimizing environmental impacts, ease and cost of maintenance, and meeting the expectations and goals of the stakeholders. One key task when writing a project plan is identifying which information gaps need to be filled. Early identification and resolution of important questions reduces project risk and facilitates project development. To assess which information is most crucial, one must consider the influence of factors such as potential project ownership and financing structures, likely technical and environmental issues, project scale, and schedule flexibility.

If the project is complicated, the overall development plan may be composed of several subplans:

Technical Plan: All wind projects have many technical factors to consider. These include the wind data, turbine performance, electrical interconnection, site access and constructability, construction design, and forecasts of expected production.

Permitting Plan: All wind projects will require a variety of permits, ranging from building permits to Conditional Use Permits (CUPs). These are usually issued by the county and influenced by what kind of entity owns the site and how it is zoned. A permitting plan includes surveys of the site property for environmental and other purposes, translation of technical factors into a permitable project layout, and a schedule for filings and hearings.

Community Education Plan: Nearly all wind projects affect people outside the site boundary, so this plan focuses on how and when local stakeholders will be informed about the project.

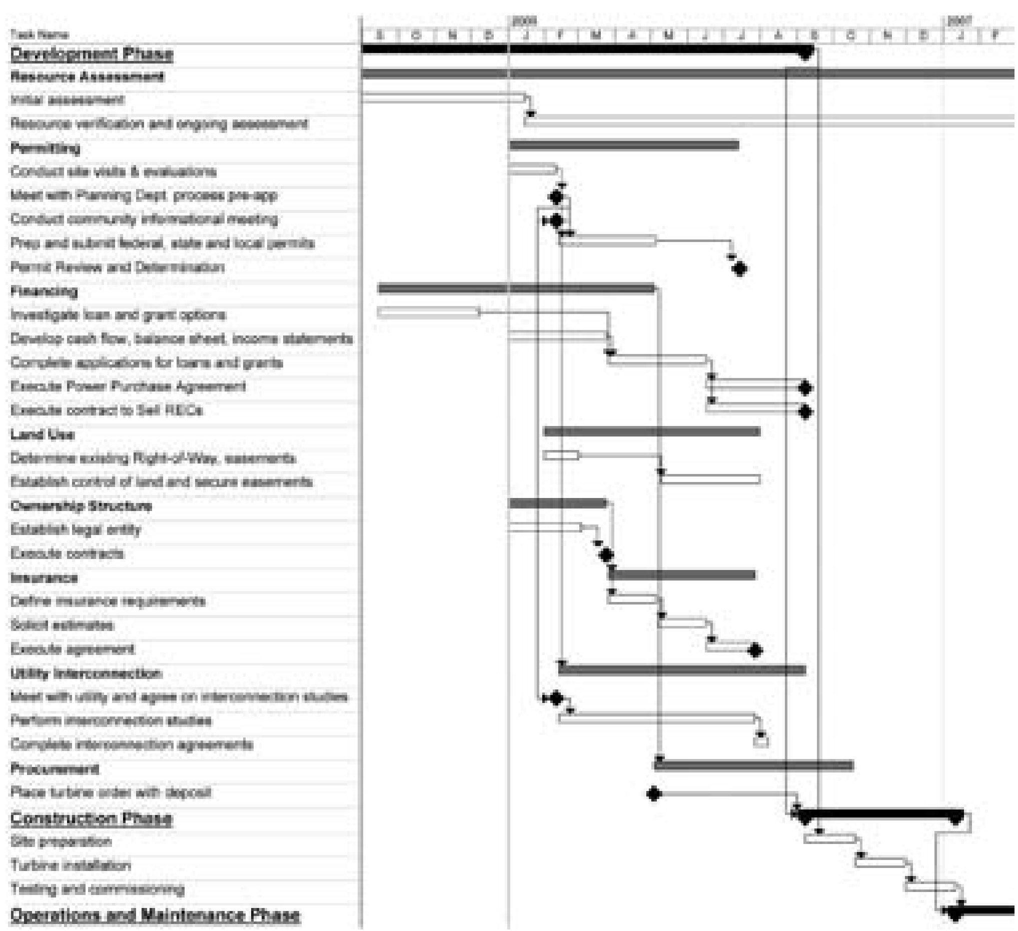
Financial Plan: All wind projects have a strong financial component, which determines profitability or achievement of other goals, what incentives are used and how, who takes risks and earns rewards, how the development budget is controlled, and what has to be done to qualify for the intended financing.

Business Plan: This plan synthesizes all other plans into a coherent whole relative to the project's objectives and risk-management strategies. It includes a schedule, progress metrics, and a strategy for how problems or major changes in direction would be addressed. The business plan may be organized around particular milestones or decision points. It also will include the legal actions to assure development rights on the site property, the legal aspects of various applications for permits and financial resources, the utility interconnection agreement, the electricity sales contract, and other legal and professional contracts.

Another important element in planning and designing the project is to define each step and process that needs to be completed in both the long and short term. A Gantt chart is a tool that can be used to schedule tasks, assign resources, and identify the critical path for the project. Gantt charts typically include a sequential listing of tasks, resources, duration, relationships, and dependencies. However, they can also be used to track budgets, changes in milestones, and completion risks. When the project is under way, Gantt charts can be used to monitor whether the project is on schedule. If it is not, it allows the project manager to pinpoint remedial actions necessary to put it back on schedule. Figure 2.2 is a sample Gantt chart for a community wind project.

SAMPLE GANTT CHART

FIG. 2.2



A Gantt chart is useful for tracking project tasks and displaying task relationships. This figure displays a simplified chart for the development of a community wind project.

Typical Community Wind Project Phases

The industry's standard phases include Development (all tasks from project conception up to construction), Construction, and Operations and Maintenance. Because this Guidebook focuses primarily on the first phase, we have broken the Development phase into tasks. The Development tasks, as described below, often overlap in timing and are not necessarily completed in the order listed. These phases and associated tasks are discussed in depth later in the Guidebook.

Development Phase

Conception and Feasibility:
The goal of conception and feasibility is to determine if there is an opportunity for a wind project and enough wind to justify the project, identify any potential supporters, confirm absence of major obstacles, and gauge the local community and utility's receptivity to a project. Costs associated with the conception and feasibility tasks typically make up ~1–2% of the total project budget. For a 2 MW project with a $3 million budget, this research will likely require an investment of $50,000. A wind energy consultant may be able to provide an initial review of the wind resource and identify potential utility interconnections, as well as help with the fatal flaws review. The consultant may also have suggestions for sources of grant money and other funding.

Credit: David Hansen, Minnesota Agricultural Experiment Station

Tasks Associated with Conception and Feasibility:

- Resource review
- Site inspection
- Investigation of interconnection opportunities
- Fatal flaws review
- Grant research and application development
- Investigation of site access

Project Design and Development:
If initial research reveals that a wind project may be economically feasible at one or more sites, design and development begin. At this point a project manager is often hired, the project's specific goals are defined, and the project manager identifies the tasks needed to achieve them. An initial timeline and financial analysis are completed (these are later refined as more information is collected). Site surveys for the permitting process begin, long-term wind data collection is started, and the range of project possibilities is narrowed down to a few "best" plans. It is important to begin these processes early, because the actions and studies involved set the future course of the project and can

take several months or years. Preparations for the formal utility interconnection process should also begin. Costs associated with project design and development typically amount to 2–5% of the total project cost.

Tasks Associated with Project Design and Development:

- Obtain meteorologist recommendations and data collection
- Identify financial incentives
- Design and initiate wildlife surveys
- Begin interconnection evaluations
- Begin electricity marketing discussions

Pre-construction Development:

Once preliminary planning and analysis steps are completed, the project begins its Pre-construction and Site Development phase. This phase includes completing environmental reviews, applying for permits, and finalizing the interconnection agreement. Negotiations should begin on the Power Purchase Agreement (PPA), although this agreement is not executed until the project is close to receiving its construction financing and the final permits are ensured. Negotiations and a finalized PPA are immensely important to a wind energy project. Not only is the primary revenue stream determined in the PPA, but the permits and the PPA, along with the revenue projections and interconnection agreement, set the basis for later financing negotiations. Major equipment orders need to be placed as soon as possible, but coordinated with assurance of financing, application for state tax credits (see BETC in Section 7), and site suitability assessment.

The application for the Oregon Business Energy Tax Credit (BETC) needs to be made before the start of the project.

Long waits for turbines, towers, and transformers are not at all unusual due to high demand from project developers wanting to take advantage of the Production Tax Credit before the expiration deadline. The project team releases a Request for Proposals (RFP) and chooses a construction manager based on the proposals received. Costs for these tasks are typically 3–7% of the total project costs, plus the deposits required for ordering the turbines (often 20% of the turbine cost).

Tasks Associated with Pre-construction Development:

- Obtain permits (conditional use permit, road permit, building permit, etc.)
- Finalize development plan
- Finalize interconnection agreement
- Negotiate Power Purchase Agreement
- Plan incentive use and complete applications
- Finalize financing

Construction Phase

Once all the essential project elements are in place, the construction manager can begin site preparation for delivery and installation of the turbines. Site preparation tasks include road improvements and construction, foundation excavations and turbine pad preparation,

preparation of temporary-use areas such as crane pads, installation of the collector system, and preparation of the substation pad. Also included are any upgrades or construction for interconnection to the utility grid and for transmission of energy. Once the turbines arrive on the site, all effort is channeled into installing and commissioning the turbines as quickly as possible. After the safety tests have been completed and proper turbine operation is confirmed, the project is ready to begin commercial production. After all construction is complete, site restoration tasks are completed. The majority of capital costs, 70–90%, are typically incurred during this phase.

Courtesy GE Energy, © 2005, General Electric International, Inc.

Tasks Associated with Construction:

- Completion of site preparation tasks
- Grading and road improvements/construction
- Trenching, cable-laying, and transformer installation
- Foundation and crane pad construction
- Fencing and erosion-control projects
- Substation construction/improvements and testing
- Turbine and tower transportation
- Turbine and tower installation
- Interconnection
- Commissioning
- Site restoration
- Inspections completion

Operations and Maintenance Phase

Once the wind project is operational, it must be maintained for its lifespan. A maintenance contract with the manufacturer or a qualified firm is a common way to do this. Operating costs also include warranties, administrative fees, insurance, property taxes, land-lease payments and a contingency fund for unforeseen problems. In addition, some projects will have a period of revegetation and wildlife impacts monitoring. Together, these costs typically average between 4 and 5% of the total capital costs each year. After the useful lifespan of the wind turbines, there will be decommissioning costs associated with the removal of the machines and restoration of the site.

Credit: Tom Roster

Cost Management

COST MANAGEMENT INCLUDES THE FOLLOWING:

Resource Planning and Cost Estimation: determining which resources (people, equipment, material) and what quantities should be used to complete and operate the project, developing an approximation of the costs of these resources, and developing a budget.

Cost control: tracking and controlling changes to the project budget.

Project Budget

The primary tool for cost management is the budget, which is developed using the best available information for each expected expense. The budget is used as a financial tool in determining project feasibility, and as an accounting tool for project management. During a project, expected costs are assembled to construct a budget and actual expenses are tracked and compared to budgeted amounts. Accurate initial budgeting and a plan to respond to budget deviations are essential in managing a project.

Project costs vary based on the size and complexity of the project, the chosen equipment, and the project site, among other factors. (These variations make it difficult to generalize costs. The Expense Example (shown as Table 7.1) is intended to convey the essential elements of a project, not to give exact costs for any particular project. The Expense Example also expresses costs as a rough percentage of total project costs, for reference.) Developing a good budget will require considerable research and consultation with experts and vendors. Inevitably, the budget will be revised as estimated costs are confirmed, problems arise, and new information is received. It is critical, however, to have a reasonably certain expense budget and schedule established for project financing.

Cash Needs—Expense Estimate per Project Phase

The following estimates of costs incurred during each phase of a project allow project coordinators to plan cash needed during project development. Some expenses, most notably those for project management, occur throughout more than one phase of the project. These “estimated costs per phase” have been drawn from work done by Jeff Keto at the Oregon Department of Energy, as well as other industry experts.

TABLE 2.1

Project Phase	Typical Expense Percentage
Development: Feasibility and Conception	1–2%
Development: Project Design	2–5%
Development: Pre-construction	3–7%
Construction	70–90%
Operations and Maintenance	4–5%

Early in the process it is difficult to obtain outside financial resources due to the high risk that the project will not be completed. As a result, the project coordinator often supplies the capital and in-kind support for early work on the project such as research, grant writing, and outreach to the community. Sources of capital used for development work, construction work, and operations and maintenance will depend on the financial structure of the project. The financial structure will determine who owns the rights to the project and who carries the risks at various stages.

Risk Management

Being prepared to face and manage risks is essential to any type of project development, and wind energy projects are certainly no exception. Wind projects often have a protracted period of at-risk investment. Until all permits and equipment are obtained, there remains the risk that the project will not be completed. However, with the right project team, a project manager who is familiar with the associated risks should be able to incorporate risk mitigation into a successful management plan.

Risk factors, or sources of risk, fall into several main categories: Energy Production Factors, Other Revenue Factors, and Other Project "Make or Break" Factors. Described on the next page are the typical sources of risk within each of these categories and key tools to help manage the associated risk.

RISK FACTOR TABLE

RISK FACTOR	ISSUES & MITIGATION TOOLS
Energy Production Factors	
Wind Resource	Higher-quality and longer resource assessment mitigates the risk of inadequate long-term production. However, more robust resource studies require more upfront capital that may not see any return. To balance this risk, consider getting expert opinions, using public reference stations for data, and implementing other strategies as described in Section 3.
Equipment	Warrantees will generally cover parts, while performance guarantees will cover the availability of the turbine and sometimes the manufacturer's power curve. Turbine components typically are designed with a lifespan of twenty years, but parts warranties and performance guarantees do not last this long. (Guarantees may also be conditional on the manufacturer performing operation and maintenance or on other requirements). Reserve funds, careful siting, and more wind data help mitigate these risks.
Operation and Maintenance	Mitigate operations risks by hiring an experienced site manager and entering into a maintenance contract.
Force Majeure	Fully insuring the project mitigates your financial loss due to force majeure, i.e. acts of nature such as tornados.
Other Revenue Factors	
Value of Energy Produced	Consider what type of utility provides service in the area where the project will be located. Then consider that utility's attitude towards community wind projects and need for power. This will affect Power Purchase Agreement (PPA) negotiations. Under Oregon's PURPA Order, PPAs with investor-owned utilities will be 15–20 years, mitigating this risk. Also consider Renewable Energy Credits as an additional commodity worth negotiating. Wheeling will add cost and complexity, but may possibly result in greater overall revenue. See Section 6 for more detail.
Tax Benefit Allocation	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. See Section 6 for more detail on tax allocation issues.

TABLE CONTINUED ON NEXT PAGE

TABLE 2.2 (CONTINUED)

On-again/Off-again Tax Subsidies	The uncertainty of incentives such as the Federal PTC can wreak havoc on projects dependent on the revenue from these incentives. Be aware of any assumptions made in the financial plan, and have a contingency financing plan whenever possible. Also, make sure that you apply for the Oregon State business tax credit before the project starts. For more detail, see Section 6.
Transmission	If the electric grid faces transmission constraints, the project may have to be downsized or relocated to avoid large utility upgrade costs. This can severely impact the cost structure of the project and its viability. This risk can be mitigated with careful siting within the utility system, or relocation or resizing of the project.
Other Project "Make or Break" Factors	
Environmental Impacts	In deciding whether to issue a permit, local planning departments may require a number of environmental studies on noise, wildlife presence and use, rare plants, land-use impacts, and aesthetics. Researching existing information on these topics will help determine whether the project might raise critical environmental concerns. Early involvement of potential critics, responses to concerns, careful project layout, and a detailed construction plan can mitigate the risk of many of these impacts.
Public Acceptance/ Politics	Public opinion challenges can be hard to predict or solve. However, risks can be mitigated through initial review for "fatal flaws" during the site evaluation process. Siting the project to minimize noise, visual, and wildlife impacts decreases the likelihood of public opposition. See Sections 4 and 5 for more information. Plan to communicate 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 the public acceptance challenge.
Site Control	In "locking up" the site too soon, there is risk of investing in a site that turns out to be unsuitable. Waiting too long increases the risk of investing significant time and money 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. Section 3 provides more detail on this point. 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	To mitigate the risks associated with construction delays, develop a contract that includes completion dates and penalties.

Procurement

When choosing a wind turbine, knowledge of how site-specific factors will influence a turbine's performance, lifespan, and maintenance costs can affect the choice. Factors to consider are wind speed distribution, shear, icing, peak winds, and turbulence levels.

Wind speed distribution: Turbines with two generators, one of which operates at lower wind speeds, or units with longer blades relative to their generator size may be more appropriate for sites that experience sustained winds at lower speeds.

Climatic conditions: Many turbine manufacturers make versions of their turbines that are designed specifically for harsh climatic conditions. While it is unlikely that the cold climate version of a turbine would be required in Oregon, anyone considering a development near the coast may wish to talk to the manufacturer about availability of a marine environment model. Expected peak winds could be a factor in choosing a particular model.

Turbulence levels: The ability of the generator to handle gusty winds without affecting power quality, maintenance requirements/costs, and unit life can be important in areas with turbulent winds or high wind shear. Pitch-controlled blades can respond quickly to changes in wind speed to reduce the impact on the generator, but even this takes time. Very gusty sites require a generator that allows "slip" (variation in rotor speed) while maintaining proper function. Slip will compensate for an increase in shaft speed coming from a gust of wind.

Under ideal circumstances it would be possible to choose a turbine type based on the site-specific factors listed above, place an order, and receive the turbine(s) in plenty of time for the installation. Unfortunately, turbine demand is so high that that the wait can be more than a year from the time the initial deposit is paid to turbine delivery. The result is that turbines are often chosen based on availability (assuming prices are equivalent). To avoid this situation, place the turbine order as soon as financing is secured and the project owners feel comfortable that the project will go forward. Most turbine manufacturers require a 20% deposit and a letter of credit for the remainder before they will place an order in the queue. The delivery and maintenance terms will be specified in the contract between the project owners and the manufacturer.

Another option that is becoming increasingly cost-effective is to purchase refurbished or remanufactured turbines. Turbines are designed to last twenty years, but with proper care and replacement of the parts that receive the greatest wear and tear, they can last much longer. Several companies now offer remanufactured turbines, some with warranties. These warranties may not be as long-lasting as those on new turbines, but do guarantee that the turbine provided is a functioning piece of equipment. The advantage of remanufactured turbines is their reduced cost, but there are also disadvantages to be considered. Buyers should conduct reasonable research into remanufactured turbine vendors to ensure they are working with a reputable firm. Older turbines require more maintenance, so Operating and

Maintenance (O&M) costs will be higher. Also, turbine manufacturers do not continue to make replacement parts for past models indefinitely, so ensuring a supply adequate for the lifetime of the project is necessary when considering refurbished turbines. If considering a remanufactured turbine, it is also important to verify that any state or federal subsidies applied for support the use of remanufactured equipment.


Photo credit: Tom Roster

The construction of Carleton College's wind turbine

Construction Management

One of the key players on a wind project team is the construction manager. This person is responsible for getting the tangible parts of the project installed and operating within budget and schedule constraints. The difficulty of this task is dependent on such site-specific factors as soil composition for the turbine foundations, proximity to roads, approved work corridors and grid access, delivery coordination, and weather conditions. Access to the heavy equipment required to install a turbine, such as large cranes, is another key factor. In the ideal case there will be a local general contractor with previous experience managing wind turbine installations. If limited local expertise exists, an out-of-area contractor's greater experience with wind projects must be weighed against the benefits of local knowledge and relationships. It is important that the general contractor be bonded, because the penalties for failure to perform may be many times the value of the construction job.

The type of installation required will be clarified in the contract with the construction manager. Large general contractors with wind turbine experience may be able to offer turn-key installation. In such an installation the construction manager will take charge of all construction, interconnection, and installation tasks. These installations are either design-build jobs or are built to a given design. Any professionals required for the task will be subcontracted by the construction manager, who is responsible for delivery of the completed operational project on schedule and on budget.

Turbine vendors may also be willing to provide a turn-key installation, in which case they will assume responsibility for all turbine-related construction. The vendor's turn-key option may be more expensive than hiring a construction manager, but may be a good option when qualified firms are not available in the area. Wind project teams with greater experience may be able to save money on installation costs by not choosing to contract for a turn-key installation. Acting as the General Construction Contractor (GCC) can save money, but a much larger organizational burden, and increased risk, will fall on the project team.

The list on the next page illustrates the common construction components of a wind project installation, other than the turbine itself. This list might help to clarify the qualifications necessary in a wind project construction manager. It also sets up some questions that the project team must address in the project plan.

Roads: At most sites new roads will need to be built to provide access to the turbine site for the construction vehicles and crane. Old roads may also require improvement to ensure that they meet grade, load capacity, and turning radius requirements. Associated improvements are usually necessary for erosion control, drainage, and access gates. Rock and water for the roads and foundations may come from new pits on site or be trucked to the site.

Photo credit: Tom Roster

The construction of Carleton College's wind turbine

Grading: Beyond grading for any new roads, the site of the turbine foundation needs to be graded so the crane will sit level during installation. Additional grading may be necessary to set up temporary storage areas.

Cables: Cable needs to be laid from the turbine to the transformer and from the transformer to the site of interconnection. Generally, the cable from the turbine to the interconnection point is underground. The decision to run the wires under or over ground should be based on expense, permit requirements, land-use impacts, maintenance requirements, and habitat disturbance. Trenching will disturb habitat, but installing overhead wires may add risk to wildlife, interfere with land use, and be vulnerable to fire.

Foundations: The foundations for transformers are straightforward concrete pads, but turbine foundations require engineering to meet the specifications of individual sites and the specific turbine(s) selected. One common foundation-type uses two cylinders, one placed inside the other, to reduce the total amount of concrete. This type of foundation works well in places without a lot of rock. In areas with a lot of rock, this kind of foundation would require blasting, so a slab-type foundation might be more practical instead. Site preparation for a substation may require specialized engineering and construction to ensure proper grounding.

Other Electrical Work: Any utility facility upgrades specified in the interconnection agreement need to be completed before the turbines are energized. This work can be done by the construction manager or by a contractor specified by the utility.

Meteorological Tower(s): Many projects include tall "met" towers to provide data independent of the control sensors on the wind turbines. The data from these towers are typically used for power curve confirmation and warranty purposes. Information is communicated remotely to the project owner and utility.

Operations and Maintenance

Scheduled Maintenance and Contracting

Periodic maintenance begins as soon as the project starts commercial operations. This maintenance must be performed according to a specific schedule to meet the requirements of the warranty. Many turbine vendors have options for maintenance services during the early years, focusing on their warranty periods. There are also wind industry firms that specialize in turbine maintenance. These firms may be used as an alternative to the vendor or after the vendor maintenance period has expired. It may also be possible to hire a project crew from a nearby wind project, especially if that project uses the same type of turbine. At a much larger expense, a dedicated maintenance crew (never fewer than two people for safety reasons) can service the turbines.

Preventative maintenance is particularly important for community-scale wind projects because the off-warranty costs of major repairs involving cranes can consume many years of potential profit. The crane pad should be maintained in case of such an eventuality. Site-specific factors will also have an impact on required maintenance. If the site is dusty or subject to seasonal insect infestations, the turbine blades may need to be washed regularly. These issues should be included in the maintenance contract.

The high-voltage equipment connecting the project to the grid must be maintained. A service contract for this equipment may be created with the utility or a specialty company. This will be outlined in the interconnection agreement.

Site maintenance is also important and may include noxious weed control, gate and cattle guard maintenance, signage installation, and road and erosion control. These tasks can be handled by competent local contractors.

Replacement Parts Availability

While turbines are typically designed to have an operating life of twenty years, not all of the components are likely to last that long without major rebuilding or replacement. Experience has shown that blades, gearboxes, and brakes are most likely to require rebuilding or replacement. While preventative maintenance decreases the likelihood of a major expense, the replacement or rebuilding of a major component can be a significant financial commitment.

Courtesy GE Energy, © 2005, General Electric International, Inc.

