AN ABSTRACT OF THE DISSERTATION OF

Yao Yin for the degree of Doctor of Philosophy in Environmental Science presented on May 24, 2011.

Title: Understanding Community Wind Energy Development in Oregon: An Integrated Analysis

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Brent S. Steel

This research intends to provide insights into community wind energy development in Oregon using an integrated analysis approach, which incorporates GIS Suitability Analysis, Socio-Political Analysis, and Empirical Case Studies. In the GIS analysis, we developed a model through a series of steps (including data acquisition, preprocessing, data management, manipulation and analysis, and output generation) to measure how suitable a location is for developing wind energy in Oregon. The socio-political analysis adopts the Socio-Political Evaluation of Energy Deployment (SPEED) framework and categorized policies and incentives that are applicable to community wind projects into three classes: strategic, tactical, and operational. The empirical case studies, focused on seven projects in Oregon, are analyzed using the actor-network theoretical framework, and their opportunities and barriers are explored as well.

Understanding Community Wind Energy Development in Oregon: An Integrated Analysis

by
Yao Yin

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APPROVED

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Major Professor, representing Environmental Sciences

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Director of the Environmental Sciences Graduate Program

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Dean of the Graduate School

I understand that my dissertation will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my dissertation to any reader upon request.

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Yao Yin, Author

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Lastly, I want to say I love you to my dad, my mom, and my husband! I’m so fortunate to have your love and encouragement at all times. 我爱你们！

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LIST OF ACRONYMS

ANT	Actor-Network Theory
ARRA	American Recovery and Reinvestment Act of 2009
AWEA	American Wind Energy Association
BETC	Business Energy Tax Credits
BLM	Bureau of Land Management
BPA	Bonneville Power Administration
C-BED	Community-Based Energy Development Tariff or Legislation
COU	Consumer-Owned Utilities
CREFF	Community Renewable Energy Feasibility Fund
CUP	Conditional Use Permit
CX	Categorical Exclusion
DEM	Digital Elevation Model
DOD	Department of Defense
DOE	U.S. Department of Energy
EA	Environmental Assessment
EFSC	Energy Facility Siting Council
EIS	Environmental Impact Statement
GIS	Geographic Information System
HRVRC	Hood River Valley Residents Committee
IA	Interconnection Agreement
ITC	Business Energy Investment Tax Credit
IOU	Investor-Owned Utilities
kV	Kilovolts
LUD	Land Use Decision
MCCOG	Mid-Columbia Council of Governments
MW	Megawatt

MWh	Megawatt hour
NEPA	National Environmental Policy Act
NREL	National Renewable Energy Laboratory
OPUC	Oregon Public Utility Commission
ORCWind	Oregon Community Wind
ORS	Oregon Revised Statutes
PGE	Portland General Electric
POD	Plan Of Development
PPA	Power Purchase Agreement
PTC	Production Tax Credit
PUD	People's Utility District
PURPA	Public Utility Regulatory Policy Act
REAP	Rural Energy for America Program
REPI	Renewable Energy Production Incentive
ROW	Right-Of-Way
RPS	Renewable Portfolio Standard
SELP	State Energy Loan Program
USDA	U.S. Department of Agriculture

Dedicated to the Memory of My Grandfathers

Xuchu Yu and Guangde Yin

For Giving Me a Wonderful Childhood

1. INTRODUCTION

This dissertation addresses questions of what is community wind energy, where are the suitable locations for such projects in Oregon, what relevant policies are available to promote community wind development, and what lessons have specific projects learned in developing community wind projects.

This dissertation consists of five parts: introduction, three manuscripts, and a concluding chapter. The introduction begins with descriptions of wind energy development in the world and in the U.S. Then it gets down to community wind and presents differing ways to define community wind. Next, I stress the importance of this type of ownership to local communities and what major steps are involved in building a community wind project. In the end of the Introduction, I propose an interdisciplinary framework for this dissertation with three methodologies that will be used to operationalize the framework, as well as how the dissertation will be structured. The second section of the dissertation focuses on GIS suitability analysis of wind energy development in Oregon, and it is written in a journal article format. We visualize our outputs into a colored map to indicate varying wind suitability throughout Oregon. The third section examines the policies, incentive programs and regulations targeting community wind from strategic, tactical, and operational perspectives, and is organized in the format of journal article as well. The fourth section presents results of semi-structured interviews with a number of community wind project representatives and/or owners as well as local government officials who have experience with specific community wind projects. Lastly, this dissertation concludes with a synthesis of the findings from the previous three articles and discusses the future of community wind in Oregon.

1.1.Background

> "It begins with energy. We know the country that harnesses the power of clean, renewable energy will lead the 21st century." President Barack Obama, address to joint session of Congress, February 24, 2009

As the world becomes more and more concerned about climate change, energy security, and public health, nations have started to rethink their energy portfolio and turn to power from renewable sources for a sustainable future. Unlike conventional energy sources such as coal and oil, renewable energy is cleaner and "greener" with less adverse impacts on the environment.

Generally, major renewable energy includes wind, solar, geothermal, bioenergy, small hydroelectric, and wave energy, among which wind energy is by far the fastest growing energy source in the world. In 2009, 38,312 MW of wind energy capacity was created worldwide, leading to a total global capacity of 159,213 MW (See Figure 1.1.1. and Figure 1.1.2). The growth rate of 2009 was 31.7 percent, which was the highest growth rate since 2001 (See Figure 1.1.3). Wind energy sector employed 550,000 employees worldwide and had a turnover of 50 billion Euros in 2009. Remarkably, the momentum remains that wind capacity has doubled every three years since 2001 (World Wind Enery Association, 2010).

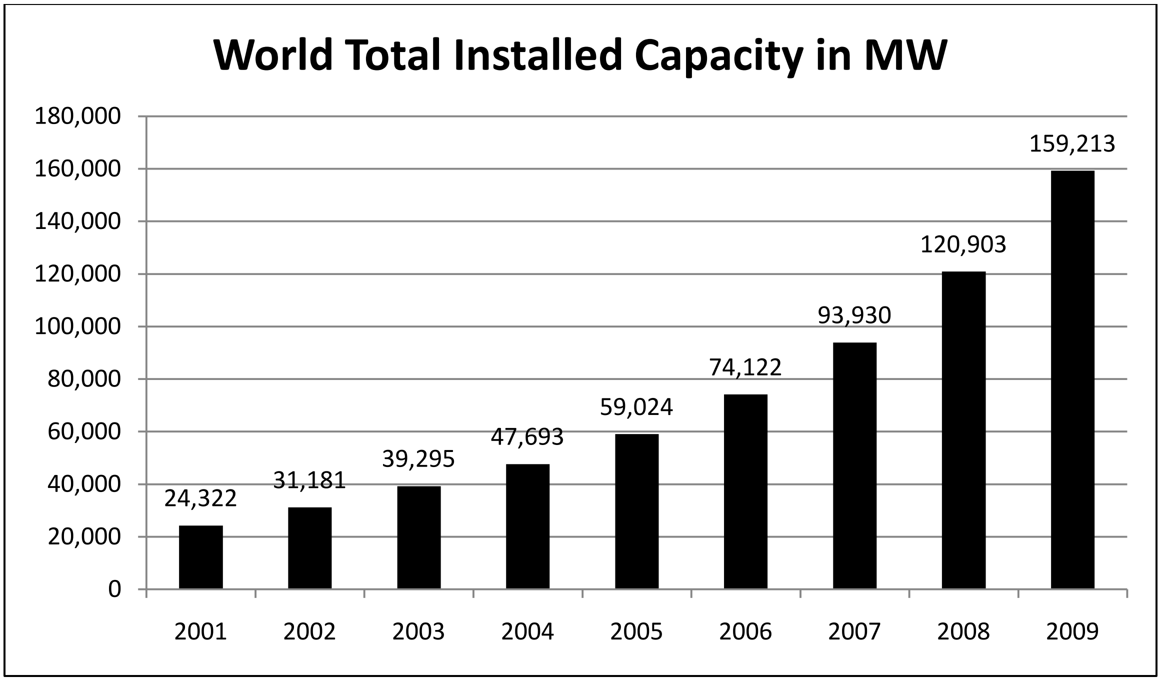
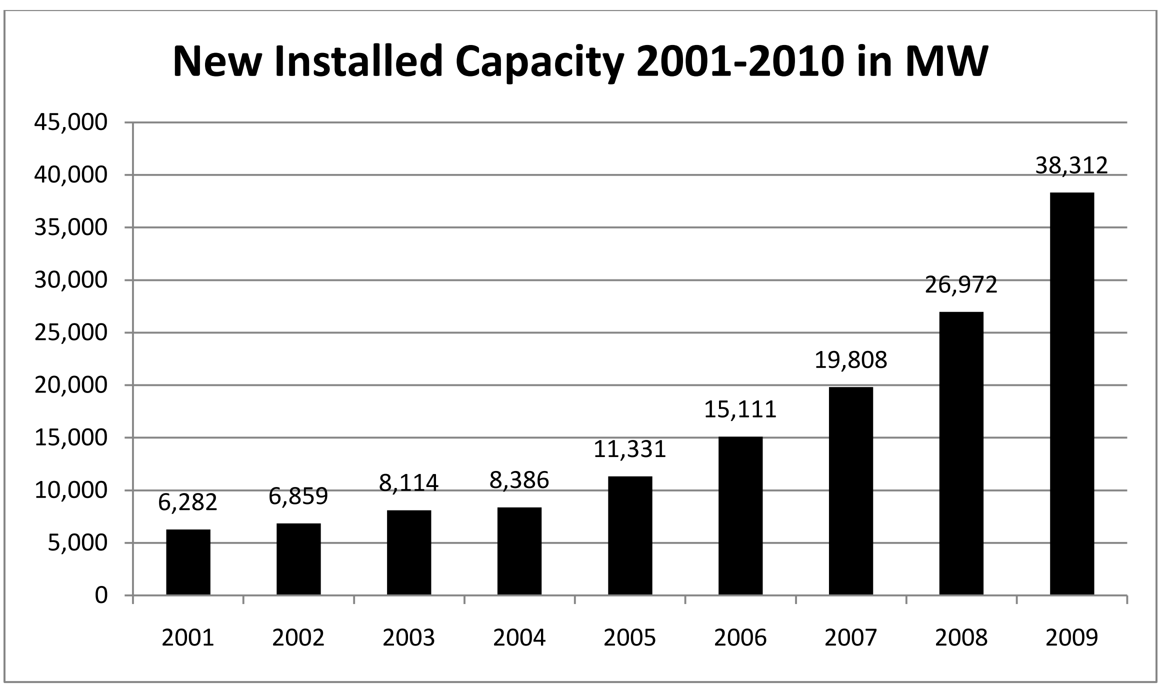


Figure 1.1.1. World total installed capacity in MW (World Wind Enery Association, 2010)



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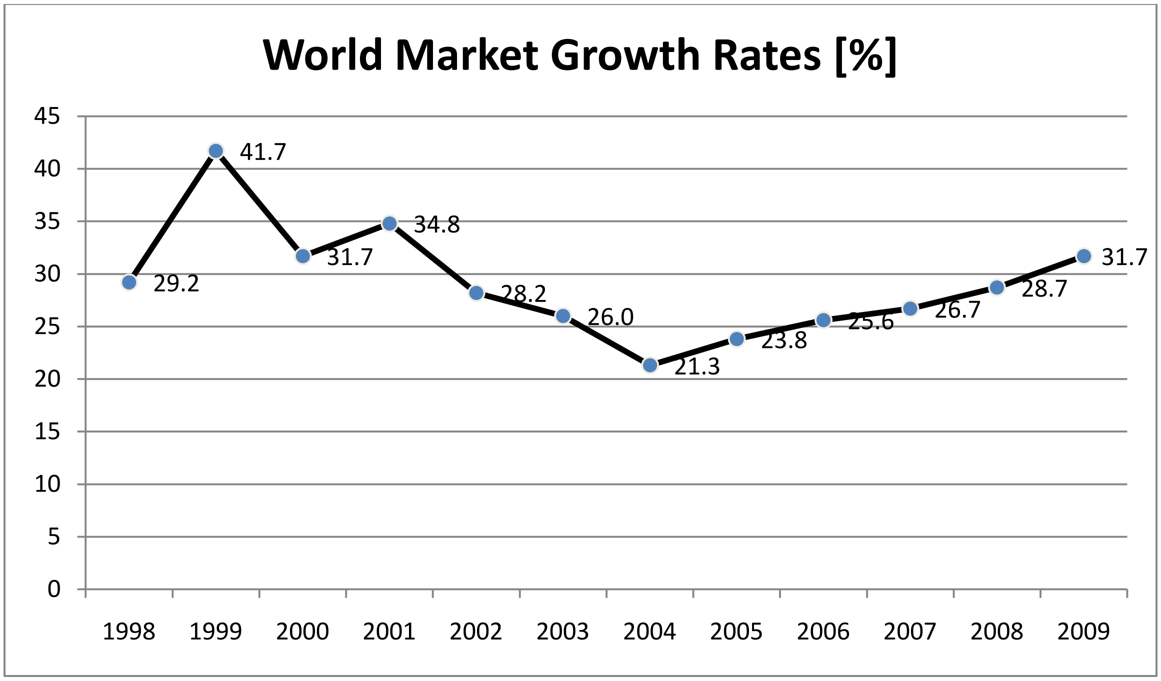