O&M at the Klondike Wind Farm in Wasco, OR

Replacement parts are not likely to be needed until after the warranty period is over. During that time some parts may become unavailable as turbine manufacturers improve upon their technology. Keeping a spare parts inventory, a reserve fund, and additional insurance can mitigate the financial burden of parts replacement.

Decommissioning

It is common for permits to require assurance that there will be funds available to pay for decommissioning. This assurance can take the form of a bond, corporate guarantee, letter of credit, or reserve fund. Whatever the required method, the fund guarantee will be monitored to ensure ongoing compliance. If the decommissioning tasks cost more than expected, the project owner will be responsible for the remaining costs.

An alternative to decommissioning at the end of a project's life is repowering. Repowering involves turbine replacement, removal of old hardware, foundation replacement, possibly a reconfiguration of roads, permit revision, new financing, and negotiation of a new PPA. The site will also need to be restored once repowering is completed.

When and How to Seek Professional Assistance

There are several key areas where professional expertise will likely be essential:

Project Management: If no one on the initial project team is experienced with energy project development, a project manager will be essential in moving a project through the development process.

Construction Management: The importance of this team member has been discussed in this section. Local turbine dealers may be able to provide information on where to find a construction manager. Energy Trust can also provide information on how to locate a potential construction manager.

Micro-siting Assistance: Consulting a meteorologist for input on where turbines should be sited is required for some federal grants, and is recommended for sites with complex terrain. A meteorologist will confirm the best position(s) for the equipment. For names of local meteorologists, contact the Energy Trust.

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 has the knowledge to conduct soil tests and recommend a foundation design, or to create a new design as the case warrants. The turbine manufacturer may have a list of engineers who have previously designed foundations for their turbines.

Interconnection Design: An engineer who is independent of utility involvement will help design the interconnection system and ensure that the utility's plans are appropriate. Construction managers are often able to recommend an engineer with interconnection experience.

Legal Assistance: Power sales, project financing, land control, and various associated contracts are specialized to the independent power industry. Some attorneys also specialize in permitting and environmental compliance. The development process depends on these documents being up to industry standards.

Environmental Study: There is a realm of professional biologists who can help negotiate study protocols with the Oregon Department of Fish and Wildlife and conduct a scientifically sound field survey. Having a defensible set of environmental studies is important for permitting and community support.

3

Credit: Warren Gretz

RESOURCE ASSESSMENT AND SITING

Just as in real estate, in wind development, location is everything. The first consideration in choosing a site is the wind resource. Without a good wind resource, no wind project will ever be viable. There are many tools available to examine the wind resource, and this examination goes on throughout project development. Average wind speed, however, is not the only determining factor when choosing a site. Proximity to transmission lines and roads, terrain, and land use are just a few of the other factors that require consideration when siting a wind project. This section discusses the tools available to measure the wind resource at a site, the type of assessments that are required to complete different project tasks, and additional factors to consider when siting a project

Resource Assessment

Wind Vocabulary

Describing the wind resource at a site requires the use of "wind vocabulary." The following terms are necessary to explain exactly how the wind behaves, which in turn leads to an estimate of the energy produced by a project.

The power density is proportional to the cube of the wind speed, which means that every time the wind speed doubles, the power density increases by a factor of eight. As air density decreases at higher altitudes and temperatures, the power density decreases proportionally. Wind farms built in the mountains and in hot climates must take this into account when estimating energy production.

Wind Power Density (Wind Class): The power density of the wind determines how much energy can be extracted by a wind turbine and is influenced by two factors: wind speed and air density.

To simplify the comparison of the wind resource at different sites, wind power density has been standardized in Wind Power Classes. These classes are based on wind speeds taken at specific heights, generally using sea level air densities. Since the wind speed at any site will vary with height due to the effects of the terrain on the wind flow, the wind class is often defined at more than one height. A site with a measured average wind speed of 5.8 m/s at a height of 10 m and 7.2 m/s at a height of 50 m has a Class 4 wind resource. Table 3.1 displays the wind speeds associated with Wind Power Classes at 50m, assuming sea level air density.

Shear: Friction created by a site's vegetation and terrain slows the wind close to the ground. The shear of a site determines how quickly the wind speed increases with increasing height above the ground. This number can be used to estimate the wind speed at the height of a proposed turbine even if the wind speed data were taken at a lower height.

WIND POWER CLASS TABLE

Wind Power Class	50 meters		
	Wind Power Density (watts/m^2)	Wind Speed (m/s)	Wind Speed (mph)
1	<200	<5.6	<12.5
2	200 - 300	5.6 - 6.4	12.5 - 14.3
3	300 - 400	6.4 - 7.0	14.3 - 15.7
4	400 - 500	7.0 - 7.5	15.7 - 16.8
5	500 - 600	7.5 - 8.0	16.8 - 17.9
6	600 - 800	8.0 - 8.8	17.9 - 19.7
7	>800	>8.8	>19.7

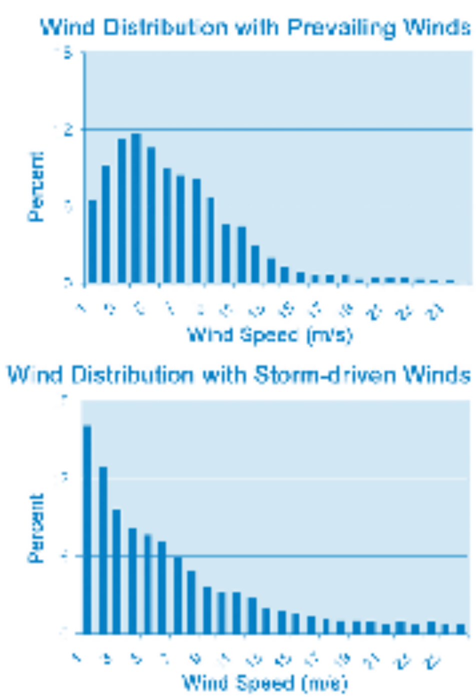
Source: Battelle Wind Energy Resource Atlas, for standard sea level conditions

Turbulence: Wind obstacles such as trees, buildings, and large land features affect the smoothness of the wind. When the wind is turbulent, the forces on the turbine blades can vary, affecting the production of the turbine.

Frequency (Weibull/Rayleigh) Distribution: The basic tool for estimating energy production at a site is the frequency distribution. A frequency distribution shows the percentage of time that the wind is blowing at certain speeds over the course of a study period. The wind speeds are binned, meaning that wind speeds between 0 and 1 m/s are binned as 1 m/s, wind speeds between 1 and 2 m/s are binned as 2 m/s, and so on. Once the wind speeds are binned, a count of all the wind speeds falling within each bin can be made and the frequency of the wind occurring in a particular bin calculated. The shape of the curve created by these bins is often referred to as a Weibull distribution. Average wind speed at a site can be influenced by prevailing winds or by storm-driven winds. Wind turbine performance is best in an environment with smooth, prevailing winds. A frequency distribution can clarify which type of wind is contributing to the average wind speed. Manufacturers often use a simplified version of the Weibull distribution, known as the Rayleigh distribution, to show estimates of annual energy production when only an annual average wind speed is known. The Rayleigh distribution assumes a generic distribution and should only be used for preliminary energy production estimates. Figure 3.1 shows

FREQUENCY DISTRIBUTION

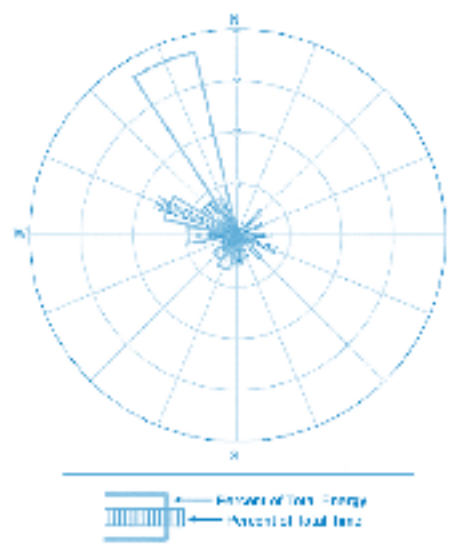
FIG. 3.1



The two sites from which these data were taken have similar average wind speeds. However, one site receives most of its wind during high-wind storms, while the other site experiences a prevailing wind.

WIND ROSE

FIG. 3.2



This wind rose shows that the prevailing wind at a site is not necessarily the direction from which the majority of the energy comes from.

examples of frequency distributions at a site with strong prevailing winds and at a site with storm-driven winds.

Wind Rose: A wind rose is a useful tool for delineating the directions from which the wind blows. It displays not only wind direction, but also the percentage of the power in the wind that comes from that direction. Alternatively, it can display the average wind speed by direction. This is a valuable tool for project layout and micro-siting. Figure 3.2 shows an example of a wind rose.

Initial Assessment

A quick and easy initial assessment of the wind resource at a potential site is essential to prevent wasting time and money preparing an unsuitable site. There are several ways an initial assessment can be done, but the best way is to use all of the tools listed below.

Credit: Ohio Office of Energy Efficiency

Wind maps: Contemporary computer climate models can estimate average wind speeds at a site. These models use information about the landscape and prevailing winds to estimate a site's wind resource. Many of these maps are then validated using actual wind speed data from measurement sites. This is important to ensure the quality of the model. As these models have become more sophisticated, the resolution of the wind maps has increased, making it possible to use them to site wind farms rather than just to get an idea of the average wind speed of an entire state. Appropriate uses of these maps include first-pass looks for windy locations in a region and initial confirmation of a wind resource at a chosen location. They do not eliminate the need for actual data from the site. A high-resolution wind map of Oregon is available at http://www.windmaps.org.

Oregon State University (OSU) Energy Resources Research Laboratory (ERRL): OSU's ERRL maintains a database of wind data for many sites in Oregon. Some of these sites have been monitored since the 1970s. The laboratory's Web site contains a map of the monitored sites that can be used to locate data near the site under consideration for development. If the site is in close proximity

to a monitored location, those data can be used to estimate the site's wind resource.
Web site address:
http://me.oregonstate.edu/ERRL/index.html

Site visit: A site visit cannot be used to definitively determine the wind resource, but can be used to look for signs that there may or may not be a good wind resource. Signs that indicate a good wind resource are desiccated vegetation or vegetation that shows marked flagging. Flagging occurs when the pressure from constant winds on a tree or shrub causes all of the branches to grow away from the direction of the prevailing winds. Tall trees and vegetation that do not show any signs of flagging can indicate a poor wind resource. Wind speed measurements taken on the day of a site visit will not provide reliable information as to a site's average wind resource.

If one of the above resources indicates a Class 3 or greater wind resource, it may be worthwhile to investigate the site further. A preliminary study using a relatively short meteorological tower, i.e. between ten and twenty meters tall, can serve to confirm or refute the indicated wind resource. If none of these resources indicate an adequate annual wind speed, an alternate site should be considered.

Other Factors

The wind resource is certainly the most important factor to consider when choosing a site for a wind project, but it is by no means the only factor worth consideration. Some of the following factors are uncovered during the permitting process, but there are a few that should be considered early on, before a significant amount of time and energy have been invested in a particular site.

Terrain: The wind resource on mountain peaks and ridges is often quite high, but installing a wind development at such a location may be impractical. During an initial site visit, a quick examination of the terrain can reveal issues that may be difficult to overcome.

Steep Slopes: Steep slopes are very difficult to build on, and increase construction costs tremendously.

Soil and Substrate Condition: Some sites will require blasting, which makes the building process more expensive and increases environmental damage.

Distance to Access Roads: A road with suitable grading for the crane will be needed to access each turbine site. Increased distance to local access roads increases costs significantly. The cost of grading a road will depend on the ground cover and the slope of the local terrain.

Site Accessibility: Harsh climates will limit the time periods during which site construction can be accomplished.

Transmission Access: Many of the windiest places in this country remain undeveloped because the distance to the closest transmission lines with available capacity makes the sites cost-prohibitive. Installing transmission lines is much more expensive than creating access roads and requires the cooperation of the local utility. It also necessitates an extensive permitting process. Below are issues to consider when examining a site's transmission access.

Proximity to Nearest Line: The cost of installing line will depend on the size of the development, the terrain, and the requirements of the county (i.e., Can the lines be pole-mounted or do they have to be buried?)

Voltage Level of Nearest Line: This will determine what level of step-up transformer is needed to make the voltage produced by the turbines compatible with the voltage of the nearby distribution or transmission line.

Line Capacity and Substation Proximity: The nearest distribution or transmission line must have the extra capacity required to accept the electricity from the turbine, or, if the nearest line cannot support the output from the turbines, a nearby substation may be necessary to accept the power.

Land Use (of Both Humans and Wildlife): The installation of even one wind turbine will have an impact on near neighbors, be they human or non-human. An initial consideration of this impact can prevent the project from being halted after a further investment of time and money.

NIMBY (Not In My Backyard): Wind turbines placed near housing developments often face opposition from landowners. This is particularly true in areas that were developed for their scenic value. Such locations will likely require substantial community outreach.

Wildlife: Previously undeveloped areas are more likely to contain wildlife populations that will be affected by the construction of a wind project. It is preferable to use previously disturbed land—including land in use for agriculture or grazing—for wind projects. Where this is not feasible, it is important to look at the prevalence of the type of habitat represented by the site. If the habitat is unique to the area, environmental issues are more likely.

Noise rules: See http://egov.oregon.gov/ENERGY/RENEW/Wind/noise.shtml. The link to the specific rules is given in the right-hand sidebar on this Web page.

These and other potential land use issues are discussed in more detail in the following chapter. Though some public opinion or wildlife impact challenges can be avoided or minimized through careful planning and appropriate mitigation, it is worth an initial review for obvious "fatal flaws" during the initial site evaluation process. For example, if a potential wind site is found to be adjacent to a critical nesting area for an endangered bird population, there may be no recourse but to seek a new project site.

Utility Service Territory: Utilities vary in their need for power, their interest in wind development, and the laws and regulations under which they buy power. Early communication with the local utility is critical to determine their unique circumstances. Please see Section 7 for a discussion of the impact of PURPA regulations on power purchase price, and how they differ between Investor-Owned Utilities (such as Pacific Power) and Consumer-Owned Utilities (such as Tillamook PUD).

Resource Validation

Following a positive initial assessment of a possible wind project site, a more in-depth resource assessment must be done to validate the energy production potential of the site. This assessment is necessary to validate the wind resource, estimate the monthly and annual production from one or more turbine types, and create a financial model incorporating estimated production. The scale of the resource assessment should be proportional to the size of the project. A two-year data collection period involving multiple tall meteorological towers spread over a site is probably unnecessary for a project with just one or two wind turbines, just as a single 10-meter tower collecting data for several weeks is not rigorous enough for a community-scale project. In general, data collection for one year with a 50- or 60-meter tower is sufficient, provided that those data can be correlated with another suitable site that has high-quality, long-term data.

Types of Data Required: Much of the data available from OSU's ERRL is averaged hourly. Hourly data are acceptable for a detailed resource assessment, but data averaged over each 10-minute period are preferred.

Wind Speed: Ideally, 10-minute wind speed data will be taken with calibrated anemometers from two heights for one or more years to get a high-quality estimate of average wind speed, and diurnal and monthly variations. One of these anemometers should be placed at or near the hub height of the proposed wind turbines. If the tower height of the turbines is undecided, data taken at three heights, from 30 m up to 50 or 60 m will be most useful. Collecting data at more than one height provides information about the surface roughness of the site and allows interpolation to wind speeds at greater heights. Hourly averages are acceptable if 10-minute averages are unavailable, but this is the maximum amount of time over which data should be averaged. It is also possible to take data for one year or less if there is a measurement station nearby with which the new data can be correlated. If a strong, long-term correlation between the proposed site and the measurement station is established, it may be possible to use historical data to estimate the wind resource at the proposed site. When using this approach, it is very important to ensure the quality of the data from the measurement station.

Wind Direction: Placing a wind direction sensor at the same height as the primary anemometer and taking data at the same averaging interval as the primary anemometer is necessary to provide information about prevailing wind directions. The wind direction information can be used to create a wind rose and to space the turbines so that they do not experience wake effects from each other or nearby obstacles in the prevailing wind directions.

Temperature: A temperature sensor is important for verifying the quality of the wind speed and direction data. At temperatures near freezing, precipitation can collect and freeze on the sensors, affecting their performance. There may be periods of time when the anemometer is measuring high wind speeds while the wind vane is immobile, or the wind vane may be indicating direction changes while the anemometer is not measuring a wind speed. Correlating temperatures to these data can verify icing conditions. Incorrect data should be removed or corrected before analysis is conducted.

Using Previously Recorded Data:

Quality Control: When using data collected by someone not affiliated with the project, it is essential to verify that the data are accurate, and in a form that allows the appropriate analyses to be completed. Below is a list of issues to address when using previously recorded data.

1. **Sensor Height:** The anemometer must be placed high enough to be free from the effects of any wind obstructions. Most banks require hub height wind measurements to qualify for financing.
2. **Sensor Type:** Cup anemometers are the most frequently used and most reliable wind speed sensors. Any other type of sensor should be investigated for its accuracy.
3. **Sensor Calibration:** Calibration of the sensors ensures that they are recording accurate information. The most reliable sites will have records that track when the sensors were calibrated.
4. **Averaging Interval:** Measurements should be averaged over a period of no more than one hour. The wind data taken by OSU uses a 10-minute averaging interval. Instantaneous measurements are only useful for detailed site analysis.
5. **Period of Collection:** The longer the collection period, the more useful the data. A full year is required to include seasonal variations in the data.
6. **Data Format:** Data are most useful in a time series format that lists each sensor's reading with the correlated time period.

Correlating Previously Recorded Data with Current Data: As previously mentioned, it is possible to correlate data taken at a nearby site with three months or more of current site data to extrapolate the annual wind pattern. If there is a good relationship between the wind speeds at the two sites, and the quality of the previously recorded data can be verified, this is an acceptable way to validate the wind resource for community-scale projects.

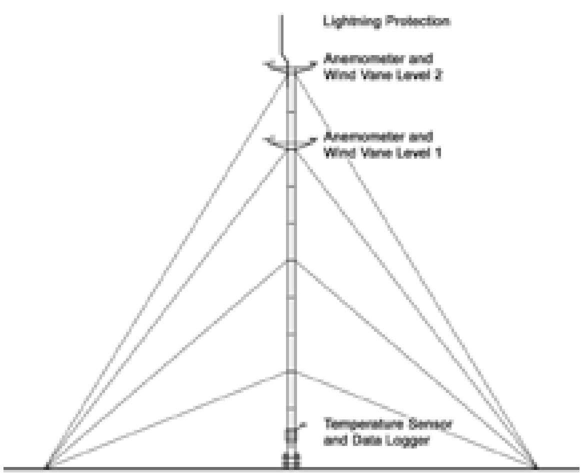
Collecting New Data:

Wind Assessment System (See Figure 3.4): A guyed tower is the preferred mount for a wind assessment system. The sensors are placed at various heights on booms connected to the tower, and a data logger is placed at the bottom of the tower.

1. **Anemometer(s):** An anemometer should be calibrated and placed on a boom at the height of the hub or at a height of 50 to 60 meters. Ideally, one or two more should be placed on booms at lower heights. The booms on which the anemometers are mounted should be oriented such that wake effects are minimized in the direction of prevailing winds.

METEOROLOGICAL TOWER DIAGRAM

FIG. 3.4



Created by Jeff Speert

2. **Wind Vane:** A wind vane should be calibrated and placed on a boom at the same height as the primary anemometer.

3. **Temperature Sensor:** The temperature sensor can be placed at a lower height than the anemometer and wind vane.

4. **Data Logger:** The data logger should be placed in a weatherproof container at the base of the tower for easy access. Its batteries, if not charged by a solar panel, will need to be changed regularly.

Wind Assessment System Sources:

1. Companies providing equipment:

• NRG Systems (http://www.nrgsystems.com)

• Second Wind (http://www.secondwind.com)

• Campbell Scientific (http://www.campbellsci.com)

2. Programs providing funding and/or equipment:

Energy Trust of Oregon Anemometer Loan Program: For Pacific Power and Portland General Electric customers (or for projects that will sell their power to Pacific Power or PGE), the Energy Trust, in conjunction with OSU's ERRL, has set up a program to lend wind assessment systems to landowners and municipal governments. The program currently has nine systems, which are lent out for yearlong periods. The collected data are available to the renter and also stored in the OSU database. For more information and an application, see the Web site at: http://me.oregonstate.edu/alp/alp-1.htm or call 541-737-7022.

USDA Value-Added Producer Grants (VAPGs) are available to fund feasibility studies for renewable energy systems. In the past, Energy Trust has offered funding for the preparation of USDA VAPG applications. Energy Trust has also offered 50-meter and 60-meter anemometer systems for use in feasibility studies supported by Value-Added Producer Grants. For more information on this program, and to find out the current status of Energy Trust support, see the Web site at: http://energytrust.org/RR/wind/

Data Analysis

Most investors will require a resource assessment done by a trained professional. Contact either the Oregon Department of Energy or the Energy Trust of Oregon for recommendations.

Resource assessments—including purchasing, installing, and decommissioning the equipment, and collecting and analyzing data—can cost as much as $30,000. This cost can be reduced if the project developer can do some of the labor and if used or rented equipment is employed.

Information in the resource assessment will include:

- Annual average wind speed
- Monthly average wind speeds
- Annual diurnal wind speeds
- Monthly diurnal wind speeds
- Weibull distribution
- Wind rose

If it is known in advance which type of turbine will be used, the resource assessment can also include expected production and turbine siting. Once this assessment is completed, an accurate picture of the wind resource at the site and the potential for wind development should be clear.

Estimating Production: The goal of any wind project is to produce energy, so an accurate estimate of production is essential when planning a project. This estimate always involves uncertainty, but how much uncertainty there is depends on the amount of data available both for the wind resource and turbine performance. Production is estimated using the wind speed frequency distribution generated during the resource assessment, along with the manufacturer's power curve. Multiplying the power output of the turbine at each wind speed by the frequency that the wind blows at that wind speed results in an estimate of production at that wind speed. Repeating this procedure for each wind speed bin and adding the results produces an estimate for the turbine's overall production. In general, the consultant providing the resource estimate will also provide a production estimate for a number of different turbines. This analysis will include an explanation of the amount of uncertainty in the calculations.

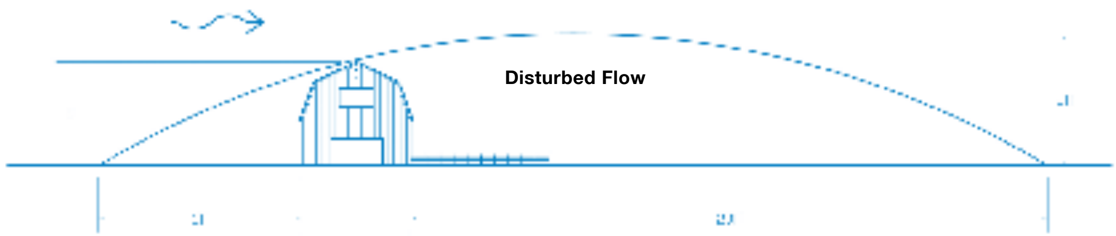
Turbine Micro-siting

Siting turbines within a wind project, or micro-siting, involves careful consideration of an array of factors relating to wind flow, terrain, equipment access, environmental and land-use issues, and visual impact. Maximizing production is the most important factor, but without attention to aesthetics, the project may not

TURBULENT FLOW DIAGRAM

FIG. 3.5

Placing a wind turbine within the zone of disturbed ***flow will result in lower energy production.***



Created by Jeff Speert

make it past the permitting phase. To maximize production, careful attention must be paid to the prevailing wind direction(s), wind obstructions from man-made structures or vegetation, and terrain effects. The impact of the wind disturbance caused by one turbine on another turbine is another important factor. Below is a list of general rules for siting turbines.

On a site with multiple wind turbines, the turbines should be placed at least two rotor diameters apart in the plane perpendicular to the prevailing wind direction, and at least ten rotor diameters apart in the plane parallel to the prevailing wind direction. This will prevent the turbines from experiencing reduced wind speeds and increased turbulence due to the other turbines.

To avoid turbulence, turbines should be placed at a distance twenty or more times the height of any man-made structure or vegetation upwind of the project. The turbulent wind flow created by a structure generally extends vertically to twice the height of the structure, so small structures may not have any impact on the tall turbines used today.

Avoid areas of steep slope. The wind on steep slopes tends to be turbulent and has a vertical component that can affect the turbine. Also, the construction costs for a steep slope are greatly increased.

On ridgelines and hilltops, set the turbines back from the edge to avoid the impacts of the vertical component of the wind.

Along with the rules stated above, it is important to take into consideration the visual impact of the site. Grids of turbines tend to be much less visually appealing than turbines placed along the curves created by natural features. It is also sometimes possible, on a large site, to place turbines where they will not be as visible to residents in the proximity.

Software programs now available are capable of taking into consideration most of these factors. When wind resource and topographical data are entered into these programs, the software can optimize turbine siting for maximum production and minimal visual impact. The turbine sites can be adjusted, and models within the program can show a simulated view of the project from different locations. This software can be quite complicated to use, so it is recommended that a consultant undertake the analysis. The consultant can also use site visits and local knowledge when creating a project plan.

Credit: Tom Roster

SITE CONTROL

If preliminary evaluation indicates that the proposed site has a substantial wind resource, and no other obvious obstacles to site development are apparent (such as neighbor opposition or sensitive wildlife habitat, as mentioned above), project coordinators should take steps to secure control of the site. Establishing site control ensures the exclusive rights to develop a wind project at the proposed site. There are a few different options for controlling the land on which the project is to be built and securing unfettered access to the wind resource itself. Regardless of how site control is established—whether by ownership or through a land-lease agreement—project coordinators must separately negotiate the ownership of the wind project itself (see Section 7: Financing and Development Models).

Ownership

If the landowner of the proposed wind site is already involved, or is interested in becoming involved in developing the wind project, the only necessary action for securing site control is to execute an agreement with the landowner that gives exclusive permission to pursue building the project on the land. This should be sufficient evidence of site control to satisfy permitting authorities and project funders, and to proceed with project development.

A less common—and likely less desirable—way to establish control of the site is to purchase the property. This is likely to be an expensive approach, and involves several challenges and risks. First, the existing property owner may not be interested in selling. Second, the land is presumably of value to a wind developer only if a project can successfully be developed on it. Should the project fail for any reason, at any stage of development or operation, the wind developer would be left owning the property but no wind project. For these reasons, and because the goal of site control can be just as easily accomplished without owning the project property, it is more common for wind developers to lease the land they need for the project.

Land Lease

The objective of leasing land for wind development is twofold: to secure the right to build turbines, roads, and other project facilities where necessary; and to ensure that no other development on or near the project site will affect the wind project's productivity or ability to interconnect. This makes wind development a good fit for land used to raise crops or livestock. Agricultural activities can continue right up to the base of each turbine or to the edge of each road, and will pose no threat to the project's operation. The Owner or Project Coordinator typically pays the property owner for the right to build on only those small portions of land actually needed for project infrastructure, with additional compensation for the right to the property's unimpeded wind resource. The wind project does not own or lease any more land than is necessary, and the farmer or rancher gets to continue using the majority of the land for agricultural production as before.

Land-Lease Agreements

A land-lease agreement is a contract in which the wind project owner agrees to make payments to the landowners on whose land the turbines or project infrastructure will be sited. In exchange, the landowner allows the use of designated portions of the land for wind turbines, roads, and associated infrastructure. The terms of this agreement should be carefully considered by all parties, ideally with professional legal advice, as it is a long-term contract with important financial and land-use implications. For very good summaries of the various topics to consider in land-lease agreements, see the Windustry organization's guide, "Wind Energy Easements: Legal Issues" (available at http://www.windustry.org/opportunities/easements.htm), and the "Landowner's Guide to Wind Energy in the Upper Midwest" (available from the Izaak Walton League of America).

Of particular importance for project economics are the lease payment terms. The wind project owner may pay each landowner for the wind rights to their land on a per-acre or per-turbine basis. This payment may be a one-time, up-front payment; a recurring payment (e.g. annual) of a fixed amount; a recurring payment that depends on the amount or value of the power generated by each turbine; or some other type. There are pros and cons of each payment structure for each party to the agreement, as described in the Windustry guide.

Easements

In Oregon, a wind easement is defined by Oregon Revised Statute (ORS) 105.900 as "any easement, covenant or condition designed to insure the undisturbed flow of wind across the real property of another." A wind easement ensures that the wind resource at the project site will not be diminished by other land uses. This differs from a land-lease agreement in that it does not grant permission for a developer to build a wind project, but rather guarantees that the landowner granting the easement will take no action to impede the flow of wind to the project. For example, a wind easement would prevent a landowner upwind of the project from constructing a tall grain silo that would block or diminish the wind resource at the project site.

Wind easements can be granted by landowners who will have project infrastructure sited on their property, either as a clause in the land-lease agreement or through a separate agreement. A wind easement may also be used to compensate landowners upwind of the project who will not actually host turbines or project infrastructure on their property, but whose cooperation and agreement not to obstruct the wind resource is desirable.

According to Oregon Revised Statute 105.910, an agreement granting a wind easement must include the following:

- legal descriptions of the property burdened by the easement
- legal descriptions of the property on which the wind project will be built
- a description of the horizontal and vertical dimensions of the easement
- a list of the restrictions placed on vegetation and structures that can be planted or built on the property
- terms or conditions under which the easement may change

Other types of easements that may also be necessary for the project include easements to guarantee access to the site via neighboring properties; easements to allow trenches, overhead lines, or underground cables; or easements for permanent roads to cross neighboring properties.

When to Establish Site Control

The Project Coordinator must demonstrate exclusive rights to develop the wind project site in order to secure permits and financing. It will likely be desirable to establish control of the site as early as possible in the development process. However, there is a balance between securing the site too soon or too late. In "locking up" the site too soon, there is a risk of paying for control of a site that turns out to be unsuitable for wind development. Waiting too long, though, increases the risk of investing significant time and money into project development only to lose the right to build at the site to a competing developer—or to a simple change of heart by the landowner.

In order to protect any investment made in project development, it is prudent to execute a pre-development option agreement in the early phases of site assessment. As soon as the landowners of a potentially good wind site are identified, executing such an agreement with them secures the exclusive right to obtain or negotiate a longer-term wind lease. It is especially important to have the exclusive rights to a lease agreement at a set cost if the developer is making significant pre-development investments in wind data monitoring, wildlife studies, etc.

An option agreement usually expires if the developer does not begin active project development within a reasonable timeframe (1–5 years). This allows the landowner to pursue wind development on his or her property with another developer in the future, if the original developer decides not to pursue a project.

If pre-development studies indicate the project will likely succeed, the developer and landowner should then execute a long-term wind lease governing the site control relationship for the construction and operations phase of the project.

Other Site Control Issues

The Project Coordinator should work with property owners and county planning office staff to ensure that no surprises related to land ownership or use restrictions arise later in the development process. Potential land title issues include: problematic impairments (such as liens, easements, mortgages, or other claims against the property), old public roads, subsurface mineral rights, and different objectives among title holders (if multiple). The existence and potential impact to the project of these or other land title issues should be investigated, and the issues resolved, before attempting to obtain permits or financing for the project.

Additional Siting Considerations

When developing plans for siting turbines, roads, and other project infrastructure, certain other criteria must be considered along with the location of the best wind resource. In order to successfully obtain permits and financing, the project must be planned to avoid or mitigate any potential hazards or inconveniences to nearby residents, wildlife, or project personnel. These siting issues will be covered in more detail during the permitting process, but it makes sense to anticipate—and make plans to avoid—potential points of contention during the initial project siting decision. In other words, consider any potential "fatal flaws" in an initial site review, to avoid spending time and resources developing a site that would likely prove unsuitable for wind energy due to neighborliness, safety, or wildlife concerns.

Neighborliness Issues

Siting turbines to maximize production must be balanced with the long-term impact of turbines on properties and local residents. Minimizing the effect of the project on neighbors is not only considerate, but it will also help avoid opposition to the project during the permitting process (see Section 5: Permitting).

One issue that may be raised by project neighbors is noise. Some noise, especially during the construction of the project, is unavoidable. With careful design and mitigation, however, the amount of noise can be minimized to avoid disturbing neighbors. This issue must be addressed in depth during the permitting process. Neighbors may also have concerns about the safety of the proposed project and what potential hazards the project's operation may pose for nearby residents. Detailed information about and plans for the safe operation of the project should also be developed during the permitting process.

Turbines are usually set back a minimum required distance or more from residences, public roads, and property lines to insulate participating and neighboring landowners from noise and safety concerns. Consider these issues when conducting an initial site analysis: Is the site large enough or configured in such a way that turbines and other project components can be located sufficiently far away from residences and property lines?

Other

As project coordinators inform the community and permitting agencies about the project, other siting issues may come into play. Project design and micro-siting decisions may be influenced by questions about wildlife, safety, lighting and design aesthetics, property values, and air traffic. These topics and others are discussed in the next section of this Guidebook. To the extent possible (within fundamental siting constraints dictated by the wind resource, transmission access, etc.), project coordinators should try to maintain flexibility in their siting process to accommodate potential conflicts with their chosen site or project design as they may arise.

5

Courtesy PPM Energy

PERMITTING

Once an appropriate site for a community wind project is identified and secured, permits must be obtained to build the project at the chosen site. Obtaining the necessary land-use and building permits can take anywhere from a few months to more than a year. The length of time depends on the jurisdiction (local or state) under which permits are sought, the permitting process in place under that jurisdiction, the results of pre-construction surveys and studies, the level of community support for or opposition to the project, and other factors. This section discusses the importance of communicating with officials and the community early on, briefly describes state and local land-use laws, and goes into detail on the various concerns that are typically addressed in the primary permit application (usually a Conditional Use Permit).

Communicating With Local Permitting Officials

In order to ensure that the permitting process for your wind project goes as smoothly as possible, it is advisable to inform your local planning department of your plans early to ensure that both project coordinators and planning department staff clearly understand the details of the permitting process.

Community wind projects are a relatively new idea in Oregon, where several commercial wind projects have already been installed. In order to ensure that the permitting requirements for a community wind project are appropriate given such a project's scale, it may be necessary to work with planning department staff, who may be unfamiliar with the technology, to distinguish between a relatively small community-scale project and a utility-scale project.

Depending on the size and structure of your county government and standard local permitting procedures, it may be necessary to hold a public meeting to present your proposal and solicit public feedback, distribute written notice of your plans to the community and invite written comments, and/or present your plans at a hearing of the Board of Adjustment, Board of County Commissioners, Planning Board, or other advisory or decision-making body. If a city or county Conditional Use Permit or Zoning Variance is sought, there will be a public hearing of the county planning commission to present the project application and solicit public feedback. When such a decision-making body is involved, it is common for planning department staff to review the application first. Staff will then provide the decision-making body with a recommendation for whether to approve or reject your permit application and will suggest conditions for approval. This recommendation is based on local zoning and permitting ordinances, the details of the application, and the project's anticipated compliance.

Keep in mind that decision-making bodies such as these are often composed of elected officials, who may pay as much attention to public opinion of the project as the facts of the project as they pertain to land-use law. It is always a good idea to actively seek public support for a proposed wind project, but it is especially important to ensure that your project is well represented by outspoken, supportive community members when going before such a decision-making body.

Communicating with Neighbors and Other Community Members

Once a project site is identified and site control is established, inform neighbors about plans for wind development and identify potential neighborliness issues while project planning is preliminary enough to avoid or mitigate conflicts (see Section 3: Resource Assessment and Siting).

Because local permitting processes usually include some vehicle for public comment, which decision-makers will consider when deciding whether to approve a permit, public support for or opposition to wind development can make or break a project. It is, therefore, critical to cultivate support for your project within the local community.

When presenting information on the project to neighbors or the community at large, be able to clearly describe the scale and specifics of the proposed project. Be ready with information about the technology, project design, and expected impacts on neighbors, wildlife, views, etc. In particular, because utility-scale wind turbines are a fairly new and unfamiliar technology for our region, be prepared to correct any misconceptions about the project or wind energy in general by referring to the latest, best available information. (see Section 8: Resources).

Clearly articulating the expected community benefits of the proposed project should help develop community support. When available, share projections for job growth, local government tax revenues to be paid by the project, lease payments for local landowners, business generated for local contractors during construction and O&M, and other expected economic benefits. This information may be presented in general terms when necessary; for example, to respect the private financial information of participating landowners.

Land-Use Laws

Under Oregon state law, a wind turbine or wind farm is an authorized use for Agricultural Lands (e.g. zoned EFU: Exclusive Farm Use or GF: Grazing/Farm Use; see your county comprehensive plan for zoning designations) provided that the project "(a) . . . will not force a significant change in accepted farm or forest practices on surrounding lands devoted to farm or forest use; and (b) will not significantly increase the cost of accepted farm or forest practices on lands devoted to farm or forest use."

Likewise, on Forest Lands, a wind turbine is an authorized use provided that the project: "(a) . . . will not force a significant change in, or significantly increase the cost of, accepted farming or forest practices on agriculture or forest lands; (b) The proposed use will not significantly increase fire hazard or significantly increase fire suppression costs or significantly increase risks to fire suppression personnel; and (c) A written statement recorded with the deed or written contract with the county or its equivalent is obtained from the land owner which recognizes the rights of adjacent and nearby land owners to conduct forest operations consistent with the Forest Practices Act and Rules . . . "

Permissible uses of land are detailed in the Oregon Administrative Rules, Chapter 660, Land Conservation And Development Department. Rules detailed are from Division 6 (Forest Lands) and Division 33 (Agricultural Land), including OAR 660-033-0120, OAR 660-033-0130, and OAR 660-06-0025. These and other Oregon Administrative Rules can be viewed online at http://arcweb.sos.state.or.us/rules/OARS_600/OAR_660/660_tofc.html.

A facility that permanently converts for wind project use twenty acres or more of agricultural land, twelve acres or more of high-value farmland (check with your county to identify areas designated as high-value farmland) or ten acres or more of forest land must seek an "exception" to Oregon's statewide land-use planning Goal 3 or 4 (see below).

OREGON'S LAND USE GOALS

At the direction of the state legislature, Oregon's Land Conservation and Development Commission adopted nineteen statewide Goals to guide land-use planning. Under the program, all cities and counties have adopted comprehensive plans that meet mandatory state standards as expressed in the Goals. The Goals are designed to balance development and conservation concerns, encouraging development and redevelopment in existing urban areas while protecting farm and forestlands and natural resources.

For example, Goal 3 is "to preserve and maintain agricultural lands. Agricultural lands shall be preserved and maintained for farm use, consistent with existing and future needs for agricultural products, forest and open space and with the state's agricultural land use policy expressed in ORS 215.243

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and 215.700." Goal 4 is to "conserve forest lands by maintaining the forest land base and to protect the state's forest economy by making possible economically efficient forest practices that assure the continuous growing and harvesting of forest tree species as the leading use on forest land consistent with sound management of soil, air, water, and fish and wildlife resources and to provide for recreational opportunities and agriculture."

An exception is "a decision to exclude certain land from the requirements of one or more applicable statewide goals . . . (from OAR 660-004-0000). " Permitting authorities can seek an exception for your project if, "(a) There is a demonstrated need for the proposed use or activity, based on one or more of the requirements of Statewide Goals 3 to 19; and either (b) A resource upon which the proposed use or activity is dependent can be reasonably obtained only at the proposed exception site and the use or activity requires a location near the resource; . . . or (c) The proposed use or activity has special features or qualities that necessitate its location on or near the proposed exception site." The viability of a wind energy project is exceptionally site- and resource-dependent, thus making a wind project a good candidate for a Goal 3 or Goal 4 exception.

State and Local Permitting Processes

In general, for wind projects of up to 10 MW in size, the permitting process is less rigorous than that required for larger, utility-scale projects. Most community wind project developers will likely find it easiest to obtain permits through their local county planning department, rather than through the state-level Energy Facility Siting Council (EFSC).

In some cases, obtaining a site certificate (a consolidated state permit allowing project construction) from EFSC may make more sense than seeking permits locally for a particular project even though it will be more costly. According to *An Assessment of Wind Project Siting Regimes,* by local wind consultants Peter D. Mostow and Andy Linehan, "Difficult projects facing significant public opposition or a divided local government may well be safer to permit at the state level . . . . The two main reasons: EFSC . . . permitting is more objective, being standards-based rather than politically-based, and there is a clear and more expeditious appeal path." It is unlikely that a well-conceived community-based project with clear local benefits and stakeholders would meet strident opposition, or that local coordinators would choose to pursue a community wind project facing significant, widespread local opposition. Nonetheless, a basic review of the EFSC permitting process can help local project coordinators evaluate the relative complexity of their local permitting process by comparison to the state process and decide under which jurisdiction to seek permits for their proposed community wind project. We have included a summary of the EFSC Site Certificate review process as Appendix B. For a complete description of the EFSC process as it relates to wind projects, see the Oregon Department of Energy's Web site on the Siting Process of Energy Facilities at http://egov.oregon.gov/ENERGY/SITING/process.shtml.

Zoning and Conditional Use Permits

Each county's permitting process is slightly different, and some counties have more experience with wind energy projects than others. For example, see the process that Union County outlined online at: http://egov.oregon.gov/ENERGY/RENEW/Wind/Permitting-UnionCountyOregon.shtm.

In general, obtaining a permit from a local permitting authority involves: compliance with land-use zoning regulations; a Conditional Use Permit (CUP); and building, road, and other permits. Each local planning department will have information about the zoning designation for the land proposed for the wind project. As described above, wind farms (up to a certain size) are an authorized use on lands zoned for agricultural or forest use under state law. Some counties may allow wind development in other zones as well. In some zones, wind development is not a permitted use. In this case, it will be necessary to apply for a Zoning Variance (an exception from the zoning rules for those land parcels proposed for wind development) prior to applying for any other permits.

For land where wind is a permitted use, a Conditional Use Permit will usually be required, which grants permission to build the project as long as certain conditions are met. The wind project developer must provide the local permitting authority with information about the proposed project: equipment specifications; construction, operations, and decommissioning plans; possible negative impacts and plans to avoid or mitigate these impacts; etc. The permitting authority will use this information to decide whether or not to grant the project a Conditional Use Permit.

The cost of a Conditional Use Permit alone varies by county, but tends to be around a few hundred dollars. Larger projects, with more extensive review and staff time invested by the county, may be required to pay more to help defray the county's processing expenses. The amount of time required to obtain a Conditional Use Permit varies by project, depending on the structure of the local permitting process and whether pre-development studies must be conducted prior to applying for permits.

In deciding whether to issue a Conditional Use Permit, a local planning department may require information about some or all of the following.

1. Site plans

A site plan should include information about where project components will be located, and what other natural features or manmade structures are in the vicinity. A legal description of the project area should be included, along with area maps and site layout drawings.

2. Environmental information and/or studies

Local planning department staff will set guidelines for these studies. Among the studies that may be required are soil studies, avian surveys, other wildlife surveys, and rare plant surveys. Even if detailed, site-specific studies are not required, a review of existing information on such environmental topics will help determine whether the project would raise any critical environmental concerns. Such a review could include, for example, searching agency databases for records of critical habitats, endangered species populations, and soil types.

3. Natural resource impacts

It will be necessary to detail any potential impacts to storm water drainage patterns and provide a control plan to the Oregon Department of Environmental Quality's National Pollution Discharge Elimination System (NPDES) permit program. Water is not used in wind project operations, but local water resources are necessary for construction activities; for example, for dust suppression, fire protection, or mixing concrete. Information about the amount and source of this water may be required in the permitting process. Because wind projects are not usually sited in heavily forested areas, it is unlikely that a wind project would have any significant impact on forest resources. Any expected impacts to forest resources should be explained and mitigated if necessary. (See also pg. 55 for more information on NPDES).

4. Cultural resource impacts

Planning staff may require that a professional archaeologist survey the project area to assess potential impact on historical or cultural resources. Otherwise, it may be sufficient to review existing public databases of cultural resources to determine whether any known resources exist in the vicinity of the project. If the project will be visible from identified historically or culturally important sites, this alteration of the view may be considered an impact on those sites.

To find out about known historic or cultural resources in the area of a proposed wind project, consult the State Historic Preservation Office (http://www.oregon.gov/OPRD/HCD/SHPO/survey.shtml). The SHPO maintains a database of historic sites, the Oregon Historic Inventory, which is available for research purposes at the SHPO office. The database may be available online in the future. SHPO also maintains a database of known archaeological resources, which is available only to "qualified archaeological researchers."

Even if there are no known cultural resources on the project site, planning staff may require that developers prepare a plan detailing the actions to take should any resources be uncovered during project construction.

5. Neighborhood impacts

This may be the most difficult and potentially contentious issue to address in project siting. Though many people find wind turbines to be attractive, especially when they understand the environmental and economic benefits of wind power, others may dislike the appearance of the turbines or simply prefer not to have such projects in their viewshed. The aesthetic preferences of community members are personal, but can be influenced by information or opinions on the perceived positive or negative impacts of a proposed project. Just as it is a good idea to publicize the expected benefits of siting a wind project in the community, it is also helpful to inform members of the local community about what efforts you are taking to make sure that construction and operation of the wind project will not have negative impacts on their quality of life.

Wind power has been a part of rural living for centuries. Long before rural electrification projects brought power lines to small towns throughout the country, farmers and ranchers used windmills to pump water and create electricity for their homes and farms. Today community support for local wind projects is usually very high once the projects are installed. To help promote the wind project in the community, include statements of support from community members.

Noise

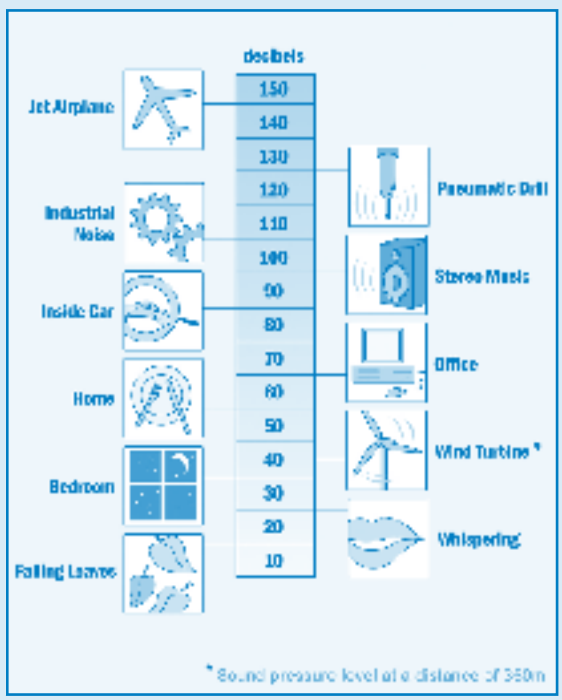
One issue that may be raised by project neighbors is noise. Some noise, especially during the construction of the project, is unavoidable. With careful design and mitigation, however, the amount of noise can be minimized to avoid disturbing neighbors.

HOW NOISY ARE WIND TURBINES?

The American Wind Energy Association (AWEA) explains: "Noise was an issue with some early wind turbine designs, but it has been largely eliminated as a problem through improved engineering and through appropriate use of setbacks from nearby residences. Aerodynamic noise has been reduced by adjusting the thickness of the blades' trailing edges and by orienting blades upwind of the turbine tower. A small amount of noise is generated by the mechanical components of the turbine. To put this into perspective, a wind turbine 250 meters from a residence is no noisier than a kitchen refrigerator."

TURBINE NOISE CHART

FIG. 5.1



Source: AWEA

Local permitting authorities may require that you develop and follow a noise minimization plan during project construction. This plan should designate work hours when construction activity will take place and "quiet hours" when machinery will not be operated. Other ways to minimize construction noise include: outfitting construction vehicles and machinery with noise reduction equipment at least to the level of industry standards (i.e. properly operating mufflers on vehicles); setting vehicle alarms and back-up warnings to their lowest volume; and turning off vehicles when not in use, rather than letting them idle.