Figure 1.1.3. World market growth rates 1996-2009 (World Wind Enery Association, 2010)

The United States is a world leader in wind energy generation, currently ranking number one in terms of total installed capacity. In 2009, over 10,000 MW of capacity was installed in the U.S., bringing the country's total capacity to over 35,000 MW (See Figure 1.1.4 and Figure 1.1.5). The average annual growth rate over the past five years is 39 percent. The wind manufacturing sector in the U.S. increased its employment from 2,500 jobs in 2004 to around 18,500 at the end of 2009, over a seven fold increase in six years (American Wind Energy Association, 2010b).

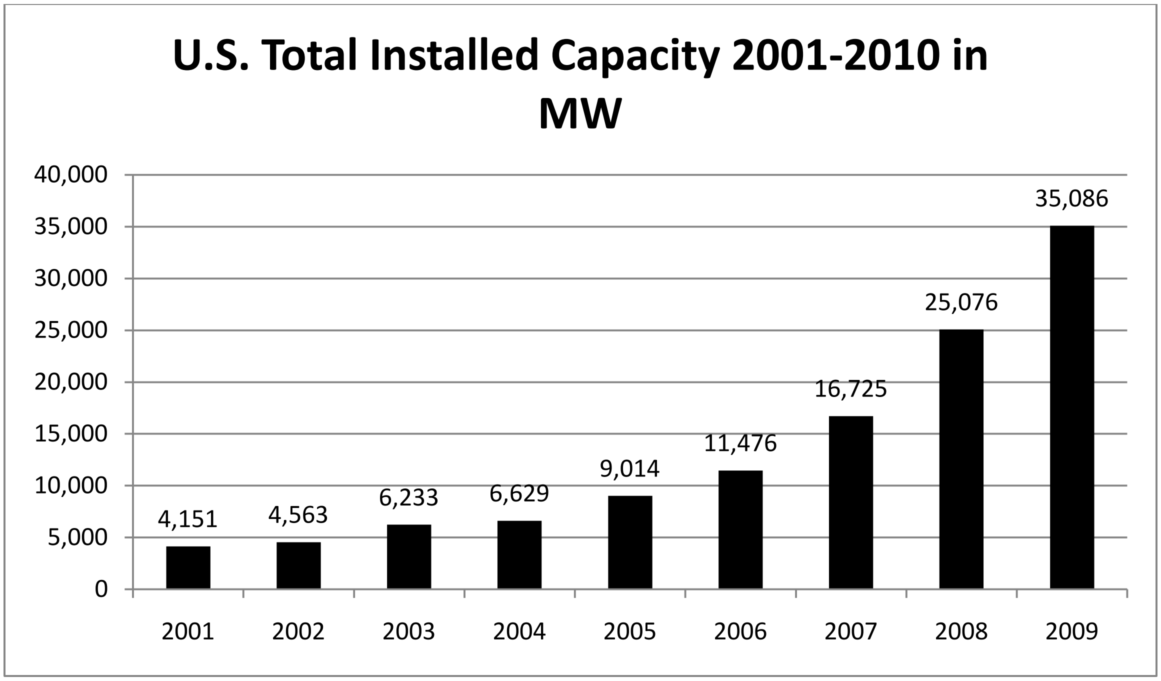

Figure 1.1.4. U.S. Total Installed Capacity 2001-2010 in MW (American Wind Energy Association, 2010b)

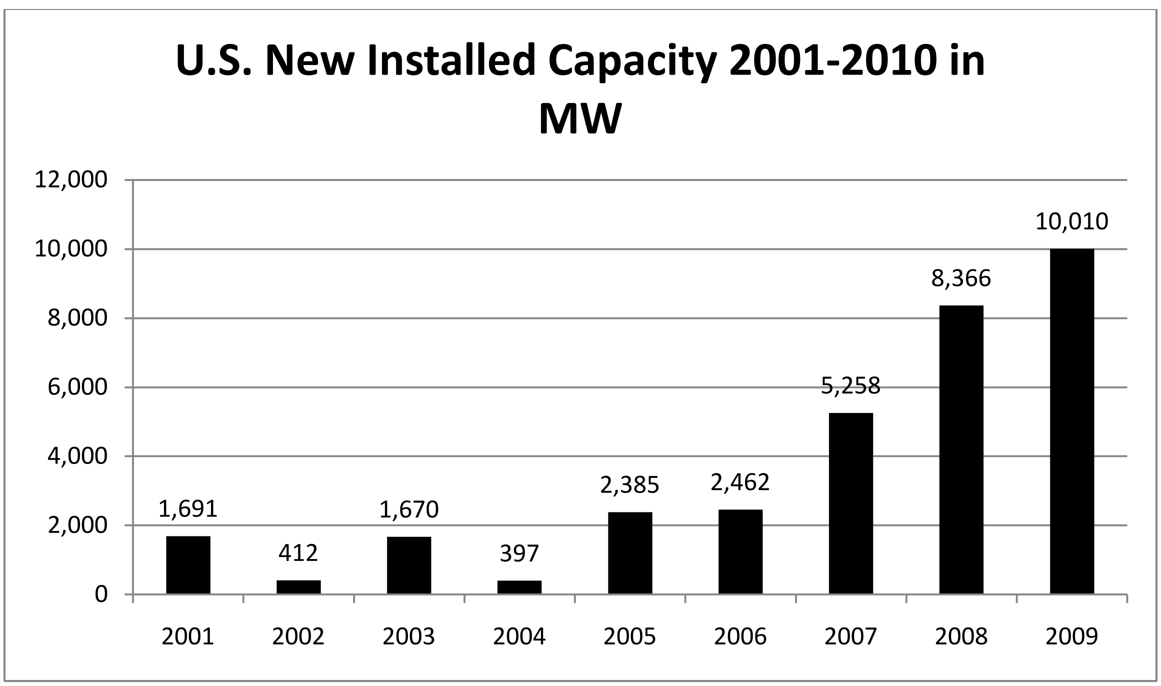

Figure 1.1.5. U.S. New Installed Capacity 2001-2010 in MW (American Wind Energy Association, 2010b)

Wind energy throughout the world, however, is mostly generated in a centralized way by large wind farms, and despite a great many benefits to local areas and the fact that wind resources are accessible to anyone, decentralized wind energy generation is still not commonly seen in most industrialized countries. Some developed countries, such as Denmark, Germany, the Netherlands, and the United Kingdom, are exceptions with successful stories of decentralized community-owned wind development (Bolinger, 2001). For example, in Denmark, citizens and families have started investing in cooperative wind farms and becoming shareholders of such projects since the late 1970s. The Danish policy favors community wind by ensuring interconnection of the projects to the national power grid and guaranteeing a cost-covering payment from the utilities for the electricity generated. Consequently, there were about 200,000 Danish families that were shareholders of community wind projects as of 2008 (Gsanger, 2008).

Unlike Europe, the U.S. has not pursued community wind development until about a decade ago (Bolinger, 2001). Since the turn of the century, however, community wind has emerged and started to grow substantially. From 2001 to 2007, the U.S. saw an average growth rate of 76 percent per year in installed capacity of community wind (Bolinger, 2007). By the beginning of 2010, community wind has accounted for more than four percent of the total wind energy capacity (Windustry, 2010). Although interest in community wind is surging throughout the country, the speed of development varies from state to state (See Figure 1.1.6). Minnesota, the first state to have community wind in the U.S., maintains its leadership with a variety of favorable policies at the state level. By January 2010, Minnesota has 469 MW installed capacity of community wind, the largest in the whole nation. Iowa, Idaho, Colorado, and Oregon are expected to expand their capacity and contribute to 80% of total community wind by 2011 (Bolinger, 2007).

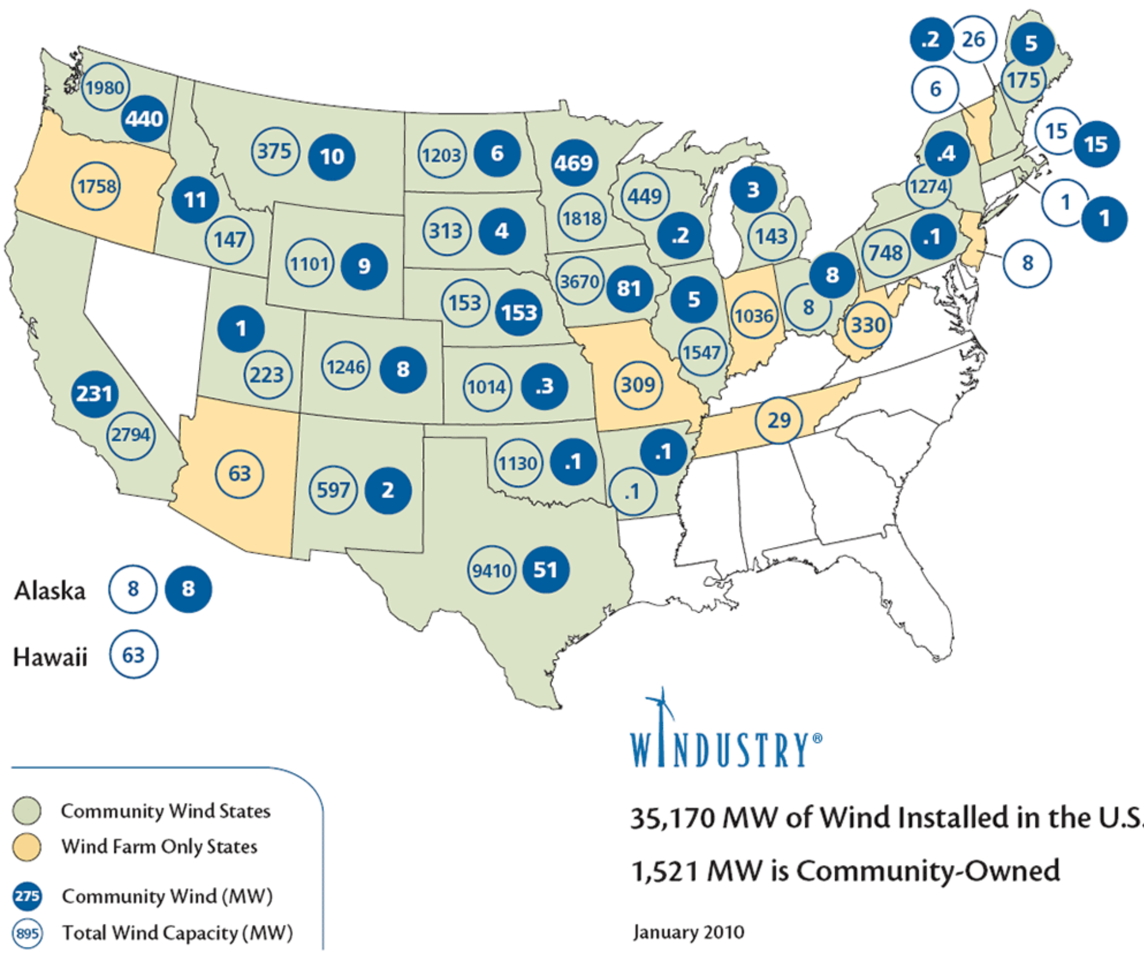

Figure 1.1.6. Installed Community Wind and Wind Capacity in the U.S. (Windustry, 2010) (Permission to cite obtained from Windustry on March 3, 2011)

Although Oregon didn't have any community wind in early 2010 as shown in the map, there have been a great many efforts from local communities for years to make such projects possible. In recent years, Oregon finally saw a handful of successful projects up and running, and because of the timing, this dissertation analyzing community wind projects in Oregon was seen as timely by local farmers, government officials, and energy professionals, many of whom were considerably supportive throughout the period of research.