Noise created during the wind project's operation can be minimized through careful project design and equipment selection. Use new or fully remanufactured equipment with well-documented noise testing conducted by the manufacturer (for more information about remanufactured turbines, see Section 2). Maintain all equipment according to the manufacturer's recommendations to avoid noise caused by equipment malfunction. Set turbines back from residences and property lines to ensure compliance with Oregon Department of Environmental Quality noise regulations.

Property Lines and Setbacks

Turbines should be set back from residences and property lines to insulate participating and neighboring landowners from noise and safety concerns. State siting standards for wind facilities do not set specific guidelines for setbacks; instead, each local permitting authority may set its own regulations regarding setbacks from property lines, roads, residences, etc.

OREGON NOISE REGULATIONS FOR WIND FACILITIES

The Oregon Department of Environmental Quality recently updated their noise regulations for wind facilities. These regulations are applied by the Energy Facility Siting Council for facilities sited through the state process. The same regulations may be adopted by counties for their wind siting processes, at their discretion. Key updates to the noise regulations include the following:

- **Ambient background noise level is assumed to be 26 dBA or actual ambient background level, whichever is greater**

- **The wind facility may increase the noise level more than 10 dBA if permission is granted in writing by the affected (noise-sensitive) property.**

Ensuring compliance with the noise regulations will likely require site visits, measurements, and other assistance from DEQ staff. For more information about the regulations, visit: http://egov.oregon.gov/ENERGY/RENEW/Wind/EQC_Approval.shtml.

In the model planning ordinance included in their guidance document, "Planning for Locally-Regulated Energy Facilities," the Oregon Department of Energy suggests that, at a minimum, turbines should be set back from property lines at least 1.5 times the height of the turbine plus the blade at its tallest point. Your local ordinance may be more or less restrictive than this. In particular, the required setback may be less for property lines where the neighboring property is owned by another project participant, or where the neighboring property owner has explicitly agreed to allow turbines to be located very near the property line.

Local regulations for setbacks from residences vary from county to county. A required setback of 750 to1,000 feet from the residences of landowners participating in the project is typical. Neighboring landowners may ask for an even greater setback to minimize the impact of a project from which they will not directly benefit. When possible, turbines should be sited farther from, rather than closer to, dwellings to avoid casting shadows over residences and to minimize noise impacts. A good description and calculator of shadow "flicker" from turbines can be found at the Danish Wind Industry Association Web site: http://www.windpower.org/en/tour/env/shadow/index.htm. Setbacks that prevent noise impacts are generally sufficient to prevent shadow flicker problems as well.

Aesthetics

The visual impact of wind turbines is a frequently-cited argument against wind development, and perhaps the most difficult to counter. Other concerns about project safety, efficiency, wildlife impact, economic impact, etc. are usually put to rest by simply making available the facts about modern wind energy technology and the proposed project. On the other hand, some people simply do not like to look at wind turbines, and commercial-scale wind turbines may be visible from many miles away, creating a relatively wide area affected by the project's appearance.

There is no question that the majority of people would prefer an unbroken view of mountains/oceans/valleys to a view of a wind farm. However, when the choice is between the use of locally-produced, locally-used, environmentally-sound energy on the one hand and a view on the other, the decision becomes more difficult. All sources of electricity come with a price, be it pollution, greenhouse gases, or aesthetics. In the case of community-owned wind turbines, that price is paid by the people looking at the turbines rather than by people all over the world subjected to large-scale environmental impacts. When communities make the choice to rely on a local wind project for their energy, they are choosing both to reduce the use of fossil fuels and to pay the environmental price for their energy themselves. Local citizens can feel good about the fact that they are taking responsibility for their energy use by choosing a view with wind turbines.

Certain project design decisions can greatly increase public acceptance of the wind project's appearance. Among the most fundamental is the decision of where to site the project; for example, siting a project in or near a scenic corridor or within sight of a recognized scenic vista may be objectionable. Areas with significant existing or proposed residential development, especially those areas where people choose to locate because of their scenic beauty, may also be more resistant to the alteration of the viewshed caused by wind turbines. In contrast, more rural, agricultural areas may more readily accept the visual impact of a wind project, recognizing that, like farm equipment or crops, wind turbines change the appearance of the landscape but serve a useful purpose.

The Oregon Administrative Rule "Siting Standards for Wind Energy Facilities," which EFSC uses when considering whether to issue a site certificate for a project— and which may also be adopted by local permitting authorities—suggests that project developers should:

> " . . . design and construct the facility to reduce visual impact by methods including, but not limited to: (a) Not using the facility for placement of advertising, except that advertising does not include the manufacturer's label or signs required by law; (b) Using the minimum lighting necessary for safety and security purposes and using techniques to prevent casting glare from the site, except as otherwise required by the Federal Aviation Administration or the Oregon Department of Transportation, Transportation Development Branch, Aeronautics Section; and (c) Using only those signs necessary for facility operation and safety and signs required by law."

Other ways to ensure the most visually unobjectionable project include:

- Design the project to blend with the existing surroundings by choosing a color for turbines, towers, and other project components that is neutral and non-reflective.

- When installing more than one turbine, choose identical or similar turbines to create a uniform-looking group of machines.

- When given the option, choose a small number of large turbines over a greater number of small ones. Many people find turbines with slower-moving blades more pleasing to view than those with faster-moving blades, describing them as "graceful," "elegant," and "relaxing." Most modern utility-scale turbines are designed to operate at a constant speed of around 30 rpm. By using longer blades to capture energy from a wider area of wind, this slower rpm does not negatively impact these turbines' ability to produce power.

- Design Operations and Maintenance (O&M) buildings or other new structures to be consistent with the character of the area. In one celebrated case, a wind developer refurbished a local barn to serve as the on-site O&M facility, preserving the historic building for the community and eliminating the need to build another new structure on the site.

- When possible, minimize the use of overhead electrical wires and guy wires. Using buried, rather than overhead, electrical lines minimizes visual impact.

- When lighting is advised or required on the project site, such as outdoor lighting near O&M or storage facilities, choose lighting that will be the least visually intrusive to neighbors. For example, hooded, downcast lights and motion detector lights that only turn on when needed will minimize unnecessary light pollution. Tower lighting should be limited to the minimum required by the Federal Aviation Administration and avian experts, to minimize the nighttime visual impact of the project.

- Maintain a clean-looking project site, with spare parts or equipment neatly stored.

Property Values

One common concern raised by project neighbors is the possibility that wind development will cause a decline in area property values. Recent nationwide and local studies show no evidence that wind farms decrease the value of neighboring properties. For more information, see the Renewable Energy Policy Project report, "The Effect of Wind Development on Local Property Values," and the ECONorthwest report "Economic Impacts of Wind Power in Kittitas County."

Communications Interference

According to AWEA, "Large wind turbines, such as those typically installed at wind farms, can interfere with radio or TV signals if a turbine is in the 'line of sight' between a receiver and the signal source, but this problem can usually be easily dealt with by improving the receiver's antenna or installing relays to transmit the signal around the wind farm. Use of satellite or cable television is also an option." When interference is an issue, the wind project developer is typically responsible for paying for any necessary mitigation. If concerns about interference are raised, whether before or after project construction, planning officials may ask for a commitment to make the necessary improvements to ensure communications signals maintain pre-project quality.

6. Socioeconomic impacts

The local economic benefit of wind power can be one of the strongest arguments in favor of wind development, particularly for projects where local investment or ownership conducts a greater share of profits directly back to the local community. The process of developing construction plans and cash-flow models will yield some estimates of local economic benefits, including number of construction and long-term jobs, business for local contractors, local tax revenues, etc. It may also be helpful to refer to the known economic impacts of existing local projects (commercial-scale or community-scale) and publications discussing economic benefits of wind energy. Two useful documents which discuss the economic impacts of wind development are "A Methodology for Assessing the Economic Development Impacts of Wind Power," prepared by the National Wind Coordinating Committee, and "A Guidebook For Estimating the Local Economic Benefits of Small Wind Power Projects for Rural Counties In Washington State," prepared by ECONorthwest.

7. Transportation impacts

The primary period of impact to local transportation resources is the relatively short construction phase of a wind project, when large turbine and tower components and installation equipment and vehicles travel to and around the project area. Local permitting authorities may request an estimate of expected vehicle trips per day during construction and O&M phases of the project. They may also request information about how and where large project components will be delivered. An approved routing agreement with the county roadmaster will be needed for heavy and large deliveries, to assess road and bridge capacity for the loads, to provide for any necessary upgrading, to document condition before the transport, and to restore public roads to their prior condition after construction is completed.

8. Impacts on other resource uses (e.g. farming, forests)

The amount of land taken out of production for each wind turbine—including that for roads, trenches for cables, transformers, and accessory structures—is minimal compared to other types of energy facilities. A general rule is that around one-quarter to one-half acre of land will be taken out of production for each turbine—this area will of course vary by project design and site characteristics. Clearly explain to local permitting officials how much resource land will be temporarily and permanently disturbed. Also make clear your plans for effectively restoring land temporarily disturbed during construction so that it may be used for renewed resource activities in the future. In addition, the land-lease agreement signed with each landowner may stipulate an additional payment to be made to the landowner to compensate for the loss of productive agricultural land.

9. Wildlife/habitat impacts

The impact on birds and other wildlife is one of the most common concerns raised about wind energy projects. Pre-development studies and the siting decisions made based on these studies can help avoid significant wildlife impacts by indicating locations within the proposed site that would likely have more or less impact on birds or other wildlife.

To find out whether threatened and endangered species or critical habitats are present on or near the project site, consult with your Oregon Department of Fish and Wildlife (ODFW) field office. If extensive pre-development wildlife studies are required for your site, your wildlife consultant may work with ODFW staff directly. If long-term wildlife surveys are not required—for example, for a single-turbine project on a previously disturbed site with no known sensitive habitats or species—a review of ODFW databases or a site visit by an ODFW biologist may yield sufficient information about on-site wildlife resources to apply for local permits. ODFW staff can also work with local planning officials to help determine prevention or mitigation strategies to protect wildlife while allowing project development to go forward.

Local authorities may also recommend some project design options and construction practices that can help prevent and mitigate wildlife impacts, including:

- Designing project components to discourage avian perching or nesting near turbines (e.g. using best available turbine and tower technology; minimizing overhead lines and guy wires; installing anti-perching devices on structures constructed near turbines)

- Designing towers and other project infrastructure to avoid creation of artificial habitat or shelter for raptor prey
- When possible, siting turbines and roads to preserve existing trees, vegetation, water resources, habitat, and other significant natural resources
- When pre-development studies indicate nesting activity in the area, avoiding construction activities near nesting locations during sensitive breeding periods and establishing appropriate no-construction zones around nest sites

Remember, disturbing sensitive or protected species or removing empty nests (except in cooperation with ODFW) is illegal. Consult early with ODFW to avoid inadvertently harming sensitive species or habitats.

Finally, because the image that wind turbines are unavoidable hazards for birds is a very common misperception, it may be worthwhile to do some basic outreach and education throughout project development, both for local planning officials and for the general public. A good place to start is the AWEA FAQ on birds and other environmental issues around wind power (http://www.awea.org/faq/tutorial/wwt_environment.html). Compared to many other human activities—including extracting and burning fossil fuels, constructing tall buildings, and even driving—most wind projects have a negligible effect on birds and wildlife.

Conducting the necessary research on local habitats and species, and designing the project to avoid significant impacts to these habitats and species, will ensure that your community wind project maximizes the considerable environmental benefits of wind power while minimizing any negative impacts on wildlife.

10. Wetlands impacts

It is unlikely that a wind project would affect wetlands because wetlands tend to form in low-lying areas and the wind resource tends to be better on higher ridges or buttes. Unless water drainage patterns that lead to a wetland are significantly altered by the construction of a wind project, any impact to wetlands would be unlikely. Consultants hired for wildlife surveys or ODFW staff can help project developers determine whether any wetlands exist that might be affected by the wind project.

11. Public safety/prevention and mitigation of criminal activity

While fencing off the entire site to restrict access may not be necessary, restricting public access to the turbine itself and other site facilities will likely be required. Tubular towers are usually designed with no exterior ladders, or with a ladder that begins well above ground level. Access to the interior of a tubular tower can be restricted with a locking door. In the event that a lattice tower is used, it should be designed to discourage climbing for the first twelve feet. (See OAR 345-24-0015, “Siting Standards for Wind Energy Facilities.”).

Restricting access to the wind project site, when required, is intended to help prevent the wind project from becoming an "attractive nuisance" or something that attracts undesirable activity such as vandalism, trash dumping, arson, etc.

Local authorities will likely seek assurance that all electrical equipment and power lines associated with the project are properly labeled with standard warning signs, and are designed per industry standards to prevent unauthorized access.

12. "Covenant Not to Sue" for generally accepted farming practices

Some local permitting authorities may request that wind project developers sign a "Covenant Not to Sue" or similar assurance to permit existing farming or forestry activities to continue as before in the areas surrounding the wind project. The impetus for such a requirement may be the fact that increasing residential development in rural areas has at times caused conflict between existing agricultural operations and new residents. Complaints from wind farm operators about nearby farming activity are unlikely as agricultural activities have, in hundreds of projects across the country, proven to be very compatible with wind energy projects.

13. Fire prevention/emergency response plan

Local permitting officials may require that you prepare a plan detailing the procedures to be employed by project personnel for preventing, controlling, and mitigating fire or other emergencies that occur at the project site. This plan is of particular importance during the construction phase. During normal wind project operations, the risk of fire or turbine malfunction is low. Modern utility-scale turbines are equipped with sophisticated lightning protection systems. They also employ automatic braking systems to stop the turbine in the event of malfunction. Describe for local permitting authorities the specific safety features of the planned turbine, and develop a maintenance plan that will ensure that such safety features operate properly.

14. Erosion control plan

The erosion control plan will be part of the NPDES permit, which will be required either before or after the Conditional Use Permit. Permitting authorities will want to know whether any construction will take place on steep slopes or other areas prone to erosion. They may also ask that new roads be covered in gravel to avoid wind erosion of dirt roads, and that an erosion control plan be implemented to minimize erosion and sediment runoff from roads or other construction areas. It may be necessary to obtain a separate road permit for new road construction. One way to minimize the impact of road construction is to use existing roads rather than building new ones when possible. Promptly revegetating areas temporarily disturbed by construction will also help minimize erosion. A permit from the county roadmaster will be required if any work needs to be done on public roads. See also the section on National Pollutant Discharge Elimination System (NPDES) permits, below.

15. Weed control plan

Invasive weed species can be carried to a wind project site on construction vehicles and equipment, and can pose a hazard to local ecosystems and farming operations. Some local permitting authorities may require that a plan be developed and implemented to prevent the introduction of invasive weeds to the area, including thoroughly cleaning the undercarriage and tires of all construction vehicles, cleaning dirt and organic matter from excavation equipment, etc.

16. Decommissioning plan

It is important for a local community to know that, at the end of a wind project's useful life span, project components will be removed and the site restored to a usable condition. Some local authorities may require that project developers provide a bond or letter of credit to the county in the amount necessary to properly decommission the turbine.

17. Reporting

Some local authorities have required wind projects to prepare an annual report of energy production, non-proprietary wind information, summary of changes, summary of avian monitoring program, employment impacts, success/failure of weed control, status of decommissioning fund, and/or summary comments.

18. Other conditions

The State of Oregon has developed Specific Safety Standards for Wind Facilities (OAR 345-024-0010). In order to obtain a site certificate from EFSC, a proposed project must prove compliance with these conditions pertaining to visual impact, public access, and environmental impacts. Local permitting authorities may also refer to these standards when determining whether to issue a permit or as conditions upon which permit approval is contingent.

Other Local, State, or Federal Approvals That May Be Required

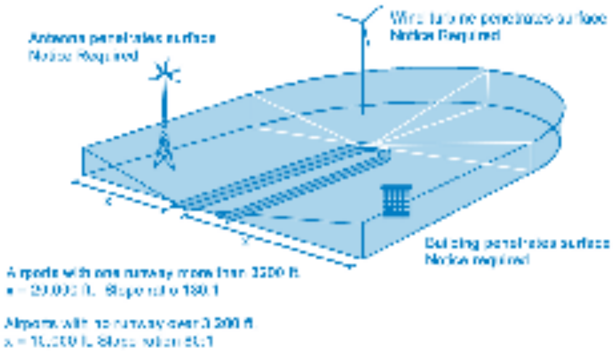
Air Safety: Notification and Lighting

Any project that includes a structure exceeding 200 feet at its highest point (the highest point of a wind turbine is the tip of a blade extending vertically upward) or located within the virtual surfaces of an airport (see Figure 5.2) must notify the Federal Aviation Administration (FAA) and the Oregon Department of Aviation of construction plans. These agencies will likely require that at least some of the turbines or towers in a wind project be lighted to ensure air traffic safety.

Submit FAA Form 7460-1, "Notice of Proposed Construction or Alteration" (available at https://www.oeaaa.faa.gov/oeaaaEXT/portal.jsp) at least thirty days before applying for a building permit from both the FAA and the Oregon Department of Aviation. While the standards for marking and lighting obstructions are outlined in FAA Advisory Circular 70/7460-1K, "Obstruction Marking and Lighting," the FAA may allow project developers an opportunity to submit a preference for the design of any required tower lighting. The American Wind Energy

FAA DIAGRAM

FIG. 5.2



The "surface" defined by the FAA illustrates the area in which a planned, tall structure will need to notify the FAA and the Oregon Dept. of Aviation before construction. Courtesy FAA

Association (AWEA) has been working with the FAA to determine the effects of tower lighting on birds. As a result of these studies, the FAA has circulated new draft guidelines for lighting and marking wind turbines to its regional offices. These guidelines have not yet been finalized and incorporated into a revised FAA Advisory Circular, but local offices may consult the new guidelines when determining the requirements for your project. Consult the AWEA Web site for the latest information and recommendations on avian and aesthetic issues surrounding tower lighting.

Electrical Permits

In some areas, electrical permits are administered by the local city or county; in other areas they are administered by the Oregon Building Codes Division. To find out who has jurisdiction over the area in which your project will be built, check with the Oregon Building Codes Division (http://www.bcd.oregon.gov/jurisdictions.html).

Structural (Building) Permits

In some areas, structural permits are administered by the local city or county; in other areas they are administered by the Oregon Building Codes Division. To find out who has jurisdiction over the area in which your project will be built, check with the Oregon Building Codes Division (http://www.bcd.oregon.gov/jurisdictions.html).

NPDES/Storm Water Permits

A National Pollution Discharge Elimination System (NPDES) 1200-C permit is required for construction activities that will disturb one or more acres. Though this is a federal permit, in Oregon, the Oregon Department of Environmental Quality administers NPDES permits.

A complete project layout is necessary for this application, and all erosion-control measures must be depicted. Once submitted, the permitting process can take many months. The fee for these permits is $560, plus an annual compliance fee of $275 for each subsequent year to maintain the permit.

Contact the state Department of Environmental Quality to find out whether additional permits will be required for a particular project (http://www.deq.state.or.us/wq/wqpermit/stormwaterhome.htm).

Road Permits

Permits to build or upgrade roads are administered by each county individually. Contact your local permitting authority for information on permit requirements and fees.

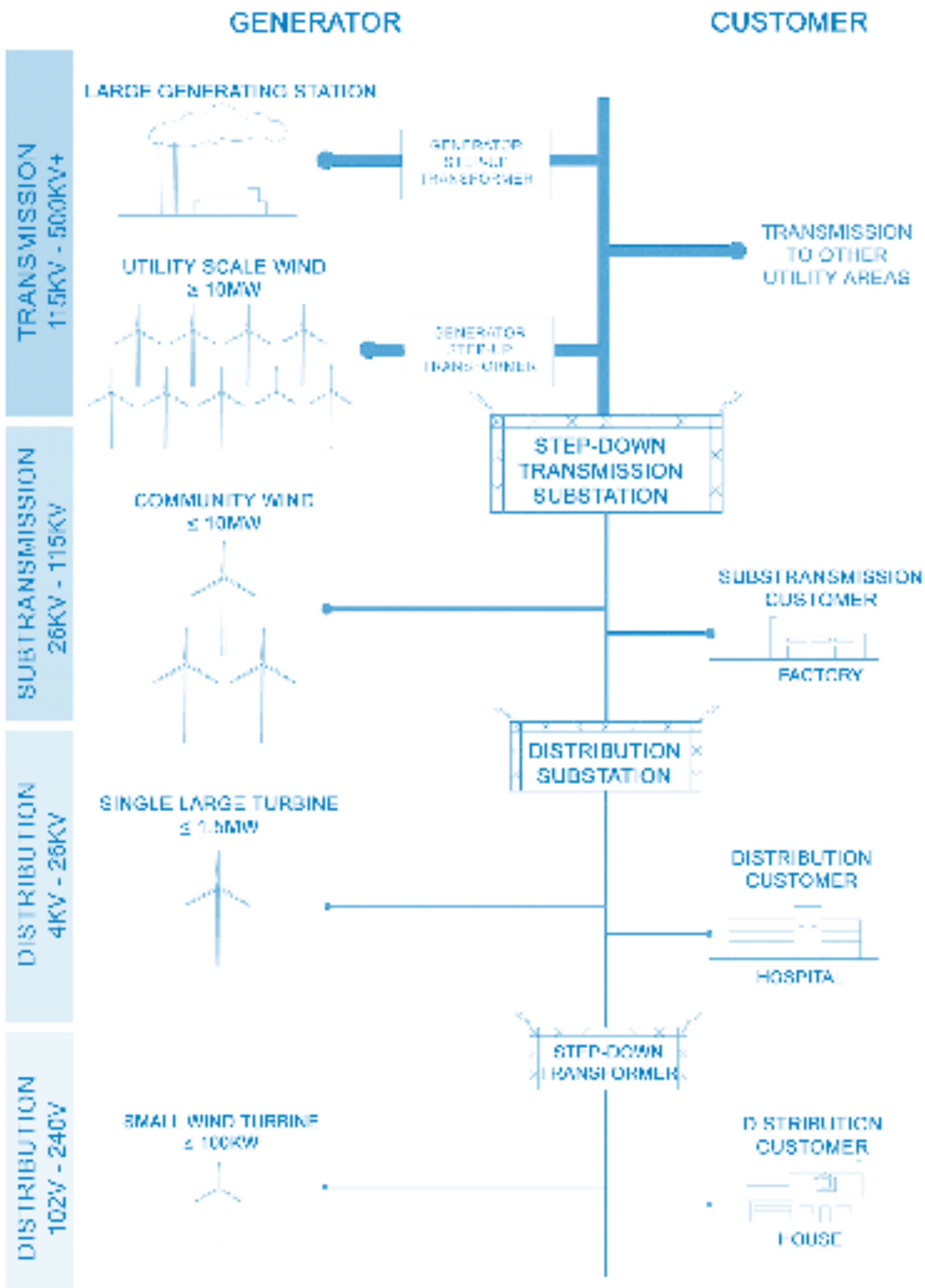
Credit: Tom Roster

INTERCONNECTION

The relatively small size of community wind projects makes the process of connecting them to the utility grid both flexible and confusing. Large wind developments need to interconnect to transmission lines through a substation, and residential wind turbines simply connect to the electrical panel serving the residence. Both of these processes are fairly standard. Community wind projects, however, varying in size from slightly less than 1 MW to 10 MW can interconnect at the distribution, subtransmission, or transmission level depending on a number of factors such as the size of the project and the capacity of the grid at the project site. Improper interconnection has the potential to cause power quality issues, while successful interconnections can even serve to strengthen the local grid. A large wind turbine interconnected to a distribution line serving just a few customers can lead to flickering lights and, for example, frequent computer crashes. A properly sited community wind project can help to relieve an overloaded subtransmission line by providing power to the load and supporting the line voltage. Unfortunately, there is no single map displaying the location and capacity of electricity lines and the transmission constraints on Oregon's grid. Much of this information is not available to the public or is known only internally by each utility. This makes it particularly important to begin the interconnection process with the local utility as soon as it is feasible.