Next, we will introduce a variety of definitions for community wind and explain why its ownership matters, what steps are involved in building community wind projects, and what barriers there are to development. This will be followed by a discussion of the Integrated Analysis Framework for Community Energy Project (IAFCEP).

1.2.Defining Community Wind

Community wind is defined in a variety of ways by scholars, consulting firms and wind energy professionals, depending on turbine technology available in market, energy capacity preferences, financial structure designs, interconnection choices, and public policies, but despite this variation, ownership and size are always the key elements in defining community wind. For example, Bolinger, Wiser, Wind, Juhl, and Grace (2004: 1) defined "community wind" as:

> …locally owned projects, consisting of one or more utility-scale wind 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…We define "utility-scale" to mean projects consisting of one or more turbines of 600kW (currently the smallest turbine size offered by the major wind turbine manufacturers) or greater in nameplate capacity.

In conjunction with Clean Energy Group, a Vermont-based non-profit organization promoting renewable energy, Columbia University explored opportunities for local communities to build their own wind projects. The definition it uses emphasizes local ownership, utility scale capacity, connection to electric grid, and clustered development of community wind (Ross, 2006: 8):

> Typical owners [of community wind] include local limited liability companies (LLC), municipal electric utilities, rural electric cooperatives, schools and universities, and Native American reservations. At least one consumer of the electricity produced must hold a financial stake in the project, and ideally the project ownership structure will place a principal financial stake in the hands of community members. Project capacity is typically from 1 MW to 20 WM. However, there are projects both smaller and larger than this scale that could be considered community wind. Interconnection is also necessary to generate revenue for the project, either through direct electricity sales or by selling excess generation to the utility. Turbines [in community wind projects] are structured near each other within relative vicinity of the community.

For those states where policies or incentives targeting community wind are available, definitions can also be found in statutory languages. Minnesota is a good example. The Community-Based Energy Development (C-BED) statute in Minnesota aims to promote locally owned wind energy facilities within the state, and it defines a community wind project as follows (State of Minnesota, 2010: 1):

> A community-based energy development project has no single qualifying beneficiary, including any parent company or subsidiary of the qualifying beneficiary, owning more than 15 percent of a C-BED wind energy project unless the C-BED wind energy project consists of only one or two turbines or the qualifying beneficiary is a Minnesota political subdivision or local government. [It needs to demonstrate] that at least 51 percent of the net present value of the gross revenues from a power purchase agreement over the life of the project are qualifying revenues; and has a resolution of support adopted by the county board of each county in which the project is to be located, or in the case of a project located within the boundaries of a reservation, the tribal council for that reservation. A qualifying beneficiary means (1) a Minnesota resident individually or as a member of a Minnesota limited liability company organized under chapter 322B and formed for the purpose of developing a C-BED project; (2) a Minnesota nonprofit organization organized under chapter 317A; (3) a Minnesota cooperative association organized under chapter 308A or 308B; (4) a Minnesota political subdivision or local government.

Other states, such as Nebraska and Iowa, followed Minnesota's path and developed similar policies that support locally-owned wind energy projects (Community-Based Energy Development, 2011; Nebraska Legislature, 2011). Definitions of community wind in these statutes identify specifically who are considered qualified owners and what size of a project is considered "community wind."

At the national level, the American Wind Energy Association (AWEA) developed their definition of community wind based on proposals from the Community Wind Working Group, which was established by the AWEA Board of Directors in 2008 to enhance the value of wind energy development to local communities (American Wind Energy Association, 2010a: 1). If a wind project is 20 MW or smaller, meets condition (a) below and one or more of the following conditions from (b), it will be considered a community wind project.

> (a) Projects larger than 20 MW cannot be separated into smaller projects to meet this 20-MW project size limit. Specifically, more than one qualifying community wind project cannot be built within five miles of another qualifying project within a 12-month period and using the same interconnect.
>
> (b) i. A local governing body (e.g., town, county) passes a resolution supporting the project; ii. Members of the community are offered the opportunity to participate in an ownership interest in the project and are involved in the decision making process in its development; or iii. The project's local benefit is demonstrated in terms of retail power costs, benefits to the local grid, is incorporated into a micro-grid or helps to resolve remote power issues.

If a wind project is larger than 20 MW but smaller than 100 MW, and at least 33.3 percent of the project is owned by local owners at the commercial operation date, it is then considered a community wind project. The term “local owners” refers to (American Wind Energy Association, 2010a: 1):

> …any individual who resides in the same state as the project, or within 250 miles of the project (and within the U.S.); state department or agency, tribal council, school, town and other political subdivision located in the same state as the project; municipal, cooperative and similar publicly-owned utility that serves no more than four million MWh (Megawatt hours) of load and that is located in the same state as the project; corporation or other similar business entity of which at least 51 percent is owned by one or more individuals who reside in the same state as the project or within 250 miles of the project (and within the U.S.); non-for-profit corporations and similar non-profit entities.

Windustry, a non-profit organization dedicated to increasing wind energy opportunities for rural landowners and communities, defined community wind as follows, a definition that has been widely used in variety of academic reports and studies (Windustry, 2008: 2):

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

For the purpose of this dissertation, we adopted a loose definition from a recent Lawrence Berkeley National Laboratory (LBNL) report that community wind “consists of relatively small utility-scale wind power projects that sell power on the wholesale market and that are developed and owned primarily by local investors” (Bolinger, 2011: 1). Most community wind projects we have encountered in Oregon are owned by local farmers with a capacity ranging from three megawatts to 10 MW as a result of the Public

Utility Regulatory Policy Act (PURPA), and their power is typically generated for commercial sale rather than on-site use (Bolinger, 2011: 1). Although the definition from the LBNL is a good fit for this dissertation, it should be noted that larger community wind projects with a capacity of hundreds of megawatts might emerge in the future.

1.3.Ownership Matters

Traditionally, the most common way for local communities to participate in commercial wind development is to enter into a lease or easement agreement with conventional, non-local, absentee corporate wind energy companies. Rather than put up, own, or operate the turbines, local people let the developers use their land for building wind projects and, in return, receive compensation from the companies (Windustry, 2011). So why does it matter for a community to own a wind project?