COMMUNITY WIND AND THE GRID

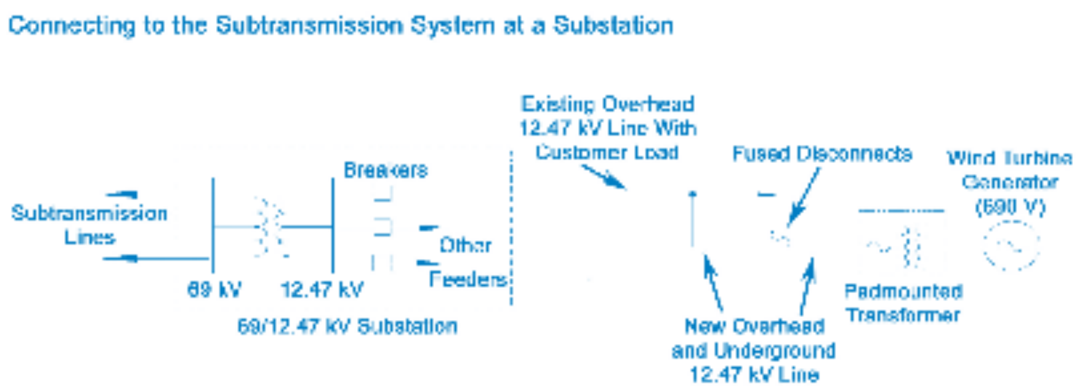
FIG. 6.1



The voltages we have used here to define transmission, subtransmission, and distribution are generally accepted, but grid voltage groups are not strictly defined. Community wind projects fit in well at the subtransmission level. Unlike large commercial wind farms which connect to the grid at the transmission level, community wind projects can interconnect with the utility at the subtransmission level which provides them with many more locations for interconnection.

INTERCONNECTION DIAGRAM

FIG. 6.2



The one-line diagram above illustrates a typical interconnection of one wind turbine to a distribution line. The important components are the wind generator, the pad-mounted transformer, the disconnects, and the substation. Appendix C explains these and other terms associated with interconnecting a community wind development to the grid.

The Interconnection Process

Introduction

The interconnection process will depend on the size and location of the wind development. It will also depend on standards established by individual utilities. The Federal Energy Regulatory Commission (FERC) has established standard generation interconnection procedures. The guidelines established by FERC are described here, but it is worth mentioning that NARUC (the National Association of Regulatory Utility Commissioners), the state of California, and the National Rural Electric Cooperative Association also have good guidelines. All costs associated with necessary studies, facility modifications, and interconnection equipment are the responsibility of the project developers unless otherwise specified in an agreement with the utility.

The steps listed below are quite comprehensive, and may not all be necessary for every wind project. FERC recommends a “Fast Track Process” for facilities no larger than 2 MW. This fast-track process uses a screening procedure to assess the ability of the local grid to accept the generated electricity, thus bypassing the need for a series of studies. Early meetings with the utility should include a discussion of the studies necessary to ensure a safe interconnection while keeping expenses and time investment to a minimum.

Step 1: Submit Interconnection Request to Transmission Provider

It is extremely important to start discussions with your utility—or utilities, if wheeling is an option—very early in the wind development process. Interconnection costs can be the limiting factor in a project, so it is best to find out early on how much the expense will be. Interconnection request forms are available at each utility's Web site. A fee may be required along with submission of the request. Below is a list of information necessary to complete an interconnection request.

- Facility location
- Generating purpose (What will the energy be used for? i.e. used on site, sold to others, etc.)
- Local electric service provider (if different from Transmission Provider)
- Energy source and conversion technology
- Type of generator and specifications
- Generator manufacturer, model name, number, and version number
- Generator nameplate rating in summer and winter in kW and kVA
- Maximum physical export capability requested (equal to the total kilowatts the facility could produce)
- Components of facility that are certified and who certified them
- Individual generator power factor
- Total number of generators to be interconnected
- Power systems load flow data sheet
- One-line diagram of facility
- Transformer specifications

While the amount of information requested may be daunting, it is best to submit your request as soon as possible to allow the utility to set up a project file. Design changes are frowned upon by financial backers, but may be necessary to accommodate the requirements of the utility as well as the needs of the project.

Step 2: Scoping Meeting with Utility

"The purpose of the scoping meeting is to discuss the Interconnection Request and review existing studies relevant to the Interconnection Request. The Parties shall further discuss whether the Transmission Provider should perform a feasibility study or proceed directly to a system impact study, or a facilities study, or an interconnection agreement." (FERC, 2005)

The scoping meeting should include qualified technical team members to assess the relative ease with which the proposed wind project can interconnect with the utility. Given the information provided on the interconnect request form and information provided by the utility on the transmission and distribution system close to the project site, engineers from the utility and project team will recommend next steps. If there is agreement that there will be no adverse impacts on the transmission and/or distribution system, then the team may move on to a system impact study. If the team believes that there may be adverse impacts, then a feasibility study will be required to identify the problem areas and decide if an interconnection at the proposed site is possible.

Step 3: Feasibility Study

The feasibility study will determine if additional facilities are necessary for the proposed wind project to interconnect to the utility. When possible, the utility will use previously developed studies to examine the impact of the proposed project, but they may, in some cases, need to perform a new study. The cost of this new study would be the responsibility of the customer. The study would seek to determine the potential for circuit breaker faults and thermal overloads or voltage limit violations that would result from the interconnection. It would also provide an initial review of grounding requirements and electric system protection. If required, the study would describe facilities needed for the interconnection and a cost estimate for those facilities. If the feasibility study shows no adverse impacts, the utility may provide an interconnection agreement without further study. Otherwise, a System Impact Study will be required.

Step 4: System Impact Study

"A system impact study shall identify and detail the electric system impacts that would result if the proposed Small Generating Facility were interconnected without project modifications or electric system modifications, focusing on the adverse system impacts identified in the feasibility study, or to study potential impacts, including but not limited to those identified in the scoping meeting. A system impact study shall evaluate the impact of the proposed interconnection on the reliability of the electric system." (FERC, 2005)

At the end of the System Impact Study, the customer and transmission provider should have an accurate read on the facility changes needed to accommodate the interconnection. With this knowledge, a Facilities Study will be started.

Step 5: Facilities Study

The Facilities Study is the last step before an Interconnection Agreement is finalized between the utility and the project developer. In the Facilities Study, the utility lays out exactly what needs to be done to interconnect to its system, the equipment necessary to complete the interconnection, and the associated costs, including construction costs. The design of the required facilities and upgrades may be done by the utility or their contractors. Alternatively, the utility and the customer can come to an agreement wherein the customer's contractors design the facilities and upgrades, which are then approved by the utility. This approach could be useful if the utility does not have significant experience with community wind projects.

Step 6: Interconnection Agreement

Once the facility upgrades and their associated costs have been agreed upon, the utility will write an executable interconnection agreement. Along with the facility upgrade costs, this agreement may include O&M fees payable to the utility for the upkeep of the facilities. O&M fees are often paid annually and calculated as a percentage of the actual installed cost of the interconnection facilities. These fees can be substantial and should be accounted for in the project's financial plan. With these fees agreed upon and the document signed, the "customer" can begin construction of the wind project with a guarantee that the utility will allow the interconnection of the wind turbine(s) to its grid. This agreement should not be confused with the Power Purchase Agreement, which is dealt with separately and is addressed in this Guidebook in Section 7.

In Conclusion

All of the steps above are flexible at the discretion of the utility. The initial meetings with the utility will establish the procedure for generating an interconnection agreement. Utilities with prior wind interconnection experience may already have an established procedure or may work on a case-by-case basis. Talking with other small generators already interconnected to the utility can provide insight into how the utility approaches the process and can provide a baseline to ensure that community wind developments are not asked to undertake unnecessary studies and transmission improvements.

Note: Appendix C contains definitions of many of the terms used to discuss interconnection.

Credit: Matt Morris

FINANCING AND DEVELOPMENT MODELS

Note: This section relied heavily on two excellent publications: "Community Wind Financing" written by Charles Kubert and published by the Environmental Law & Policy Center (ELPC), is available at http://www.elpc.org/energy/windhandbook2004.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, is available at http://www.energytrust.org/RR/wind/OR_Community_Wind_Report.pdf

Readers are encouraged to refer to these publications for additional financial information.

Introduction

Corporate structure (i.e. partnership vs. limited liability corporation) and ownership structure (i.e. how many owners, what allocation of equity, and how the structure may change over time) together determine a range of important project variables, including access to and cost of capital, risk allocation, ability to use tax incentives, amount of local investment, and complexity of the project. Given the importance of these factors, careful consideration should be given to available options and the benefits and costs of each.

While the range of possible ownership and financing structures is wide, the decision of which to use rests on relatively few considerations. We have targeted this Guidebook to community wind projects, therefore, our discussion focuses on those possible ownership and financing options that appeared to be the best fit for this type of project in Oregon at the time this Guidebook was developed.

The in-depth study "A Comparative Analysis of Community Wind Power Development Options in Oregon," completed by experts in the field, looked specifically at development options for community wind in Oregon. Their analysis concluded that options that take advantage of the Federal Production Tax Credit (PTC) are the most promising. Specifically, they suggest a multiple-owner model, as well as a "Minnesota-style flip," which is a special case of the multiple-owner model, wherein an investor with tax credit appetite owns most of the project the first ten years, at which point the majority ownership "flips" to the local investors for the duration of the project.

Our primary focus will be on either multiple-owner models that are shaped to take advantage of the Federal Production Tax Credit and the Modified Accelerated Cost Recovery System (MACRS) of Accelerated Depreciation, or public ownership models that can use tax-exempt financing such as the new Clean Renewable Energy Bonds (CREBs). We assume all projects will take advantage of the Oregon Business Energy Tax Credit (BETC) and possibly the Small Scale Energy Loan Program (SELP). We will not cover individual ownership or project lease approaches, but good information on these methods is available through the Environmental Law & Policy Center at http://www.elpc.org.

Factors to Consider When Deciding Corporate and Ownership Structure

Tax Benefits vs. Low-cost Financing

A primary decision that should be made early in the project design process is whether the project will be structured to take advantage of the PTC and MACRS Accelerated Depreciation, or to take advantage of tax-exempt financing and/or other possible benefits of a public or nonprofit structure. Projects that take advantage of the PTC realize substantial economic benefits, but also see substantial increases in ownership complexity. Significant questions remain in regard to using both the PTC and the BETC and SELP (see section on incentive interaction below for more details). The difficulty of finding investor(s) with sufficient and appropriate tax appetite, and designing an ownership structure that is legal and not overly complex should be carefully considered. For further investigation of this topic, review Bolinger et al.'s "A Comparative Analysis of Community Wind Power Development Options in Oregon" listed in the reference section.

Existing Corporate Structure

The existing corporate structure of the primary group developing the project should be taken into consideration. It may be that no new corporate/business structure needs to be developed to create a project that takes advantage of low-cost financing or tax incentives. Community wind projects are complex regardless of their ownership structure, and avoiding creation of a new legal entity would reduce complexity in one area, lowering costs and risks.

Organizations (municipalities, PUDs, schools) that can access lower cost and/or tax-exempt financing such as the new Federal Clean Renewable Energy Bonds, usually also require a lower rate of return on their investment, or may have non-financial goals. The combination of these benefits may result in a viable project scenario even though the project is not eligible for tax benefits. If tax benefits—the PTC and Accelerated Depreciation—are to be realized by the project, investors with sufficient and appropriate tax liability must have an ownership role.

Complexity and Project Coordination

A substantial barrier to community wind development is the high transaction cost relative to the total project cost—the cost of feasibility studies, permitting, project financing and interconnection negotiations, power purchase agreements and construction management. Ownership and financing structures have varying levels of complexity, and with increased complexity comes increased risk and cost. Complexity will cost either time or money, and usually both, even if the project coordinator has the time, motivation, and skills needed to take on much of the work. Risk has the same effects, and its allocation among the project coordinator, final equity owner(s), and financing sources is a key issue for successful project capitalization. Various plans may need more outside expertise than others, which is a cost to be considered in budgeting and planning. An estimate of the cost of legal, financial, and management expenses—which will increase with complexity—should be carefully considered when choosing an ownership structure and financial plan.

Location: Investor-Owned Utility vs. Consumer-Owned Utility Service Territory

An important factor to consider is whether the project will be located within the service territory of an Investor-Owned Utility (IOU—such as Pacificorp, Portland General Electric, or Idaho Power) or a Consumer-Owned Utility (COU—such as a Rural Electric Cooperative, a Public Utility District, or a Municipal Utility). In May 2005 the Oregon Public Utility Commission (OPUC) issued an order related to PURPA policies (Public Utility Regulatory Policy Act policies). Under OPUC Order 05-584, the power purchase price and terms are likely to be much better when selling power to an IOU. Under this Order, IOUs are directed to purchase power from Qualifying Facilities (QF) (less than 10 MW) at their current avoided cost, the term of the Power Purchase Agreement (PPA) is 15–20 years, and many additional PPA details are standardized, lowering transaction costs and substantially increasing revenue for generators. Consumer-Owned Utilities in Oregon are governed by the federal and state PURPA laws. But they are not bound to Order 05-584. COUs must purchase from QFs at their current avoided cost, but this is typically the current Bonneville Power Administration (BPA) rate, which is much lower than the currently filed avoided costs for IOUs.

At this time, there is some uncertainty as to the impact of the PURPA provisions in the new federal energy bill, but it is possible that IOUs will no longer be obligated to purchase under PURPA. Also, as load increases for COUs, and BPA steps back from its historic role in providing power, COUs may be in the market for new supplies at full marginal cost. Transmission constraints may also steer them to consider small-scale, in-territory projects. Incentives for renewable resources from the Energy Trust are available to projects either located in the

Oregon territories of Portland General Electric (PGE) and Pacific Power, or to projects selling their output to these two utilities. Given these variables, it is possible that either IOU or COU territory could provide a viable location for community wind, and project coordinators should consider current utility needs when initially siting a project.

Securities Compliance

Any entity, no matter how small or large, that attempts to raise capital by issuing securities (i.e. offering or selling stock, membership units, partnership interests or other types of interests) may only do so by registering the offering with the Securities Exchange Commission (SEC) or by complying with the provisions of one of the specifically-defined exemptions from the registration requirements. Registration is the often time-consuming and expensive process of filing a formal registration statement with the SEC used by companies that conduct a public offering, such as an IPO. As such, it is not particularly well suited for smaller-scale (less than $50 million) projects, and is generally avoided in this context.

While many exemptions from registration are possible, most smaller-scale projects tend to offer private placements of securities to investors under exemption provisions known as Regulation D. Under Rule 506 of Regulation D, a company can raise an unlimited amount of investment capital from an unlimited number of investors, provided that all of the investors are "accredited investors" as defined in the rules promulgated by the SEC. An "accredited investor" is an individual (or entity owned exclusively by individuals) that meets one of the following criteria:

(i) has a net worth (assets minus liabilities), individually or jointly with spouse, of at least $1,000,000

(ii) has an individual income in excess of $200,000 or joint income with spouse in excess of $300,000 in each of the two preceding years and reasonably expects to reach the same income level in the current year

(iii) is an executive officer or director of the issuing company. An accredited investor can also be an entity with total assets in excess of $5 million not formed for the purpose of acquiring the securities offered

Under Regulation D, there is a prohibition on general solicitation, which means that the offering should not be made to the general public, but instead only to individuals or entities with which the issuer has an existing business relationship. One sometimes hears reference to the fact that a company can sell to up to thirty-five unaccredited investors under Regulation D. While this true, as a practical matter, the ability to make such an offering is severely limited. If the company offers or sells shares to even a single unaccredited investor, it triggers additional, far-more-detailed information requirements (such as a formal private placement memorandum), which can substantially increase the complexity and cost of the transaction.

If an offering does not meet the requirements of Rule 506, there may still be alternative ways to offer securities under Regulation D or other exemptions, but these methods also tend to be substantially more expensive and complicated (much like registering the offering).

Additionally, an issuer should keep in mind that it will also need to comply with the securities laws of all states where the securities are being offered or issued. Most states' securities laws have parallels to the federal requirements, but many states require additional filings, even if their exemptions are similar in substance to the federal exemptions.

A full review of state and federal securities requirements related to small offerings is beyond the scope of this Guidebook. Therefore, whenever offering securities, the company should consult with experienced securities counsel.

Best-Fit Ownership and Financing Models

This section will briefly describe each of three models that currently offer the best opportunities for community wind ownership in Oregon. It is certainly possible that changes in incentives, available financing, law, or other factors will result in new, better models. Project coordinators are encouraged to explore all options during the initial phase of the project.

City, County, Nonprofit

Publicly owned projects cannot take advantage of the PTC or Accelerated Depreciation. However, more importantly, they may be able to access lower-cost public financing and the new Clean Renewable Energy Bonds (please see following CREB section). Public entities also may have lower financial return requirements. Municipalities may also have internal capacity to manage many of the phases of a project, lowering costs and adding control.

Multiple Local Investors

In this model, local landowners and investors join to form a Partnership or LLC that owns and operates the project. Income, deductions, and gains and losses flow through to partners or members, who report these amounts on their individual tax returns. In this model, depending on the "tax credit appetite" of the individuals, some or all of the PTC and Accelerated Depreciation benefits can be realized. However, individuals would need other passive income (for example, from other Partnerships) and may run up against Alternative Minimum Tax constraints.

"Flip" Structure

A local investor (typically the owner of a windy site) without tax credit appetite brings in a tax-motivated corporate equity partner to own most of the project for the first ten years (i.e., the period of tax credits), and then "flip" project ownership to the local investor thereafter. This structure has been popularized in Minnesota (Bolinger et al., 2004).

Sources of Project Capital

Feasibility Capital

During the Feasibility phase, the project coordinator is initially risking time and resources without certainty that a project will come to fruition. At the very beginning, the required project capital is likely to be nominal, but as the process proceeds, significant cash has to be spent to have a viable project plan and the documentation needed to obtain outside funding or incentives. For instance, an anemometer installation, together with a tall meteorological tower and data analysis may cost between $5,000 and $10,000, but without sufficient wind data a project can't go forward.

An early task of the project coordinator is assessing how much of his or her own resources (time and cash) can be budgeted for work on the project concept. Another is identifying what incentives are available that may help cover those costs, and, if possible, producing the needed documentation to qualify for and obtain these incentives.

It is for these reasons that funds available for feasibility studies and development of the project concept are so valuable. The USDA's Value-Added Producer Grant (Section 6401 of the Federal Farm Bill), offers grants for business planning, feasibility studies, and working capital related to value-added agricultural activity (including wind energy development). Value-Added Grant funds may be used to pay up to 50% of the costs for carrying out relevant feasibility studies. In addition, project sponsors should contact the Energy Trust early in the planning process. The Energy Trust of Oregon offers various incentives for wind development, and may be able to offer grants for work in the feasibility stage.

Engaging a cohort of sponsors is another method for raising early capital. It is important to consider who has an interest in the project's success, who has needed skills or time available, and who might be willing to risk money or in-kind services in exchange for participation in a promising concept.

Finding an Equity Partner

This section originally appeared in "Community Wind Financing," written by Charles Kubert at the Environmental Law & Policy Center.

Finding an outside tax-motivated investor is one of the greatest hurdles facing community wind projects that want to realize tax and depreciation benefits. Despite the recent growth in the U.S. wind power industry, the pool of large investors for these projects has been relatively small. Most of the equity capital for U.S. wind power projects has come from a handful of strategic investors such as subsidiaries of utility holding companies (e.g., FPL Energy and PPM Energy). Institutional investors, such as commercial banks and insurance companies, have large tax liabilities and experience in structured finance; however, only a few U.S. institutional investors are active in wind power projects, and these invest in larger projects initiated by commercial developers. Another group of potential corporate investors is other companies that have tax liabilities and may want to reduce their corporate income taxes while investing in a "green" business. As awareness of wind power grows and the tax and regulatory environments stabilize, some large corporations may see the benefit of these investments. Any of these equity partners—strategic or institutional—will be seeking after-tax rates of return of 15–20 percent with the non-strategic investors seeking returns at the higher end of the range.

Arranging Debt Financing

Securing debt financing for a project will often require completion of almost all of the pre-construction work, including wind monitoring, permitting, zoning, interconnection studies, and initial PPA negotiations. If financing is approved, it likely will come with many "conditions precedent," which must be satisfied before funds are released. It is likely that there will be additional conditions after the project is built, to ensure a very low risk of default. These conditions can add unexpected costs and cause delays if not anticipated.

Since lenders do not share in any profits or benefits of the project and only get paid according to terms, they can be very risk-averse and may demand all risks to be identified and resolved. They may also require project insurance, reserve accounts, maintenance contracts, and sponsor pledges. Early contact with debt financers to understand their appetite, concerns, conditions, and requirements is essential. There are a variety of potential sources of debt financing, ranging from local lenders to the state of Oregon (see SELP) to larger regional or national banks and commercial finance firms that focus on energy project finance.

Local Lenders

Local bankers are the best source of debt financing for small, locally owned projects. These bankers have an interest in the community and established relationships with local residents. However, financing a wind turbine is very different for traditional farm lenders than financing agricultural land or machinery. Bankers may be unfamiliar with the technology and the project risks, the required loan amounts may exceed the bank's lending threshold, and the bank may seek to secure the loan with investors' land because the turbine itself has no collateral value to the bank. At the same time, as the number of successful small wind power projects grows, community banks will likely become more familiar with them and will better understand the lending risks.

Regional Banks

Foreign banks have provided debt financing for many large U.S. wind power projects while U.S. commercial banks have stayed on the sidelines. Mid-tier regional banks may be willing to provide debt for smaller projects. In addition, outside corporate investors may have banking relationships that can open doors in providing debt financing for a project.

Commercial Finance

Commercial finance companies that specialize in energy projects are participating in financial structuring of wind power projects. They can package a project and sell it to both potential lenders and equity investors. However, they also typically have a minimum project size threshold that is above that of most community wind projects.

Small Scale Energy Loan Program (SELP)

The Oregon Small Scale Energy Loan Program (SELP) is administered by the Oregon Department of Energy and can be used to provide debt financing. For more information, please see the SELP section below under “Federal and State Incentives”.

John Deere Credit Wind Energy

John Deere Credit™ (JDC) has recently entered the renewable energy arena with a business unit focused on development and investment in community-based wind energy projects. Deere & Co. has identified that wind energy, along with other renewable fuel sources such as ethanol, is an area of interest for their agricultural customers and landowners. This initiative complements Deere’s activities in a variety of other renewable alternative energy projects and also provides a source of revenue growth for Deere’s customer base and shareholders.

Generally, John Deere Credit’s role in wind energy projects is that of both a debt and equity investor that enters into agreements with local developers and landowners to facilitate wind energy projects. The business model usually includes local owners as limited partners who provide management oversight and a role in project development. Ultimately, these limited partners can gain ownership and the benefits of the project assets, including the wind turbines. Often, members of these partnerships or shareholders in these corporations are the local landowners themselves.

Think of JDC as a “phase 2” participant in high-potential wind energy projects. These projects are normally beyond the initial stages in the development process, and have completed wind assessments and obtained local permits and potential power purchase agreements. You can learn more about wind energy and John Deere Credit involvement on their Web site: http://www.deere.com/en_US/jdc/index.html

Debt Structuring

Utility-scale projects can be structured with 40–70% debt, using non-recourse financing (i.e., secured by the project itself). Although the project financing could be secured with power purchase agreements, banks generally do not go beyond these debt levels because of the perceived risk factors associated with wind projects. Lenders carefully scrutinize the production and revenue streams from the project. Revenues sufficient to cover 1.2 to 1.5 times the size of debt payments (the debt coverage ratio) are common and depend on a number of factors, including the quality and length of on-site wind measurements.

Some banks may be willing to “monetize” the future value of the PTC. This, in effect, reduces the amount of equity that an investor would put into the project by paying down this additional debt as the PTC is realized over the life of the project. Other banks, however, may not even recognize the value of the PTC and may require that a project be able to meet debt service coverage requirements without it. Again, the project sponsor should consult early in this area.

Requirements for Financing

Depending on the provider's risk aversion, and the type and term of funding, the loan application package will require the following information:

- a comprehensive wind monitoring study provided by a meteorologist, conducted at the site for at least one year, or a combination of on-site measurements which correlate very well to a long period of high-quality data from a nearby meteorological station
- a project feasibility study by a consultant, including estimates of expected project performance that account for seasonal and interannual variability
- at some sites, a means of ensuring ongoing wind access, e.g. a wind access easement (ORS 105.900)
- proven expertise in managing a wind project or an agreement with a qualified third-party project manager
- zoning and all site permitting approvals that have satisfied their appeal period
- proof of authority to execute the project on the subject properties, clear title to that authority, and use agreements that provide control transfer and landowner payments in event of default, a cure period, and limitations on cross-liability
- turbine selection and performance data
- turbine warranties and a project operations and maintenance (O&M) plan and agreement
- a plan for maintenance during the period after the turbine warrantee expires until the end of the debt service, which may include provision for capital replacements and deteriorating performance
- provision for a project decommissioning fund, especially if the PPA and debt term are the same
- completed interconnection facilities and transmission upgrades studies and a schedule for any required upgrades
- a long-term power purchase agreement (at least ten years and preferably fifteen or twenty years—in any case at least as long as the requested term financing) with a creditworthy utility that will purchase the electricity generated at specified prices, or a plan for internal use of the production
- commitments for all required equity
- a binder for all necessary insurance
- a business, financial, and risk management plan for the project, including complete pro forma financial statements

Federal and State Incentives

Federal Incentives

Production Tax Credit (PTC)

The Federal Production Tax Credit provides an inflation-adjusted tax credit for electricity produced from renewable energy sources, including wind. For electricity produced and

sold during 2006, the adjusted PTC amount is 1.9¢ per kWh. Given that typical sale prices of electricity range from 3–6¢ per kWh, the PTC, at 1.9¢, represents a substantial portion of the revenue stream of a wind project, and project sponsors should carefully consider ownership scenarios that take advantage of the PTC.

To qualify for the PTC, the person taking the credit must own all or part of the energy project. In a project with multiple owners, allocation of credits must be in direct proportion to ownership interests. The person using the credit must either take an active role in project management or else use of the credit is restricted to tax liability incurred through other "passive" investments. Various strategies exist for capturing the value of the PTC, and analysis of the requirements for claiming the credit and evaluating interactions with other subsidies is complex. We recommend expert assistance be sought on the latest information in this ever-changing area, including the current status on the PTC expiration.

Renewable Energy Production Incentive (REPI)

The Renewable Energy Production Incentive provides financial incentive payments for electricity produced and sold by new qualifying renewable energy generation facilities. Eligible electricity production facilities are those owned by state and local government entities (such as municipal utilities and PUDs) and not-for-profit electric cooperatives. Unfortunately, incentive availability is subject to annual appropriations, and incentive payments are prorated if funds are limited. While this incentive offers an alternative for entities not eligible for the PTC, the uncertainty of annual appropriations substantially reduces its value to wind projects.

Accelerated Depreciation

Community wind projects are eligible for Accelerated Depreciation through the Modified Accelerated Cost Recovery System (MACRS), which allows a project to be depreciated over five years for tax purposes. The depreciation benefits, however, will only apply to that part of the project that has been financed with equity. The portion of the project financed by non-recourse debt—i.e. that financing that is tied solely to the project and not the assets of the borrower—is not eligible for the depreciation benefits. As for the PTC, individuals and closely held corporations can only use this depreciation tax benefit if they are actively involved in the project or have offsetting passive income.

Clean Renewable Energy Bonds (CREBs)

Created by the 2005 Federal Energy Policy Act, Clean Renewable Energy Bonds (CREBs) can be issued to finance the development of renewable energy–related projects. CREBs are based upon a "tax credit bond" that currently exists in the tax code for school construction under the Qualified Zone Academy Bond (QZAB) program. Qualified issuers of the bonds include political subdivisions of the state such as local governmental bodies (including municipal utilities), tribal governments, and mutual or cooperative electric companies. In essence, a clean energy bond would provide these issuers with interest-free loans for financing qualified energy projects. CREBs do not require any corporate contribution and do not limit which parties can invest in the securities. The bonds must be issued in 2006 and 2007, but their proceeds can be spent at a later date. The anticipated term of such bonds is approximately fifteen years and is periodically adjusted by the U.S. Treasury along with the amount of the credit that can be claimed against bondholders' federal taxes.

With a conventional bond, the issuer must pay interest to the bondholder. But with a CREB, the federal government pays a tax credit to the bondholder in lieu of the issuer paying interest to the bondholder. The U.S. Treasury Department sets the rate of the credit on a daily basis, in an amount that permits the issuance of the tax credit bond without discount and without interest cost to the issuer. A bondholder can deduct the amount of the tax credit from the total income tax liability. The bonds are taxable, so if the credit is worth $1,000 and the bondholder is in the 35%tax bracket, the bondholder's tax liability would be reduced $650.

U.S. Department of Agriculture (USDA)

USDA programs are excellent sources of funding and can provide valuable financial support at various project phases—including the difficult-to-fund feasibility phase—and for various project costs. A table summarizing the various USDA programs and incentives currently available is included as Appendix E.

State Incentives

The State of Oregon has generous incentives available to community wind projects, which are detailed below.

The Energy Trust of Oregon

The Energy Trust of Oregon, an independent nonprofit organization, administers programs for renewable energy and energy efficiency improvements, with funding collected through a public-purpose charge on Pacific Power and Portland General Electric ratepayers.

Of the funds collected, at least $10 million per year are allocated to renewable energy projects. The Energy Trust uses these funds to support projects through a loan program, assistance for grant applications, potential co-funding of feasibility analyses, and direct financial support for project development. To be eligible for funding from the Energy Trust, a project must either be developed within the service territory of Pacific Power or PGE, or have a Power Purchase Agreement for the sale of energy to one of these utilities. For more information, or to enquire about financial support, visit http://www.energytrust.org or call 1-866-ENTRUST (1-866-368-7878).

Business Energy Tax Credit (BETC)

Oregon businesses investing in, among other things, renewable energy projects in Oregon can claim a Business Energy Tax Credit (BETC) equal to 35% of eligible project costs (with eligible costs capped at $10 million). The 35% credit is taken either over five years (10% in the first two years, and 5% for the next three years), or alternatively as a discounted, lump-sum, up-front cash payment from a "pass-through" partner in exchange for the five-year credit. The pass-through option was designed to allow tax-exempt entities (e.g. schools) to benefit from the

BETC by exchanging the tax credit with taxable businesses able to use the credit, and that is primarily how it has been used to date. Even taxable entities, however, may choose to seek pass-through partners and take the BETC as a lump-sum cash payment. The pass-through cash payment is currently equal to 25.5% of eligible project costs (as opposed to 35% of eligible costs for the five-year tax credit), a discount that is set by the Oregon Department of Energy (which administers the BETC) and is revisited annually. Further information is available online at http://egov.oregon.gov/ENERGY/CONS/BUS/BETC.shtml.

Small Scale Energy Loan Program (SELP)

The Oregon Small Scale Energy Loan Program (SELP) is administered by the Oregon Department of Energy and was created in 1981 after voters approved a constitutional amendment authorizing the sale of tax-exempt general obligation bonds to finance small-scale, local energy projects.

Loans are available to individuals, businesses, schools, cities, counties, special districts, state and federal agencies, public corporations, cooperatives, tribes, and nonprofits and may be taxable or tax-exempt. Tax-exempt financing is available to private parties through the use of Private Activity Bonds. This may be an advantage to borrowers who cannot take advantage of federal tax benefits. Though there is no legal maximum loan, the size of a loan generally ranges from $20,000 to $20 million and collateral may be required. Terms vary, but are fixed-rate and generally set to match the term of the bonds that funded the loans. Loan terms may not exceed project life. Further information is available at http://egov.oregon.gov/ENERGY/LOANS/selphm.shtml.

Renewable Energy Systems Tax Exemption

Oregon's property tax exemption states that the added value to any property from the installation of a qualifying renewable energy system shall not be included in the assessment of the property's value for property tax purposes. Qualifying renewables include solar, geothermal, wind, water, fuel cell or methane gas systems for the purpose of heating, cooling, or generating electricity. This exemption does not apply to businesses whose principle activity is directly or indirectly the production, transportation, or distribution of energy, such as utilities or a wind project company.

Interaction of State and Federal Incentives: BETC and SELP impacts on PTC

There are major trade-offs in Oregon when using the PTC due to provisions enforced by the U.S. Internal Revenue Service (IRS). These may be triggered when owners use the BETC or SELP, although specific impacts are uncertain at this point. The working assumptions at this point are:

- Use of BETC would result in a corresponding decrease in the PTC. That is, if 25.5% of the project's costs were financed by taking the BETC as a pass-through, the PTC would be decreased by that same percentage, 25.5%.
- If projects use a taxable SELP loan, the

double-dipping provisions should not be triggered, but if the loan is tax-exempt, double-dipping provisions may kick in. The Oregon Department of Energy has asked the IRS for a clarifying ruling on this issue.

- Depending on accounting treatment, the BETC pass-through will either reduce the depreciable basis of the project, or count as taxable income.

The equipment that must be used to qualify for the PTC consists of the turbine, its pad-mounted transformer, and—at the election of the applicant—the substation transformer. This definition is important when considering how the PTC and other incentives might be mixed in the same project. The reason for this is federal anti–double-dipping restrictions from the Tax Reform Act of 1986. Effectively, one cannot take a PTC on equipment that was also subsidized at the state level, e.g., via BETC or SELP. This takes the form of offset provisions in both federal and state code, which essentially say that, "any incentive you get from the other will offset the incentive you can get from us." So, both the PTC and BETC can be obtained for a project, but the amount of the PTC is reduced. Targeting otherwise-restricted incentives to portions of the project that are costly and not included in the roster of PTC-qualifying equipment (e.g., substation, collector system, civil works, soft costs, etc.) is a strategy that should be reviewed.

Calculating Estimated Energy Production and Value

Calculating Estimated Energy Production

Once a reliable estimate of the expected wind resource has been determined and a turbine selected, an estimate of energy production is made using the power curve of the turbine. This is typically expressed as a "capacity factor," a percentage that when applied to nameplate capacity will give the predicted energy production. For example, estimated kilowatt-hour production per year for a 3 MW system with a 30% capacity factor would be:

30% x 3,000 (3 MW) x 8,760 (number of hours in a year) = 7,884,000 kWh/year.

How much revenue will result from that production requires knowing what the sale price will be per kilowatt-hour, which is specified in a Power Purchase Agreement.

The Avoided Costs currently filed for PGE and Pacificorp provide for three pricing options (the fixed price, the deadband, and the gas market options—see Oregon PUC e-dockets for docket UM1129 at http://www.puc.state.or.us/). Each of these options specifies two prices—one for On-Peak and one for Off-Peak—which are substantially different, reflecting the higher value of energy produced during peak periods. Therefore, a reasonably accurate estimate of when energy will be produced during each day will also be needed to estimate the value of that energy when sold. This is provided by the on-site hourly wind data, with some adjustment made by an expert meteorologist to account for the duration of wind measurements and the long-term consistency of the time period they occurred. Of considerable concern, especially when debt and outside financing is used and PPA peak vs. off-peak pricing is significantly different, is the amount of variability in the production: between peak and off-peak periods and year-to-year. The amount of variability will determine how much financing is available and may motivate implementing various production risk mitigation strategies.

Power Purchase Agreements and Price per kWh

Power Purchase Agreements (PPAs) are legal contracts between buyers and sellers of energy, and specify important details of the transaction, including the term of the contract and price paid for energy. Under the Federal PURPA rules, utilities are required to purchase power from Qualifying Facilities (QFs), which are defined as production facilities that have a nameplate capacity of less than 80 MW and have utility ownership of less than 50%. See discussion above ("Factors to Consider") for more details on IOU and COU power purchases.

Whether selling to an IOU or a COU, sellers of energy (as well as buyers) need to demonstrate creditworthiness, for the protection of both the buyer and the seller, to ensure on the one hand that the project will remain in operation and continue to deliver electricity to the utility, and on the other that the power will be purchased as agreed. For example, to establish creditworthiness, Portland General Electric requires a written acknowledgement that the seller is current on all existing debt obligations and that it was not a debtor in a bankruptcy proceeding within the preceding twenty-four months. Preferably, the term of the PPA should be at least as long as the period during which the owners will be making loan payments. Ideally, the term of the PPA will extend beyond the amortization period, to cover potential financial difficulties in later years.

When negotiating a PPA, environmental attributes, often called "Green Tags" or "Renewable Energy Credits" (see detail below) are usually sold with the power, but this must be specified in the PPA or it will be assumed that they are owned by the project owner. Additional considerations, specified and agreed to for the protection of both parties, include development timeline, permitting, interconnection, performance, operation, and billing. Given the complexity and importance of PPAs, it is highly recommended that project coordinators secure legal assistance in negotiating the terms of PPAs.

Environmental Attributes

Green Tags Production and Marketing

Wind projects do not pollute—there is no fuel extraction, transportation, or emission from combustion. This, and other incremental values of renewable energy generation, compared to generation from conventional sources such as fossil fuel and nuclear, are often recognized and quantified as "Green Tags" (GTs), "Renewable Energy Credits" (RECs), or "Tradable Renewable Certificates" (TRCs). These are defined and sold separately from energy. A voluntary national standard exists, to ensure consistency in these products. See http://www.green-e.org/ipp/standards.html. One Green Tag is produced with every 1,000 kWh of clean energy, and currently sells for between $2 and $5 per tag in the Northwest. GT buyers, such as the Bonneville Environmental Foundation, Green Mountain Energy, or 3 –Phases Energy, resell to utilities and others interested in supporting renewable energy. GTs belong to the buyer of the power, depending on the structure of the Power Purchase Agreement. While environmental attributes can often be sold for a substantial amount, the market is quite volatile and sale contracts are often only available for three to five years.

Financing Models

Financial modeling may well be the single most critical analysis of a wind project. Project coordinators should seek expert advice and direction early in project development. We have included an Expense Example spreadsheet at the end of this section, but caution that project coordinators should not assume their project will have the same costs. Recent substantial turbine price increases demonstrate how quickly costs can change. We have not included sample pro formas in the Guidebook, given the unique characteristics of each wind project, we instead recommend that project coordinators research and use available financial modeling tools (in addition to securing expert assistance). Here are several examples:

http://www.windpower.org/en/tour/econ/econ.htm

http://www.retscreen.net/ang/menu.php

http://analysis.nrel.gov/windfinance/login.asp

http://www.windustry.com/calculator/default.htm

Sources of Information and Assistance

We recommend that project coordinators start their research by contacting the Oregon Department of Energy and the Energy Trust of Oregon (see Resources section). These organizations will provide suggestions for additional research and expert assistance in legal and finance areas.

EXPENSE EXAMPLE

TABLE 7.1

	3MW			10MW		
	$	**$/kWh**	**% of total**	**$**	**$/kW**	**% of total**
Turbine						
Turbine & Tower	$3,600,000	$1,200		$12,000,000	$1,200	
Freight	$110,000	$37		$366,667	$37	
FAA lights	$10,000	$3		$33,333	$3	
Cold Weather	$15,000	$5		$50,000	$5	
Subtotal	***$3,735,000***	***$1,245***	*74.2%*	***$12,450,000***	***$1,245***	*78.2%*
Balance of Plant						
Site Development	$100,000	$33		$300,000	$30	
Foundations	$160,000	$53		$500,000	$50	
Cranes plus Crane & Erection Labor	$163,000	$54		$360,000	$36	
Electrical System & Transformer	$150,000	$50		$500,000	$50	
MET Tower	$18,000	$6		$18,000	$2	
Supervision	$40,000	$13		$120,000	$12	
Subtotal	***$631,000***	***$210***	*12.5%*	***$1,798,000***	***$180***	*11.3%*
Interconnection						
HV line extension	$30,000	$10		$100,000	$10	
Interconnect/metering	$160,000	$53		$533,333	$53	
Labor electrical	$20,000	$7		$66,667	$7	
Subtotal	***$210,000***	***$70***	*4.2%*	***$700,000***	***$70***	*4.4%*
Soft Costs						
Legal	$60,000	$20		$200,000	$20	
Permitting	$24,000	$8		$80,000	$8	
Development/Engineering	$80,000	$27		$253,333	$25	
Insurance (Construction & Transportation)	$20,000	$7		$60,000	$6	
Title Insurance	$6,000	$2		$20,000	$2	
Financing (Application, Underwritting, Loan fees)	$10,000	$3		$33,333	$3	
Feasibility Study	$100,000	$33		$66,667	$7	
Contingencies	$160,800	$54		$268,000	$27	
Subtotal	***$460,800***	***$154***	*9.1%*	***$981,333***	***$98***	*6.2%*
Total	***$5,036,800***	***$1,679***		***$15,929,333***	***$1,593***	
Operating Costs						
O&M	$30,000	$10		$100,000	$10	
Warranty/R&R	$54,000	$18		$180,000	$18	
Management/Administrative	$20,000	$7		$25,000	$3	
Property Taxes	$42,850	$14		$132,272	$13	
Land Lease	$8,000	$3		$26,667	$3	
Equipment Insurance	$28,000	$9		$88,667	$9	
Miscellaneous	$2,000	$1		$6,000	$1	
Subtotal	***$184,850***	***$62***		***$253,606***	***$25***	

Credit: Henry DuPont

RESOURCES

This section is intended to provide direction to the reader who would like to explore a topic further. Many of these works were also useful to the authors of this Guidebook, and are also included in detail in the bibliography section. Here, resources are organized for the reader's use, and are categorized as follows.

a. Publications and Web tools

b. State agencies and incentive programs

c. Federal agencies and incentive programs

d. Nonprofit organizations

e. Utility-scale wind turbine manufacturers and distributors

f. Planning and permitting offices

g. Oregon utility companies

a. Publications and Web Tools

Community Wind Financing: A Handbook

Published by the Environmental Law & Policy Center. 2004.

This publication provides in-depth description of community wind financing models that reflect differing positions and investment goals of various project owners and developers.

Available at http://www.elpc.org.

A Comparative Analysis of Community Wind Power Development Options in Oregon

Prepared by Bolinger et al. for the Energy Trust of Oregon. 2004.

This document explores ownership and financial models for community wind. The publication provides detailed examples of European models, investigates how they may work in the United States, and includes information particular to development in Oregon.

Database of State Incentives for Renewable Energy

This database provides information on tax incentives, rebate programs, portfolio standards, interconnection standards, green power programs, and other state-level policies that encourage renewable energy development. It also provides information on selected federal incentive programs.

http://www.dsireusa.org

Federal Aviation Administration (FAA)

Advisory Circular 70/7460-2K, Proposed Construction or Alteration of Objects that May Affect the Navigable Airspace

http://www.faa.gov/arp/anm/services/safety/instructions.htm

Advisory Circular AC 70/7460-1K: Obstruction Marking and Lighting

http://www.faa.gov/ats/ata/ai/index.html

Notice of Proposed Construction form 7460-1

http://forms.faa.gov/forms/faa7460-1.pdf

Landowner's Guide to Wind Energy in the Upper Midwest

Published by the Izaak Walton League of America. 1995.

This publication offers good coverage of the various topics to consider in land-lease agreements.

Available from the Izaak Walton League of America (http://www.iwla.org/).

The Law of Wind: A Guide to Business and Legal Issues

Published by Stoel Rives LLP. 2005.

The Law of Wind provides a user-friendly discussion on legal and policy issues most likely to impact the development of individual wind projects and the wind industry in general.

Available at http://www.stoel.com/.

Permitting of Wind Energy Facilities: A Handbook

Published by the National Wind Coordinating Committee. 2002.

Prepared by the NWCC Siting Subcommittee, this publication gives specific permitting considerations, guidelines for the process, and case studies.

Available at http://nationalwind.org/publications/permit/permitting2002.pdf.

Renewable Energy Atlas of the West

A project of the Hewlett Foundation and The Energy Foundation. Produced 2002.

This atlas contains full-color maps of the renewable energy resources of eleven western states, including high-resolution wind maps that are searchable in the online version. The atlas profiles wind, solar, geothermal, and biomass potential.

Available at http://www.energyatlas.org.

Windmaps.org

Windmaps.org provides high-resolution maps of wind energy potential in the Pacific Northwest. Resource estimates are accessible to the public through an interactive Geographic Information System (GIS) website.

http://www.windmaps.org

Windustry

The Windustry Web site offers all kinds of information about wind energy, from basics to specifics. See in particular the Community Wind Energy page for a "clearinghouse" of targeted information and links.

http://www.windustry.com/community/default.htm

b. State Agencies and Incentive Programs

Energy Trust of Oregon

Energy Trust of Oregon, Inc., is a nonprofit organization dedicated to changing how Oregonians use energy by promoting energy efficiency and clean renewable energy for Oregon customers of Pacific Power, Portland General Electric, and NW Natural.

Energy Trust offers Oregonians cash incentives for energy-efficient improvements to their homes and businesses. The Energy Trust's renewable energy programs offer financial assistance for the generation of electricity using wind, biopower, and solar energy. Energy Trust also has a network of trade allies and energy specialists who execute projects and assist customers.

Energy Trust of Oregon
851 SW Sixth Avenue, Suite 1200
Portland, OR 97204

Phone: 1-866-ENTRUST (1-866-368-7878)
Fax: 503-546-6862

http://www.energytrust.org

Oregon Department of Energy (DOE)

The mission of the Oregon Department of Energy is to ensure Oregon has an adequate supply of reliable and affordable energy and is safe from nuclear contamination, by helping Oregonians save energy, develop clean energy resources, promote renewable energy, and clean up nuclear waste. The DOE administers the Business Energy Tax Credit (BETC) and the Oregon Small Scale Energy Loan Program (SELP), as well as serving as a community resource to review and comment on business plans through the Oregon Wind Working Group.

Oregon DOE
625 Marion St. NE
Salem, OR 97301-3737

Phone: 503-378-4040,
Toll-free: 1-800-221-8035
Fax: 503-373-7806

http://egov.oregon.gov/ENERGY/

Oregon Wind Working Group (OWWG)

The OWWG was formed in July 2002. It includes representatives of utilities, government agencies, environmental groups, farming and rural interests, and wind industry developers. The OWWG is partially funded by the U.S. Department of Energy as part of its Wind Powering America program.

http://egov.oregon.gov/ENERGY/RENEW/Wind/OWWG/OWWG.shtml

c. Federal Agencies and Incentive Programs

U.S. Department of Agriculture

The USDA Renewable Energy and Energy Efficiency Program provides information including details on USDA funding opportunities, links to technical and feasibility resources, environmental guidance, and more.

Oregon State Office:

USDA Rural Development
1201 NE Lloyd Blvd, Suite 801
Portland, Oregon 97232
Phone: 503-414-3300
Fax: 503-414-3385

http://www.rurdev.usda.gov/or/

National Office:

U.S. Department of Agriculture
Rural Business-Cooperative Service

Renewable Energy and Energy Efficiency Program
1400 Independence Avenue, SW
Washington, DC 20250
Phone: 202-720-1497

http://www.rurdev.usda.gov/rbs/farmbill/index.html

U.S. Department of Energy

Wind Energy Program

The program's mission is to lead the nation's efforts to improve wind energy technology through public/private partnerships that enhance domestic economic benefit from wind power development and coordinate with stakeholders on activities that address barriers to wind energy use. The U.S. DOE Energy Efficiency and Renewable Energy (EERE) Information Resources Catalog offers quick and easy access to a growing number of publications, videos, software, and other information products across EERE. Check the online catalog for the latest wind energy and hydropower publications from DOE.

Access resources such as national program-level publications, photographs, industry links, and homeowner links related to hydropower and wind energy.

http://www.eere.energy.gov/

Wind Powering America

Wind Powering America is a commitment to dramatically increase the use of wind energy in the United States. This initiative will establish new sources of income for American farmers, Native Americans, and other rural landowners, and meet the growing demand for clean sources of electricity. Wind Powering America's Web site includes state wind maps, small wind consumer's guides, wind workshops, and more. Visit the "State Activities" section to read news articles, press releases, and fact sheets.

http://www.eere.energy.gov/windandhydro/windpoweringamerica/

Green Power Network

The U.S. Department of Energy's Green Power Network provides news and information on green power markets and related activities. The Web site provides information on Green Power Marketing in Competitive Electricity Markets and Utility Green Pricing Programs. The network includes marketers of Renewable Energy Certificates.

http://www.eere.energy.gov/greenpower/

National Renewable Energy Laboratory

The National Renewable Energy Laboratory (NREL) is the nation's primary laboratory for renewable energy and energy efficiency R&D. It is the principal laboratory for the DOE Office of Energy Efficiency and Renewable Energy, and is managed for DOE by Midwest Research Institute and Battelle.