First, local ownership can effectively reduce opposition to and increase support for new wind farms. Second, community wind tends to be at smaller scale than conventional wind companies and can take advantage of existing grid infrastructure without building new transmission lines (Bolinger, 2001). Third and most important, community wind is able to bring much greater economic benefits to local communities (Oklahoma Wind Power Initiative, 2006). Although land leases can bring local landowners $2,000 to $5,000 per turbine annually, owning the turbines will provide twice or three times as much for the landowners. Plus, profits received by local people are more likely to be spent locally in the community, whereas profits earned by absentee companies will leak out of the community very easily (Galluzzo, 2005). Abundant evidence is provided below.

Research in Iowa that compared small-scale, locally owned wind projects to large-scale out-of-state corporately owned wind projects indicated that the former structure of ownership could create about 10 times more economic activity locally than the latter one (Galluzzo, 2005). For every 1 MW annually, the difference between the two ownership types is substantial (See Table 1.3.1).

Table 1.3.1. Comparing Different Ownership Structures (Galluzzo, 2005)

	Large Wind Owned by Out-of-State Companies	Small Wind Owned by Local Community Memebers
$ Stay in Community	12,200	65,900
$ Stay in State	5,100	100,300
$ Leave the State	148,000	21,300
$ From Federal Tax Incentives	63,400	66,200
$ To Wind Farm from Electricity Sales	100,400	100,400
$ From Proposed State Incentives	0	20,100

Note: The figures are based on one MW capacity.

Another study analyzed potential local economic impacts of six small rural wind projects with capacity ranging from 0.75 MW to 9 MW in Washington State and found that even though the difference in local economic impact between community wind and corporate wind projects was not obvious during the construction phase, there was significant difference between the two in the operational phase (See Table 1.3.2) (ECONorthwest, 2005).

Table 1.3.2. Average Operational Phase Local Annual Economic Impacts per MW in Washington (Kildegaard and Myers-Kuykindall, 2006)

	Corporate	Community
Sales ($)	138,800	161,200
Wages ($)	34,900	49,500
Jobs	1.2	1.5
Business Income	3,200	4,900
State & Local Tax Revenues	15,700	17,000

The National Renewable Energy Laboratory examined the local economic impacts of a variety of wind projects in California, Colorado, Iowa, Minnesota, and Texas. The study showed that most of the time community wind created twice as many local jobs as corporate wind, and local annual expenses of operation and maintenance were an order of magnitude larger in community wind than in corporate wind. Therefore, given the fact that local ownership keeps more money in the local economy with more local spending and fewer monetary leakages, community wind has greater economic impacts on local communities than conventional absentee wind projects (Goldberg et al., 2004).

For example, Oregon State University conducted a study in Umatilla County, Oregon, comparing a non-locally owned five MW wind farm and a locally owned five MW wind farm. Results indicate that community wind is likely to increase earnings or income received within the county by a factor of 3.5 beyond non-locally owned wind farms (Torgerson et al., 2006).

A number of other research studies have also revealed similar results (Costanti, 2004; Government Accountability Office, 2004). That is, given the local spending multiplier effects, community wind keeps money circulating in the community, whereas conventional, non-local wind farms tend to send money out of the community. Therefore, it is in local communities' interests to have their own wind projects.

1.4.Steps for Building Community Wind

How is a community wind project developed? What are the key steps required in the process? Essentially, developing a community wind project involves three phases:

development, construction, and operations and maintenance. The development phase is the most difficult part and can take two to four years or even longer to be accomplished. Estimated timelines for major steps in this phase are shown in Figure 1.4.1., and in reality the time each step will take varies from project to project. Next, we will introduce some of the major steps involved in the development phase, including project management and planning, studying meteorology, siting, securing land, interconnecting to grid, permitting and zoning, selecting and purchasing turbines, negotiating power purchase agreement, financing, and seeking legal assistance.

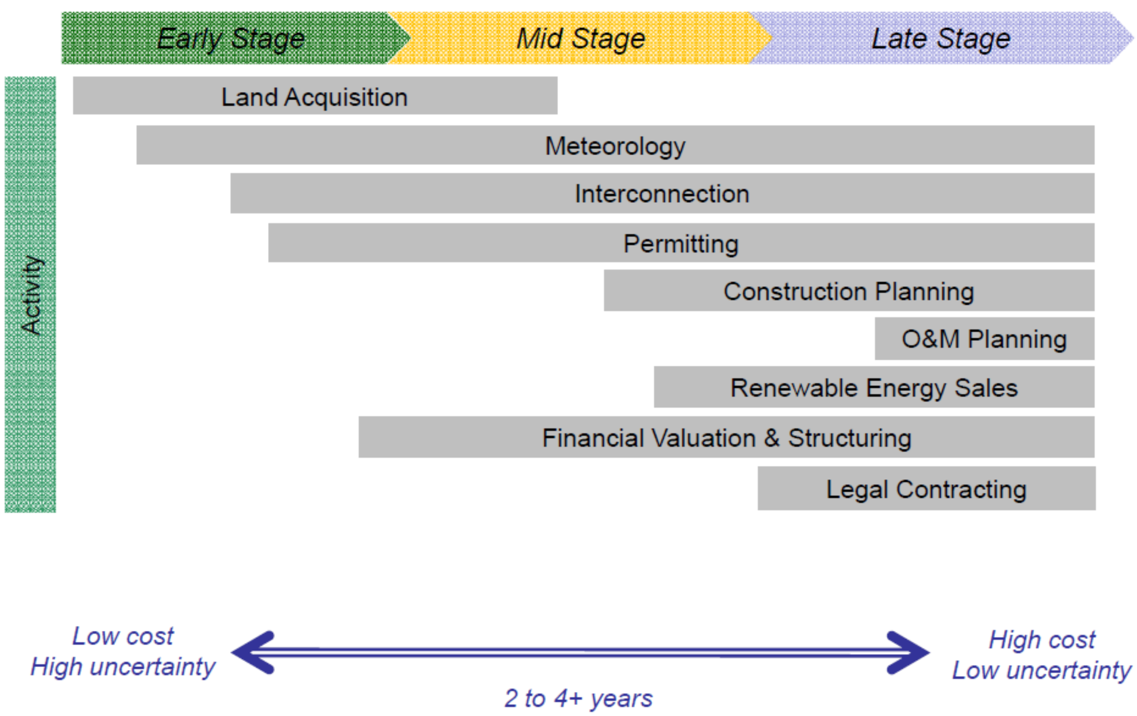

Figure 1.4.1. Typical Activities during Development Phase (Luesebrink, 2010)

Project Management and Planning

Community wind projects typically start with identifying its project goal. Some projects aim to offset local residents' electricity bills, while others want to produce power to sell to a utility company. Project developers also need to develop an overall project plan with tentative timelines before implementing the project.