National Renewable Energy Laboratory
1617 Cole Blvd.
Golden, CO 80401
Phone: 303-275-3000

http://www.nrel.gov/

d. Nonprofit Organizations

American Wind Energy Association

AWEA advocates the development of wind energy as a reliable, environmentally superior energy alternative in the United States and around the world. The AWEA Web site provides a host of useful information and allows guest access to their membership directory, which includes wind energy specialists and professionals of all types.

AWEA
1101 14th Street, NW, 12th Floor
Washington, DC 20005
Phone: 202-383-2500

http://www.awea.org
e-mail: windmail@awea.org

The Audubon Society

Audubon's mission is to conserve and restore natural ecosystems, focusing on birds, other wildlife, and their habitats. Audubon chapters provide expertise on avian issues, and can assist in project feasibility and siting.

Audubon Oregon
310 SW 4th Avenue
Suite 507
Portland, OR 97204
Phone: 503-247-3703

See the National Audubon Web site for a listing of local Audubon chapters:
http://www.audubon.org/states/index.php

Bonneville Environmental Foundation

The Bonneville Environmental Foundation (BEF) was founded in 1998 to support watershed restoration programs and develop new sources of renewable energy. BEF is a nonprofit organization, markets green power products to public utilities, businesses, government agencies, and individuals. Through the brokering of Green

Tags, BEF funds can often help finance wind energy projects.

BEF
133 SW 2nd Avenue, Suite 410
Portland, OR 97204
Phone: 503-248-1905, Toll-free: 866-BEF-TAGS

http://www.b-e-f.org

Center for Rural Affairs

The Center for Rural Affairs, a private, nonprofit organization, is working to strengthen small businesses, family farms and ranches, and rural communities.

Center for Rural Affairs
145 Main St. – PO Box 136
Lyons, NE 68038-0136
Phone: 402-687-2100
Fax: 402-687-2200

http://www.cfra.org
e-mail: info@cfra.org

Environmental and Energy Study Institute

EESI focuses on renewable energy, energy efficiency, climate change, smart growth, alternative fuels, and advanced vehicle technologies.

EESI
122 C Street NW, Suite 630
Washington, DC 20001
Phone: 202-628-1400
Fax: 202-628-1825

http://www.eesi.org
e-mail: eesi@eesi.org

Interstate Renewable Energy Council (IREC)

IREC focuses on issues affecting expanded renewable energy use such as rules that support renewable energy and distributed resources in a restructured market, connecting small-scale renewables to the utility grid, developing quality credentials that indicate a level of knowledge and skills competency for renewable energy professionals, and getting the right information to the right people.

IREC
PO Box 1156
Latham, New York 12110
Phone: 518-458-6059

http://www.irecusa.org
e-mail: info@irecusa.org

National Wind Coordinating Committee (NWCC)

NWCC is comprised of representatives from the utility, wind industry, environmental, consumer, regulatory, power marketer, agricultural, tribal, economic development, and state and federal government sectors to support the development of an environmentally, economically, and politically sustainable commercial market for wind power.

NWCC
1255 23rd Street NW, Suite 275
Washington, DC 20037
Phone: 888-764-WIND

http://www.nationalwind.org
e-mail: nwcc@resolv.org

Northwest Sustainable Energy for Economic Development (NWSEED)

NWSEED supports and develops creative programs, policies, and financing approaches to build rural economies and meet the region's power needs through affordable, renewable energy generation.

NWSEED
119 First Avenue South, Suite 400
Seattle, WA 98104
Phone: 206-328-2441

http://www.nwseed.org
e-mail: info@nwseed.org

Northwest Energy Coalition

The NW Energy Coalition is an alliance of more than 100 environmental, civic, and human service organizations, progressive utilities, and businesses in Oregon, Washington, Idaho, Montana, Alaska, and British Columbia. They promote development of renewable energy and energy conservation among other things.

NWEC

219 First Avenue South, Suite 100
Seattle, WA, 98104
Phone: 206-621-0094
Fax: 206-621-0097

http://www.nwenergy.org
e-mail: nwec@nwenergy.org

Renewable Energy Policy Project (REPP)

REPP issues briefs and research reports on growth strategies for renewables that respond to competitive energy markets and environmental needs. In 1999, REPP acquired the Center for Renewable Energy and Sustainable Technology (CREST).

REPP
1612 K Street NW, Suite 202
Washington, DC 20006
Phone: 202-293.2898

http://www.repp.org

Renewable Northwest Project

RNP promotes development of the region's untapped renewable resources, and has proven to be a forceful advocate for expanding utility use of solar, wind, and geothermal energy in the Northwest.

RNP
917 SW Oak, Suite 303
Portland, OR 97205
Phone: 503-223-4544

http://www.rnp.org
e-mail: renewables@RNP.org

Union of Concerned Scientists (UCS)

UCS analyzes and advocates energy solutions that are sustainable both environmentally and economically, with a focus on supporting policies that let renewables compete successfully.

UCS
2 Brattle Square
Cambridge, MA 02238-9105
Phone: 617-547-5552

http://www.ucsusa.org

Windustry

Windustry promotes wind energy through outreach, educational materials, and technical assistance to rural landowners, local communities and utilities, and state, regional, and nonprofit collaborations.

Windustry
2105 First Avenue South
Minneapolis, MN 55404
Phone: 612-870-3461 Toll-free: 800-946-3640
Fax: 612-813-5612

http://www.windustry.org
e-mail: info@windustry.org

e. Utility-Scale Wind Turbine Manufacturers and Distributors

For up-to-date listings of manufacturers and distributors, a great resource is AWEA's membership directory at http://www.awea.org. Other manufacturers and distributors include the following.

Gamesa Eólica

Parque Tecnologico de Alava C
Leonardo da Vinci 13
Minano, Spain 01510
Phone: 34 945 18 5772
Fax: 34 945 18 5667

http://www.gamesa.es/
e-mail: energia@energia.gamesa.es

Note: Gamesa Eólica is a Spanish manufacturer of 800 kW to 1.8 MW wind turbines.

GE Energy

Mary McCann
13000 Jameson Road
Tehachapi, CA 93561
Phone: 661-823-6700
Fax: 661-823-6464

http://www.gewindenergy.com
e-mail: mary.mccann@ps.ge.com

Note: GE manufactures 1.5 MW to 3.6 MW machines.

Lorax Energy Systems, LLC

Henry duPont
4 Airport Road
PO Box 457
Block Island, RI 02807
Phone: 401-466-2883
Fax: 401-466-2909

http://www.lorax-energy.com
e-mail: hdp@lorax-energy.com

Note: Lorax Energy Systems is the North American distributor for Furhländer turbines of 750 kW and 1 MW.

Mitsubishi Power Systems, Inc.

Ricky S. Takada, Manager of Business Development
100 Bayview Circle
Suite 4000
Newport Beach, CA 92660
Phone: 949-856-8400
Fax: 949-856-4481

http://www.mpshq.com
e-mail: rtakada@mhia.com

Note: Mitsubishi manufacturers 250 kW to

1 MW turbines.

Siemens Wind Power A/S

Borupvej 16
DK-7330 Brande
Phone: +45 9942 2222
Fax: +45 9999 2222

http://www.bonus.dk
e-mail: bonus@bonus.dk

Note: Formerly BONUS Energy A/S, Siemens Wind Power A/S manufactures 600kW to 2.3 MW wind turbines in Denmark.

Suzlon Wind Energy Corp.

8750 Bryn Mawr Ave.
Suite 720
Chicago, IL 60631
Phone: 773-328-5077
Fax: 773-444-0588

http://www.suzlon.com
e-mail: info@suzlon-usa.com

Note: Suzlon manufactures machines from 350 kW to 2 MW in Denmark. The North American subsidiary is headquartered in Chicago, with an office in Portland, OR.

Vestas Americas

111 SW Columbia Ave.
Suite 480
Portland, OR 97201
Phone: 503-327-2000
Fax: 503-327-2001

http://www.vestas.com
e-mail: info@vestas-awt.com

Note: Vestas, based in Denmark, manufactures 660 kW to 3 MW turbines. The headquarters for Vestas Americas are in Portland, Oregon.

f. Planning and Permitting Offices

For issues not addressed by a county planning or permitting office, contact the Oregon Department of Energy (see State Agencies and Incentive Programs, pg. 80) or the Oregon Department of Environmental Quality:

Department of Environmental Quality

811 SW Sixth Avenue
Portland, OR 97204-1390
Phone: 503-229-5696
Toll-free in Oregon: 800-452-4011
Fax: 503-229-6124

http://www.deq.state.or.us

County Offices:

Baker County Planning Department

Baker County Courthouse
1995 Third Street
Baker City, OR 97814
Phone: 541-523-8219

Benton County Planning & Building

360 SW Avery Avenue

Corvallis, OR 97333
Phone: 541-766-6819

Clackamas County Zoning and Planning Permits

9101 SE Sunnybrook Blvd.
Clackamas , OR 97015
Phone: 503-353-4500

Clatsop County Community Development Dept.

800 Exchange St., Room 100
Astoria, OR 97103
Phone: 503-325-8611

Columbia County Land Development Services

Columbia County Courthouse
230 Strand St.
St. Helens, OR 97051
Phone: 503-397-1501

Coos County Planning Department

Coos County Court House
250 N. Baxter
Coquille, OR 97423
Phone: 541-396-3121 Ext. 210

Crook County Planning Department

300 NE Third Street, Room 11
Prineville, OR 97754
Phone: 541-447-8156

Curry County Planning, Building, & Sanitation

PO Box 746
Gold Beach, OR 97444
Phone: 541-247-3304

Deschutes County Land Use Planning

117 NW Lafayette Ave.
Bend, OR 97701
Phone: 541-388-6560

Douglas County Planning Department

Douglas County Courthouse
Justice Building, Room 106
Roseburg, OR 97470
Phone: 541-440-4289

Gilliam County Courthouse

221 S. Oregon Street
PO Box 427
Condon, OR 97823
Phone 541-384-2311

Grant County Planning Department

County Court House
201 S. Humbolt Street
Canyon City, OR 97820
Phone: 541-575-1519

Harney County Planning/GIS Department

450 N. Buena Vista
Burns, OR 97720
Phone: 541-573-6655

Hood River County Planning Department

601 State Street
Hood River, OR 97031
Phone: 541-387-6840

Jackson County Planning Department

10 South Oakdale, Room 100
Medford, OR 97501
Phone: 541-774-6900

Jefferson County - Community Development, Building & Planning Services

85 Southeast D Street
Madras, OR 97741
Phone: 541-475-4462

Josephine County Planning Department

510 NW 4th St
Grants Pass, OR 97526
Phone: 541-474-5421

Klamath County Planning Department

Government Center
305 Main Street
Klamath Falls, OR 97601
Phone 541-883-5121

Lake County Planning and Building

513 Center Street
Lakeview, OR 97630
Phone: 541-947-6032

Lane County Land Use and Zoning

Land Management Division
125 E. Eighth Ave.
Eugene, OR 97401
Phone: 541-682-3807

Lincoln County Planning & Development Department

210 SW 2nd Street
Newport, OR 97365
Phone: 541-265-4192

Linn County Planning and Building

300 SW Fourth Ave.
PO Box 100
Albany, OR 97321
Phone: 541-967-3816

Malheur County Planning

251 “B” St. West #12
Vale, OR 97918
Phone: 541-473-5185

Marion County Planning Department

555 Court St. NE
Salem, OR 97301
Phone: 503-588-5038

Morrow County Planning

205 NE Third
PO Box 40
Irrigon, OR 97844
Phone: 541-922-4624

Multnomah County Dept. of Community Services

Land Use & Transportation Program
1600 SE 190th Ave., Suite 116
Portland, OR 97233
Phone: 503-988-3043

Polk County Planning Division

850 Main Street
Dallas, OR 97338
Phone: 503-623-9237

Sherman County Planning Department

PO Box 365
500 Court Street
Moro, OR 97039
Phone: 541-565-3601

Tillamook County Community Development

Planning Division
201 Laurel Avenue
Tillamook, OR 97141
Phone: 503-842-3408

Umatilla Planning Department

Courthouse
216 SE Fourth
Pendleton, OR 97801
Phone: 541-276-7111

Union County Planning Department

1001 Fourth Street, Suite C
La Grande, OR 97850
Phone: 541-963-1014

Wallowa County Planning Department

101 S. River Street, Rm B-1
Enterprise, OR 97828
Phone: 541-426-4543

Wasco County Planning and Development

2705 East Second Street
The Dalles, OR 97058
Phone: 541-506-2560

Washington County Land Use & Transportation

155 N. First Avenue, Suite 350, MS 14
Hillsboro, OR 97124
Phone: 503-846-3519

Wheeler County - Planning Commission

County Courthouse
701 Adams Street
Fossil, OR 97830
Phone: 541-763-2126

Yamhill County Dept. of Planning Development

401 NE Evans Street
McMinnville, OR 97128
Phone: 503-434-7516

g. Oregon Utility Companies

Regulatory Body			
Oregon Public Utility Commission			www.puc.state.or.us
Wholesale Providers			
Bonneville Power Administration			www.bpa.gov
Municipal Utilities			
City of Ashland Electric Dept.	90 N Mountain Ave. Ashland, OR 97520	Ph: 541-488-5357 Fax: 541-488-5320	www.ashland.or.us
City of Bandon	PO Box 67 Bandon, OR 97411	Ph: 541-347-2437	www.ci.bandon.or.us/utilities.htm
Canby Utility Board	PO Box 1070 Canby, OR 97013	Ph: 503-266-1156	
City of Cascade Locks	PO Box 308 Cascade Locks, OR 97014	Ph: 503-374-8484	www.cascade-locks.or.us/departments/citylight.htm
City of Drain Light & Power	PO Box 158 Drain, OR 97435	Ph: 503-836-2417	www.354.com/drain/draincity.htm
Eugene Water & Electric Board	500 East Fourth Avenue Eugene, OR 97401	Ph: 541-484-2411	www.eweb.org
City of Forest Grove	1818 "B" Street PO Box 326 Forest Grove, OR 97116	Ph: 503-992-3250 Fax: 503-992-3149	www.ci.forest-groveor.us/light1.html
Hermiston Energy Services	Russ Dorran 215 E. Gladys Avenue Hermiston, OR 97838	Ph: 541-667-5035	www.hermiston.or.us/
McMinnville Water and Light	855 NE Marsh Lane McMinnville, OR 97128	Ph: 503-472-6158 Fax: 503-472-5211	www.mc-power.com/
City of Milton-Freewater	722 S. Main Street Milton-Freewater, OR 97862	Ph: 541-938-5531 Fax: 541-938-8224	www.mfcity.com/electric/index.html
City of Monmouth	151 W. Main Monmouth, OR 97361	Ph: 503-838-0722	
City of Springfield	PO Box 300 Springfield, OR 97477	Ph: 541-746-8451	www.subutil.com/

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Public Utility Districts			
Central Lincoln PUD	2129 North Coast Hwy Newport, OR 97365	Ph: 541-265-3211	www.clpud.org/
Clatskanie PUD	469 North Nehalem St. PO Box 216 Clatskanie, OR 97016	Ph: 503-728-2163 Fax: 503-728-2812	www.clatskaniepud.com/
Columbia River PUD	PO Box 1193 St. Helens, OR 97051	Ph: 503-397-1844 Fax: 503-397-5215	https://www.crpud.net/
Emerald PUD	33733 Seavey Loop Rd. Eugene, OR 97405	Ph: 541-746-1583 Fax: 541-746-0211	www.epud.org/
Northern Wasco County PUD	2345 River Rd. The Dalles, OR 97058	Ph: 541-296-2226	www.nwasco.com/
Tillamook PUD	1115 Pacific Avenue PO Box 433 Tillamook, OR 97141	Ph: 1-800-422-2535	www.tpud.org/
Investor-Owned Utilities			
Idaho Power Co.	PO Box 70 Boise, ID 83707	Ph: 208-388-2200	www.idahopower.com/
PacifiCorp	825 NE Multnomah Portland, OR 97232	Ph: 1-888-221-7070	www.pacificpower.net/
Portland General Electric Co.	121 SW Salmon Street Portland, OR 97204	Ph: 503-464-8000	www.portlandgeneral.com
Cooperatives			
Blachly-Lane County Co-op	90680 Hwy. 99 Eugene, OR 97402	Ph: 541--688-8711	
Central Electric Coop Inc.	2098 N. Highway 97 Redmond, OR 97756	Ph: 541-548-2144	www.cec-co.com/
Clearwater Power Co.	4230 Hatwai Road PO Box 997 Lewiston, ID 83501	Ph: 1-888-743-1501 Fax: 208-746-3902	www.clearwaterpower.com
Columbia Basin Electric Coop Inc.	171 Linden Way PO Box 398r Heppner, OR 97836	Ph: 541-676-9146 Fax: 541-676-5159	www.rapidserve.net/cbec/
Columbia Power Coop Association Inc.	PO Box 97 Monument, OR 97864	Ph: 503-934-2311	
Columbia Rural Electric Association Inc.	115 E. Main Street PO Box 46 Dayton, WA 99328	Ph: 1-800-642-1231	www.columbiarea.com/

TABLE CONTINUED ON NEXT PAGE

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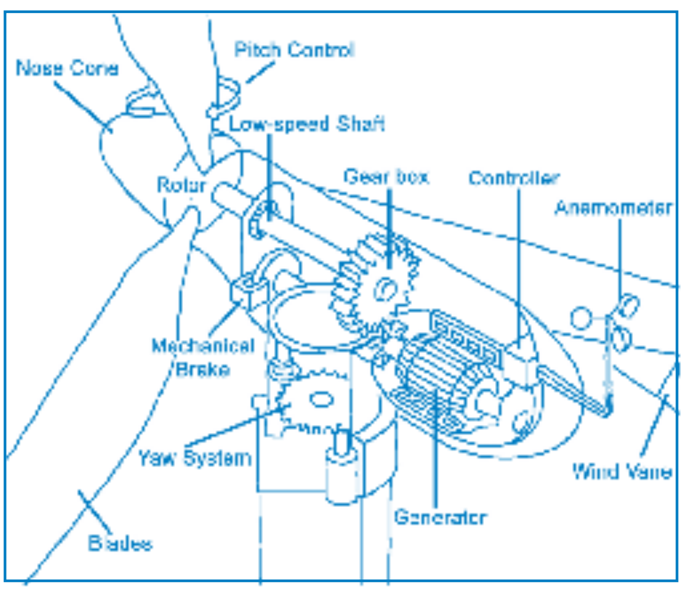
Cooperatives (continued)			
Consumers Power Inc.	6990 West Hills Drive PO Box 1180 Philomath, OR 97370	Ph: 541-929-3124 or 800-872-9036 Fax: 541-929-8673	www.consumerspower.org/
Coos-Curry Electric Coop Inc.	43050 Highway 101 Port Orford, OR 97465	Ph: 541-332-3931	www.cooscurryelectric.com/
Douglas Electric Coop Inc.	1981 NE Stephens PO Box 1327 Roseburg, OR 97470	Ph: 541-673-6616	www.douglaselectric.com/index.html
Harney Electric Coop Inc.	1326 Hines Blvd. Burns, OR 97720	Ph: 541-573-2061	www.harneyelectric.org
Hood River Electric Coop	PO Box 125 Odell, OR 97044	Ph: 541-354-1233	
Lane Electric Coop Inc.	787 Bailey Hill Road Eugene, OR 97402	Ph: 541-484-1151	www.laneelectric.com/
Midstate Electric Coop Inc.	16755 Finley Butte Road PO Box 127 La Pine, OR 97739	Ph: 541-536-2126 or 800-722-7219 Fax: 541-536-1423	www.midstatecoop.com/Home/default.aspx
Oregon Trail Electric Consumers Coop Inc.	4005 23rd Street Baker City, OR 97814 567 W. Pierce Street Burns, OR 97720 245 Canyon Blvd. John Day, OR 97845 107 Elm Street La Grande, OR 97850	Ph: 541-523-3616 Ph: 541-573-2666 Ph: 541-575-0161 Ph: 541-963-3155	www.otec.coop/
Salem Electric	PO Box 5588 633 Seventh Street NW Salem, OR 97304	Ph: 503-362-3601 Fax: 503-371-2956	www.salemelectric.com
Surprise Valley Electric Corporation	22595 HWY 395 North PO Box 691 Alturas, CA 96101	Ph: 530-233-3511 or 1-866-843-2667	www.hdo.net/~svec/
Umatilla Electric Coop Association	750 W. Elm Ave. PO Box 1148 Hermiston, OR 97838 203 E. Boardman Ave. PO Box 1149 Boardman, OR 97818	Ph: 541-567-6414 or 1-800-452-2273	www.ueinet.com/index.htm
Wasco Electric Coop Inc.	PO Box 1700 The Dalles, OR 97058	Ph: 541-481-2220 or 1-800-452-2273	
West Oregon Electric Coop Inc.	715 Maple St. PO Box 69 Vernonia, OR 97064	Ph: 541-296-2740	www.westoregon.org/

APPENDIX A: WIND TURBINE TECHNOLOGY

Today's utility-scale wind turbines have three blades that face into the wind. Their blades, which are airfoils similar to airplane wings, use the lift created by the wind to spin the turbine. The rotation of the blades is transferred to a gearbox and on to the generator, creating three-phase electricity. While the basic structure of today's utility-scale turbines is the same between manufacturers, individual components can vary. These differences can affect how a turbine performs at a particular site, so it is useful to know how the different components function. The diagram below illustrates the main components of a utility-scale wind turbine. The descriptions that follow the diagram include the different types of each component and under what conditions that type of component might be appropriate.

TURBINE DIAGRAM

FIGURE A.1



Courtesy of DOE Wind and Hydropower

Braking Systems. The primary braking system is either a change in blade pitch, in the case of pitch-controlled turbines, or tip brakes in the case of stall-controlled turbines. Turbines also have a backup mechanical braking system that can be used as a parking brake during turbine maintenance.

Controller. The turbine controller is generally located in the tower at the base. It regulates all of the equipment necessary to maintain proper function of the turbine and includes a Supervisory Control and Data Acquisition (SCADA) system that collects and transmits information on turbine parameters and provides a control device for remote regulation.

Gearing. The rotor of the turbine spins a low-speed shaft in the nacelle that enters a gearbox. This gearbox transfers the energy from the low-speed shaft to a shaft that spins much more quickly, at a rate appropriate for the generator(s).

Generator Types. A review of several of the major turbine manufacturers reveals that the majority of today's turbines are asynchronous, otherwise known as induction, generators. These generators are very similar to electric motors that are commonly used in household appliances such as refrigerators and fans. Rather than using electricity to spin the motor, these generators use the spin to create electricity. In order to make more efficient use of low wind speeds, some turbines are built with two generators, one smaller generator for low wind speeds, and a larger generator for stronger winds.

Nacelle. The nacelle is the enclosure that sits on top of the turbine tower. It houses the gearbox, the generator, and other turbine controls and has enough room for maintenance personnel to work on the turbine.

Rotor. The rotor is the visibly spinning part of the turbine. It includes the nose cone, or hub, and the blades.

Rotor Blades. The majority of turbine blades on turbines rated at 600 kW and above are made of glass fiber–reinforced plastics. Other materials can be used, but this is currently the most cost-effective option. The airfoil shape of the blades is used both to spin the turbine, and also to "spill" wind to brake the turbine when wind speeds are too high. One method of accomplishing both the lifting and braking is to design the airfoil such that high wind speeds cause the turbine to stall. These are called *stall-controlled turbines.* These blades have an additional safety measure in that the tips of the blades can rotate to act as brakes when the turbine begins to spin too quickly. Another blade design involves rotating the entire blade along its longitudinal axis. Blades that can change pitch during operation to optimize power output and brake under unsafe conditions are called *pitch-controlled turbines.* While pitch-controlled turbines have an advantage over stall-controlled turbines in their ability to manage power output at varying wind speeds, the extra moving parts add to the complexity of the design and the control system.