Studying Meteorology

Availability of good wind resources is crucial for the economic viability of a project. Project developers will first review the project site on the local wind map to gain a basic idea. Next, they will put up anemometers to collect accurate wind data over a period of time. Last, detailed estimates of annual electricity production and economic benefits are projected and used in securing financing.

Siting

In addition to wind resources, project developers need to examine many other factors to determine if a site is suitable for community wind, such as access to electricity grid, proximity to roads, absence of endangered species, and existence of favorable public perceptions of community wind.

Securing Land

Conventional wind companies often secure land for wind development through leasing or purchasing land from landowners. In community wind, local farmers typically use their own farm land for wind energy development. Sometimes, if the project is on a public land, such as Bureau of Land Management (BLM) land, the local community will need to go through governmental procedures to secure the access to land they are interested in.

Interconnecting to Grid

To deliver the power generated by a community wind project, project developers want to make sure that the wind site can access the utility grid, either the transmission lines, typically 69 kilovolts (kV) or higher, or the distribution lines with a voltage of 69 kV or under, and that the grid has enough available capacity to carry the energy generated. Projects larger than 10 MW in size often require transmission lines to deliver their power out; projects under 10 MW in size sometimes may be able to find a consumer customer on the distribution level (Windustry, 2008). However, if a project is not in close proximity to an existing grid and will need to build a new transmission line, or if the existing grid needs to be updated to carry the power generated, costs can be prohibitive for local communities to bear. Interconnection Agreement (IA) will be developed between the wind project and the utility once they finalize the deal of interconnection.

Permitting and Zoning

Investigating zoning laws and permitting regulations is a key element in building community wind. Project developers often meet with permitting authorities at local, state, and federal level in the early stage of development to prepare for permit applications. Since public hearings are often involved in the permitting process, projects faced with community opposition are very likely to be killed in midstream; on the other hand, strong support from local neighbors will help a project to obtain necessary permits.

Selecting and Purchasing Turbines

Given the project goal, energy capacity, wind resources, and financing capability, project developers need to choose wind turbines that fit their projects and site requirements. Since community wind tends to be much smaller than conventional large wind projects, many wind turbine manufacturers, based in Europe, find it more cost-effective to sell turbines to their conventional customers. Therefore, turbine availability can be a major hurdle in community wind development.

Negotiating Power Purchase Agreement

In selling the wind power generated, community wind projects need to sign a Power Purchase Agreement (PPA) with the utility that is going to buy. Negotiating and signing a PPA is critical to community wind development because it not only guarantees a long-term revenue stream, but also serves as a key condition in searching for equity and debt to finance the project. Typically, it is required to secure an Interconnection Agreement first before a PPA is pursued (Windustry, 2008).

Financing

Depending on who owns a wind farm, community wind can utilize different means to finance community wind. For example, schools and other public entities can finance their community wind in a unique way because it is not too difficult for them to obtain low interest loans, issue bonds, have lower required rates of return, or get longer financing terms (Windustry, 2008). For local farmers, taking advantage of tax credit incentives and government loans, developing a “flip” structure (discussed later) with private companies, and/or putting in their own money are common strategies.

Seeking Legal Assistance

Legal assistance is critical in almost every stage of development. Consulting attorneys specialized in power purchase agreements, turbine procurement, financing, permitting, environmental regulations, and other related areas will make a project more viable. Despite the large costs, it is worthwhile to have professional assistance throughout the process to prevent avoidable legal mistakes from happening.

After the development phase, community wind projects will enter into the construction phase, in which construction companies will be putting up turbines, interconnecting generated power into grid, restoring site, and inspecting overall performance. The last phase of community wind lifetime is the operations and maintenance phase, where maintenance contracts will be negotiated, routine checks and repairs will be performed, and decommissioning and site restoration will be done when projects are finished (Windustry, 2008).

1.5.Conceptual Framework

In order to acquire a comprehensive knowledge of community wind development in Oregon, I propose a systematic interdisciplinary framework to structure this dissertation that integrates three research components: Geographic Information System (GIS) Suitability Analysis, Socio-Political Analysis, and Empirical Case Studies (See Figure 1.5.1). Although each of the three approaches has seen tremendous efforts in addressing wind energy or other renewable energy development in itself, an interdisciplinary integrated framework that links these areas is lacking.

GIS Suitability Analysis of Wind Energy Development in Oregon

A geographic information system is a scientific method that "integrates hardware, software, and data for capturing, managing, analyzing, and displaying all forms of geographically referenced information" (Environmental Systems Research Institute, 2011: 1). GIS has been used as a common tool in identifying suitable locations for wind energy development (Heimiller and Haymes, 2001; Rodman and Meentemeyer, 2006). In our GIS analysis, we will build a suitability model through a series of steps which include data acquisition, preprocessing, data management, manipulation and analysis, and output generation to assess suitability for wind energy development within Oregon.

Socio-Political Analysis of Policies and Incentives Applicable to Community Wind in Oregon

This second research component will explore regulatory, political, and institutional factors that affect community wind development in Oregon. Stephens et al. (2008) proposed a Socio-Political Evaluation of Energy Deployment (SPEED) framework to improve understanding and modeling of energy technology deployment, which categorizes different policies and actors into three levels: strategic level, tactical level, and operational level. Policies at the strategic level involve visioning and laying out long-term aspirational goals and objectives. The tactical level focuses on institutions and policies that carry out the larger strategic goals such as incentive programs. Policies at operational are mainly targeted on details of project building and implementation such as permitting regulations (Stephens et al., 2008). We will analyze Oregon context for community wind development by examining policies and regulations at strategic, tactical, and operational levels.

Empirical Case Studies of Community Wind in Oregon

Lastly, we attempt to understand opportunities and barriers faced with community wind development in Oregon through empirical case studies, which will provide important practical experience and information to energy modelers, policy makers, county planners, and other stakeholders about what does and does not work for community wind and what should be done in the future to overcome existing obstacles.