Tower Types. There are currently two basic types of towers used for the majority of wind turbines, lattice and tubular. Lattice towers use less material and are less expensive, but may not be as aesthetically appealing, do not provide a sheltered area for the controller, and may increase avian mortality by providing perches. Tubular towers provide an enclosure which houses the controller as well as a ladder so that maintenance workers are sheltered during the climb to the nacelle. These can become hot for maintenance workers during warm weather and may have a greater visual impact as they are visible from greater distances.

Yaw System. Most wind turbines over 500 kW have an active yaw system. A controller checks the wind direction measurement supplied by the wind vane and ensures the rotor is pointed directly into the wind using a series of electric motors and brakes.

Other Turbine Information

Operational Data. A turbine's operational data provides information on the *cut-in wind speed,* i.e. the wind speed at which the turbine will start to produce power, the *nominal wind speed,* i.e. the wind speed at which the turbine reaches its nameplate capacity, and the *cut-out wind speed,* i.e. the wind speed at which the turbine shuts down to avoid damage. Cut-in wind speeds are generally between 2.5 and 4 m/s (5.6 and 8.9 mph), nominal wind speeds vary from 12 to 16 m/s (26.8 and 35.8 mph), and cut-out wind speeds are generally 20 or 25 m/s (44.7 or 55.9 mph). A turbine with a lower cut-in and nominal wind speed may be more appropriate for a low-wind site, while a turbine with a higher, cut-out wind speed may be better suited for a high-wind site.

Sound Data. Sound data is available from turbine manufacturers and should be considered when choosing a turbine. Data on both the increases in sound levels with increasing wind speed and the sound versus the distance from the turbine are important considerations.

APPENDIX B: EFSC SITE CERTIFICATE REVIEW PROCESS

Key characteristics of the EFSC Site Certificate review process are:

• Projects up to 105 MW capacity can choose to pursue permitting through their local planning department or apply for a site certificate from the state Energy Facility Siting Council (EFSC). Projects of at least 105 MW in size must go through the EFSC process. Community wind projects as described in this Guidebook—that is, of 600 kW to 10 MW in size—would be allowed to opt in to the state process, but would not be required to do so.

• To receive a site certificate, the project must meet state siting standards for a number of criteria, including organizational expertise, retirement and financial assurance, land use, soil protection, protected areas, scenic and aesthetic values, fish and wildlife habitat, threatened and endangered species, recreation, public health and safety standards for sind energy facilities, siting standards for wind energy facilities, and siting standards for transmission lines. In addition, although the Siting Council cannot apply the following standards when determining whether to approve a site certificate, the Council may impose conditions on the site certificate based on the standards for public services, waste minimization, historic, cultural and archeological resources, and structural standards. These review criteria may be similar or identical to those applied by authorities governing a local permitting process.

• If a site certificate is issued by EFSC, other state agencies or local government departments must issue relevant permits. These permits may subject the project to conditions imposed by EFSC. However, the project developer must obtain certain federal permits (e.g. regarding air or water quality) directly from the relevant agency. The Oregon Department of Environmental Quality (DEQ) administers these federal permits in the state. The EFSC site certificate is not binding for these federal permits; these permit applications will be separately evaluated by Oregon DEQ. Federal Aviation Administration lighting permits and Corps of Engineers permits are not handled by Oregon DEQ, but must be obtained from the agencies involved.

For a complete description of the EFSC process as it relates to wind projects, see the Oregon Department of Energy's Web site on the "Siting Process of Energy Facilities" at:http://egov.oregon.gov/ENERGY/SITING/process.shtml.

APPENDIX C: GLOSSARY OF INTERCONNECTION TERMS

Disconnect. Disconnect switches are used to isolate electrical equipment from the rest of the system. They act as important safety measures by allowing the turbine to disconnect from the rest of the utility grid. This prevents islanding in the case of power outages and allows for maintenance of the wind turbine without shutting down the grid. It is generally the responsibility of the party requesting the interconnection to pay for the necessary disconnect switches.

Distribution. Distribution lines carry power from substations to electricity end-users. These lines are generally between 4 and 13 kV. If a three-phase line with capacity is available and the line is relatively "stiff" (see *Stiffness* below), a single large turbine can interconnect to the distribution system.

Interconnection. The process by which power produced by the wind project is transferred to the utility's grid.

Line Capacity. The amount of power a transmission or distribution line can transmit safely.

Power Quality. Wind turbines have the potential to affect power quality in several ways. The output power from wind turbines can vary due to changes in wind speed, turbulence, and on/off status. These variations can affect *voltage levels* and degrade power quality. Some, but not all, wind turbines can also improve the voltage level by injecting reactive power into the system. Wind turbines can also have an affect on the power factor of a distribution line. The *power factor* is determined by how closely the phases of current and voltage match. Power is the product of current and voltage, which means that any difference in phase decreases the power as experienced by the end-user. Wind turbines can be ordered and operated with different power factors and can also provide leading power factor power. Yet another potential impact of the wind turbine is the possible presence of harmonics in the power generated by the wind turbine due to the turbine's power electronics. *Harmonics* occur when the power output of a generator or power converter is not a perfect sinusoidal waveform with a frequency of 60 Hz. When analyzing such imperfect waveforms, an engineer looks at a combination of power with the fundamental frequency and other frequencies around the fundamental. Harmonics can cause malfunctions of various equipment and heat transformers and cause telecommunication interference. High quality power has constant voltage, a power factor close to one, and a sinusoidal waveform consisting of only the fundamental frequency.

SCADA. Supervisory control and data acquisition (SCADA) equipment collects data from the turbines and provides a means of control from a centralized station. SCADA is used to regulate the output of the turbines to maintain proper grid function. Large wind projects must have SCADA systems so the utility can control the impact of the wind project on the grid.

Stiffness. The ability of a feeder line to maintain constant voltage during periods of high current.

(J. Green, et al) Utilities will often refer to the stiffness of a line when talking about whether or not a wind project can interconnect at a certain point. Lines that are not stiff are more prone to the power quality problems that are associated with wind turbines and loads such as the starting of large motors.

Substation. Substation facilities contain the equipment necessary to modify voltage levels between the transmission, subtransmission, and distribution systems, as well as voltage regulators and safety switches to prevent harm to utility workers and customer equipment.

Subtransmission. Subtransmission systems carry lower voltages than transmission systems. Subtransmission lines carry power to regional distribution centers and to some large customers. Subtransmission does not have a strictly defined voltage range with definitions ranging as low as 26 kV and as high as 115 kV. Wind developments at least as large as 10 MW can connect to subtransmission lines effectively, subject to other determining factors.

Three-Phase Electricity. Electricity in the U.S. transmission system is Alternating Current (AC), which means that the direction of the current alternates as a sinusoidal wave. In three-phase current there are three sinusoidal current waves traveling simultaneously, each in a separate conductor. The staggered phases of the electricity make for a more constant power transfer. Transmission and subtransmission lines always carry three-phase electricity, while some distribution lines carry single-phase electricity. Since utility-scale wind turbines produce three-phase electricity, it may be necessary to upgrade utility lines when connecting at the distribution level.

Transformer. A transformer is often necessary to step up the voltage coming from the wind turbine to match that of the distribution/transmission system.

Transmission. The high-voltage lines and associated equipment used to transmit electric power over long distances, generally from generators to subtransmission and distribution grids. Transmission lines have voltages ranging from 115 kV to more than 500 kV.

Voltage Flicker. The short time-scale variations in power output caused by wind speed changes can cause variations in line voltage. These can lead to flickering lights and computer problems. Voltage flicker is prevented by the same power electronics that control the power factor.

Wheeling. Wheeling involves the use of a local utility's transmission and/or distribution system to sell generated electricity to another utility. The utility whose service area the electricity is generated in can charge for the use of its lines to move the electricity to another service area. In some cases, the difference in the rates paid by the two utilities for the electricity generated will make wheeling an economical option.

APPENDIX D

Case Study: Klondike Wind Project in Sherman County, Oregon

At the time of Guidebook development, there were no examples of community wind projects—at least none meeting our definition—operating in Oregon. The Klondike Wind Project is far larger than the upper limit of our definition of community wind. Therefore, the following case study is intended not to redefine community wind, but to provide a real example of a community's involvement in successful wind development. Many of the challenges, approaches, benefits, and lessons learned here can be useful to planning community-scale wind projects in Oregon.

Project Snapshot

Location: Sherman County, Oregon

Developer: Northwestern Wind Power

Capacity: 24 MW

Cost: $26 million

Turbines: 16 variable-speed GE turbines, 1.5 MW each

Online: December 2002

Post-construction: Sold to PPM Energy (2004) and expanded to 99 MW (2005)

In Sherman County, just south of the Columbia River Gorge in northern central Oregon, economic livelihood is based primarily on wheat farming. Recently, five years of drought, along with the perennial risks of single-crop farming, posed great challenges to the community.

In 2000, the community took another hit when Bonneville Power Administration (BPA) announced it could not meet the electricity demands of the local aluminum smelter. BPA paid Golden Northwest Aluminum to cease the smelter's operations, and with adversity came an opportunity. Brett Wilcox, president and owner of Golden Northwest Aluminum, used BPA's payment to start a new company: Northwestern Wind Power (NWWP). Through NWWP, Wilcox was determined to provide a secure source of power for the smelter, and in 2001 began development of the Klondike Wind Project.

It became clear early on that the site proposed for wind development in Sherman County had many things going for it. The wind resource coming up through the Columbia River Gorge is strong and steady. The location with respect to the transmission grid was also opportune. Located between load centers and a congested area meant the project would face less cost and create greater value connecting to the power grid. Moreover, as the land had previously been disturbed for agricultural use, the project was unlikely to cause negative local environmental impacts. The project's positive environmental impacts include the production of enough clean energy to offset approximately 36,000 tons of CO_2, 156 tons of SO_2, 77 tons of NO_X, and 3,600 pounds of mercury each year.

While the site made sense for wind development, wind development didn't yet make sense to the entire community. In order to move forward, the project developers knew that community support was essential. As is the case with most new projects, local residents were not well informed about modern use of wind energy. NWWP and its project team took community concerns seriously. They held many local meetings, met with people who had various concerns, and even distributed a new publication called *The Wind Farmer.*

Of course, economic impact was the strongest driver of community support for the project. The investment in wind energy in the county was predicted to, and did indeed, yield far-reaching economic value for the community. It turns out that the wind farm would not only provide power for the aluminum smelter, but it would help diversify and strengthen the local economy. For site landowners, the benefits were obvious. Landowners traded production of wheat on one-half acre per turbine (a farm income of about $125 per wheat crop) for royalties of $2,000 to $4,000 per turbine, per year. It was important, though, for developers to communicate the economic impact to the community as a whole, rather than just a few individuals. Broader benefits included the local job creation during development, installation, and even through ongoing operations and maintenance. In addition, the development brought people into the county, spending money in local establishments, which flowed through the local economy. And finally, the property tax revenues could not be ignored, and were a key factor in widespread community support. In the first year of operation, the project's property tax revenues of more than $300,000 increased tax revenues in the struggling county by ten percent, providing valuable dollars and a lasting effect to the county as a whole.

Even with potential economic gains, community members did have additional concerns about the project's potential impacts. It was the developer's open communication and serious interest in addressing these questions that many attribute to the project's overall success. Once the size, scale, speed, aesthetics, avian concerns, and land-use impacts of modern turbines were addressed with public participation, there was little to no opposition to the project. Mike McArthur, who was a judge in Sherman County at the time, reports: "Before the turbines were installed, people just weren't familiar with the modern equipment. The developers did a great job informing and involving community members so that there really wasn't any opposition to the project. After the installation, many commented that the aesthetics were pleasing and that there weren't really any drawbacks to the wind farm."

In 2002, project development sped along. The Oregon Solutions Program of Governor John Kitzhaber helped expedite the project to meet the Federal Production Tax Credit deadline of December 31, 2002. NWWP negotiated a twenty-year Power Purchase Agreement with the Bonneville Power Administration, and the project began operation in December 2002. Just over one year later, PPM Energy purchased Klondike for $16.8 million, and proceeded with plans to add an additional 75 MW of capacity with the Klondike II Expansion Wind Project. Portland General Electric has agreed to a thirty-year purchase of the full output from the expansion project beginning December 2005. In addition to the amount of clean energy added to the region's power grid, the additional 75 MW expands Sherman County's economic benefits as well.

The Klondike Wind Farm in Sherman County not only demonstrates the importance of community involvement to a successful wind project, but also continues to demonstrate the viability of wind in Oregon, and specifically, the benefits to rural counties.

APPENDIX E

USDA FUNDING OPPORTUNITIES

	VAPG	9006	RCDI	RCDG	
Name of Program	Value Added Producers Grant	Renewable Energy System and Energy Efficiency Improvements	Rural Community Development Initiative	Rural Cooperative Development Grant	
Website	http://www.rurdev.usda.gov/rbs/coops/vadg.htm	http://www.rurdev.usda.gov/rd/farmbill/9006resources.html	http://www.rurdev.usda.gov/rhs/rcdi/	http://www.rurdev.usda.gov/rbs/coops/rcdg/rcdg.htm	
Purpose	This program, Section 6401 of the Federal Farm Bill, offers grants for business planning, feasibility studies and working capital related to value-added agricultural activity.	This program, Section 9006 of the Federal Farm Bill, provides grants for purchases of renewable energy systems and energy improvements for agricultural producers and rural small businesses.	These grants come through the Rural Housing Service (RHS) to develop capacity and ability to undertake projects related to housing, community facilities, or community and economic development.	Rural cooperative development grants will be used to facilitate the creation or retention of jobs in rural areas through the development of new rural cooperatives, Value-Added processing and rural businesses.	
Type of funding	Grant	Grant & Loan Guarantee	Grant	Grant	
Funding Max	$100,000 (planning), $150,000 (wkg capital)	$500,000 - grant, 50% of project costs - loan guarantee	$500,000	$300,000	
Eligibility	Independent producers, Agricultural producer groups, Farmer or Rancher cooperatives and Majority-Controlled Producer-Based Business Ventures, are eligible for grants under this subpart.	The applicant or borrower must be an agricultural producer or rural small business (in which case the business headquarters and the project to be funded must both be in a rural area).	Eligible applicants include qualified private, nonprofit and public (including tribal) intermediary organizations. "Intermediary" cannot be the same entity as "recipient" or "beneficiary."	Grants may be made to nonprofit corporations and institutions of higher education. Grants may not be made to Public bodies. No grants can be made to cities or states under his program.	
Use of Funds	Grant funds may be used to pay up to 50% of the costs for carrying out relevant projects. (a) Planning Grants - Grants to facilitate the development of a defined program of economic activities to determine the viability of a potential Value-Added venture, including feasibility studies, marketing strategies, business plans and legal evaluations. (b) Working Capital Grants - Grants to provide funds to operate ventures and pay the normal expenses of the venture that are eligible uses of grant funds.	Grant funds can be used for both hard (equipment, construction) and soft (studies, fees) costs. The grant request must not exceed 25% of the eligible project costs. 1) The project must be for the purchase of a renewable energy system or to make energy efficiency improvements. 2) The project must be for a pre-commercial or commercially available and replicable technology. 3) The project must be technically feasible. 4) The project must be located in a rural area. 5) The applicant must be the owner of the system and control the operation and maintenance of the proposed project. 6) All projects must be based on satisfactory sources of revenues in an amount sufficient to provide for the O&M of the system or project.	The purpose of this initiative is to develop or increase the recipient's capacity through a program of financial and technical assistance to perform in the areas of housing, community facilities, or community and economic development. Strengthening the recipient's capacity in these areas will benefit the communities they serve. The RCDI structure requires the intermediary (grantee) to provide a program of financial and technical assistance to recipients. The recipients will, in turn, provide programs to their communities (beneficiaries).	Grant funds may be used for 75% of the cost to establish and operate centers for rural cooperative development. (a) Applied research, feasibility, environmental and other studies that may be useful for the purpose of cooperative development. (b) Grant funds cannot be used for basic or academic research, or for research and development. (c) Collection, interpretation and dissemination of principles, facts, technical knowledge, or other information for the purpose of cooperative development. (d) Providing training and instruction for the purpose of cooperative development. (e) Providing loans and grants for the purpose of cooperative development in accordance with the subpart. (f) Providing technical assistance, research services and advisory services for the purpose of cooperative development.	
Match	Matching funds must be at least equal to the grant amount. Cash and/or in-kind.	75% match (65% cash, 10% in-kind)	Matching funds must be at least equal to the grant amount. Cash match only, no in-kind.	25% match, cash and/or in-kind	

RBOG	B&I	IRP	RBEG	RUS
Rural Business Opportunity Grants	Business/Industry Guaranteed Loan Program	Intermediary Relending Program	Rural Business Enterprise Grants	Renewable Energy Program of the Rural Utilities Service
http://www.rurdev.usda.gov/rbs/busp/rbog.htm	http://www.rurdev.usda.gov/rbs/busp/b&i_gar.htm	http://www.rurdev.usda.gov/rbs/busp/irp.htm	http://www.rurdev.usda.gov/rbs/busp/rbeg.htm	http://www.usda.gov/rus/electric/loans.htm
Grants to provide technical assistance for business development and conduct economic development planning in rural areas.	The Business and Industry (B&I) Guaranteed Loan Program provides guarantees on loans to improve, develop or finance business, industry, and employment, and to improve the economic and environmental climate in rural communities.	The purpose of the Intermediary Relending Program (IRP) is to finance business facilities and community development projects in rural areas.	Rural Business Enterprise Grants are for financing or developing small and emerging businesses.	RUS is an entity of USDA's Office of Rural Development that gives loans to maintain, upgrade and expand generation, transmission and distribution in rural areas. Funds can be used to finance renewable energy systems.
Grant	Loan guarantees	Subsidized loans	Grant	Loan
1.5M, average grant size $50,000 or less.			Not established.	No Maximum.
Grants may be made to public bodies, nonprofit corporations, Indian tribes on Federal or State reservations and other Federally recognized tribal groups, and cooperatives with members that are primarily rural residents and that conduct activities for the mutual benefit of the members.	The lender can be any federal or state chartered bank, credit union, savings and loan association, or Farm Credit Bank. The borrower can be any legal entity including a cooperative, corporation, or partnership organized and operated on a profit or non profit basis, Indian Tribe, public body or individual.	Intermediaries may be private non-profit corporations, public agencies, Indian groups, or cooperatives. Loan recipients may be any of the above, plus private businesses.	The RBEG program is for nonprofits and public bodies to assist small and emerging businesses in rural areas.	Loans may be made to Municipalities, public utility districts, subdivisions, states, rural electric cooperatives, as well as non-profit, limited dividend and mutual associations that provide retail electric service needs to rural areas or supply the power needs of distribution borrowers in rural areas.
Technical assistance for business development and economic development planning: (1) Identify and analyze business opportunities that will use local rural materials or human resources. This includes feasibility and business plan studies; (2) Identify, train, and provide technical assistance to rural entrepreneurs and managers; (3) Establish business support centers and assist in the creation of new rural businesses; (4) Conduct local community economic development planning; (5) Establish centers for training, technology, and trade; (6) Conduct leadership development training for rural entrepreneurs and managers; or (7) Pay reasonable fees and charges for professional services necessary to conduct the assistance.	Eligible loan purposes can include machinery and equipment, buildings and real estate, working capital and certain types of debt refinancing. Guarantees can be for a maximum of 80 percent and can be issued on loans up to $5 million (with lesser guarantees on loans up to $25 million). Interest rates are negotiated between borrower and lender and may be variable or fixed.	This program offers subsidized loans to qualified intermediaries to establish revolving loan funds to be used for business development and expansion or other community development projects.	Uses of funds include: technical assistance (providing assistance on complete marketing studies, feasibility studies, business plans, training, etc.) to start a small and emerging business; purchase machinery and equipment; create a revolving loan fund, or construct a building. Although these grants cannot be made directly to a private business, a non-profit or public group could receive a grant and, in turn, use the funds as seed money or as a revolving loan fund for wind projects.	The loan funds may be used to maintain, upgrade and expand generation, transmission and distribution in rural areas. Although there are no renewable energy-specific elements to the loan application process, the RUS Administrator has set aside $200 million per year to be used for renewable projects. See the web link above for details on loan terms, interest rates, etc.
				No match required.

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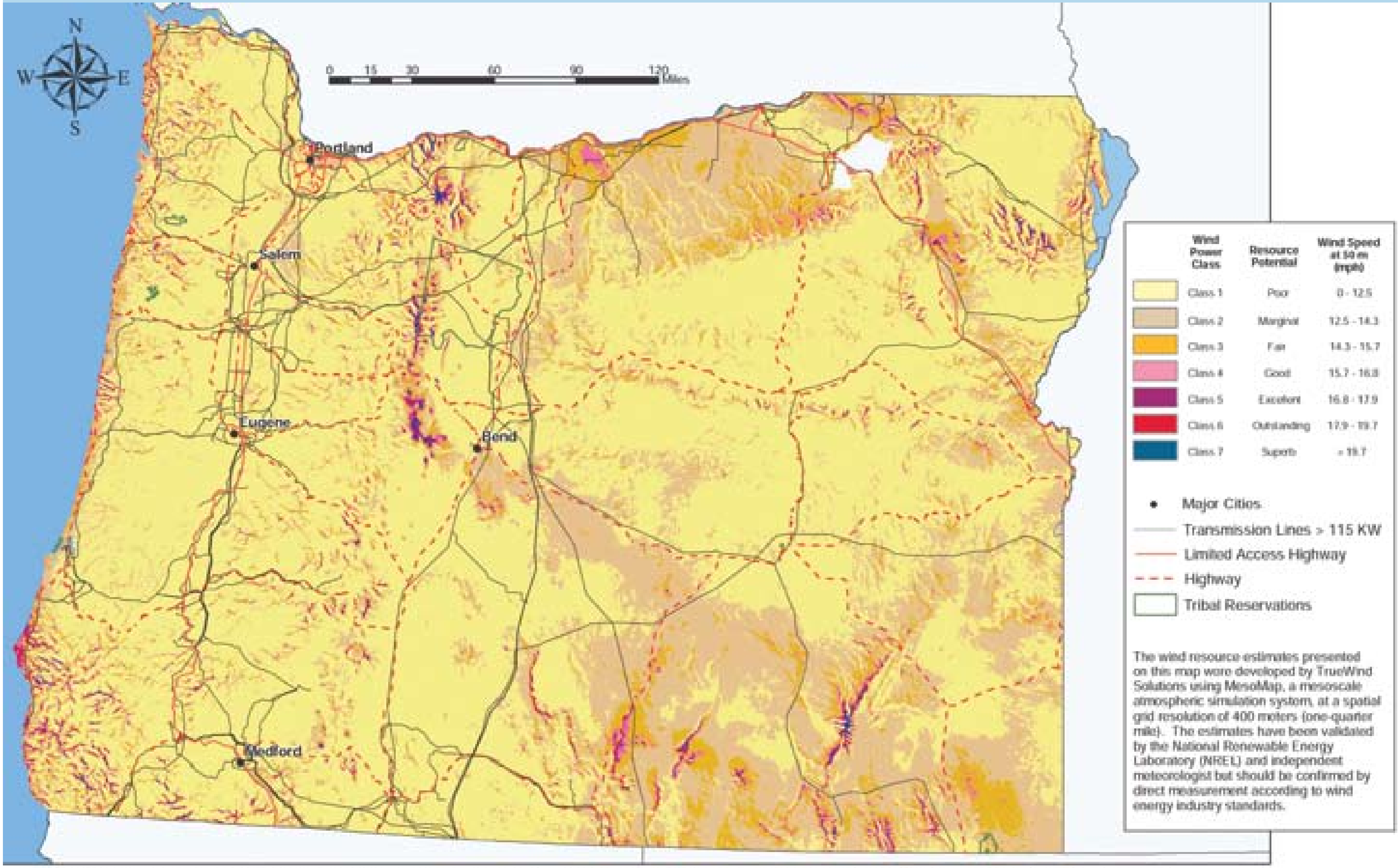
OREGON WIND POWER RESOURCES



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