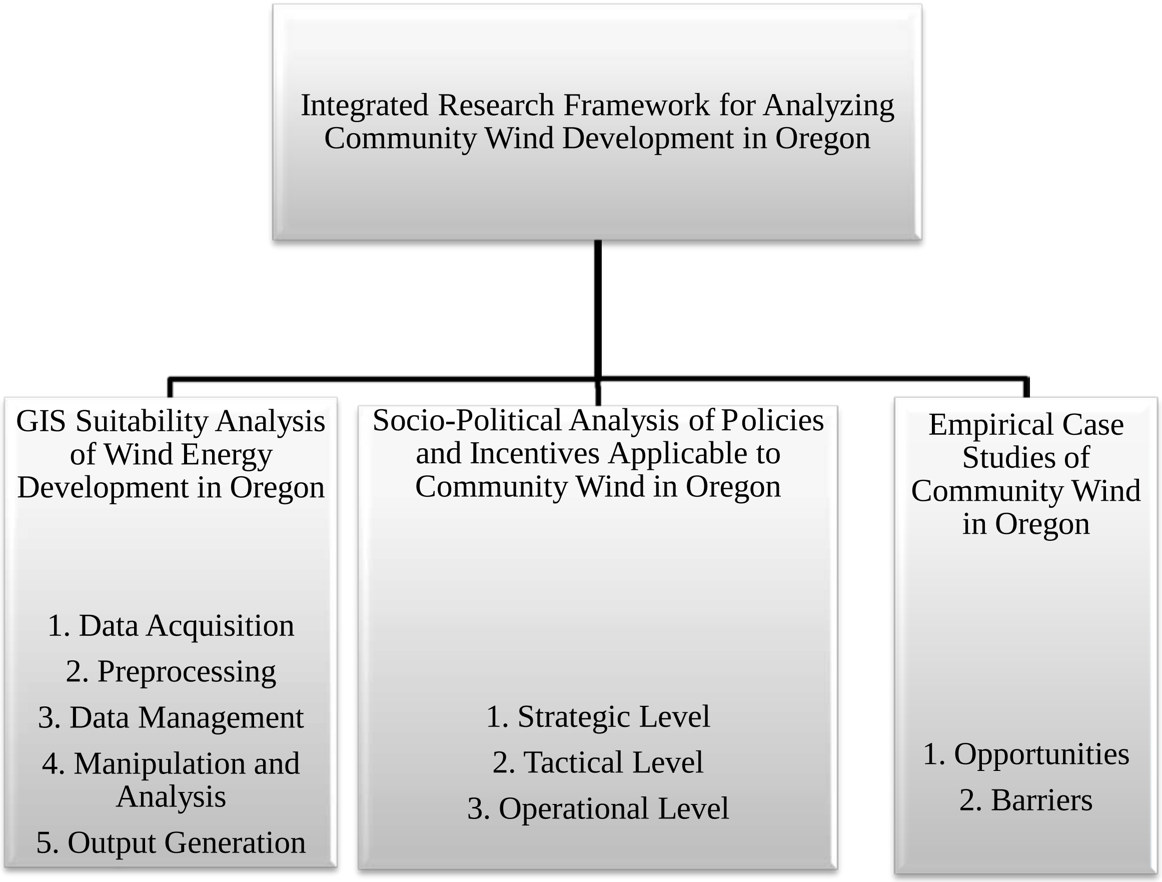

Figure 1.5.1. Integrated Research Framework

1.6.Methodology

This integrated interdisciplinary analysis will utilize three methodologies to enhance our understanding of community wind in Oregon: GIS model building, public policy review and analysis, and qualitative interview method. This combination will allow us to take advantage of the strengths each methodology has, provide unique insights by interactions between different disciplines, and broaden our horizons by understanding community wind from multiple angles. We further discuss each methodology in detail as follows.

GIS Model Building

The study area our GIS model focuses on is the whole state of Oregon. We first acquire original data to build our model. What data are selected for model building is based on literature review as well as recommendations from ecologists, GIS professionals, and other experts in this area. Next, we preprocess all the GIS data into one consistent format with the same coordinate system so that all data can work together properly. This is followed by a data management step, where we categorize data into desired categories and assign appropriate scores to these categories to reflect their influence on wind energy development. Then we manipulate and analyze the data by carrying out mathematical calculations to assess wind energy suitability for Oregon. Last, the outputs of the model will be displayed in a wind suitability map.

Public Policy Review and Analysis

This methodology will be used mostly in examining current effective policies in Oregon for community wind energy projects. In public policy review and analysis, we seek to identify policies and incentives that most often mentioned in the interviews, what roles they play for community wind, and what obstacles these policies are faced with. Analysis is based on literature review and semi-structured interviews with project developers or owners, as well as policy-makers.

Qualitative Interview Method

Qualitative interview method is a way to find out what others feel and think about a specific topic. Major types of interviews include topical oral history, life histories, evaluation interviews and focus groups (Rubin and Rubin, 1995). In this research we conduct topical oral history interviews with a number of community wind project developers or owners to learn about their experience of building their projects. Our selection of the projects is based on suggestions by personnel at Oregon Department of Agriculture, Oregon Department of Energy, and Community Renewable Energy Association.

1.7.Structure of the Dissertation

As mentioned in the beginning, this dissertation consists of five parts: Introduction, three manuscripts, and Conclusion. In terms of content, we will give general information about wind industry, definitions of community wind, and major steps involved in building community wind in the Introduction section. The second section focuses on the GIS suitability analysis of wind energy in Oregon and generates a wind suitability map to visualize the results. Policies, incentive programs and regulations targeting community wind will be explored in the third section of the dissertation from strategic, tactical, and operational perspectives. This is followed by empirical case studies of community wind in Oregon, which discusses lessons learned through real-world experiences. In the end, we will conclude with a synthesis of the findings from the previous sections and explore the future of community wind in Oregon.

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2. A GEOGRAPHIC INFORMATION SYSTEM (GIS) SUITABILITY ANALYSIS OF WIND ENERGY DEVELOPMENT IN OREGON

Keywords: GIS, suitability analysis, Oregon, wind energy

2.1.Abstract

Geographic Information System (GIS) is a valuable tool in evaluating site suitability for locating wind turbines. The purpose of this chapter is to create a GIS model to predict suitability of wind energy development in Oregon by incorporating a series of data layers and developing screening criteria which include physical requirements, and environmental considerations as well as human impact factors. The results are visualized into a final map in a meaningful way, which indicates that many areas fulfill the specified screening criteria and are fairly suitable for wind energy development in Oregon. Policy makers, energy project developers, land use planners, and other related stakeholders may find the information useful in their decision making.

2.2.Introduction

Facing issues of diminishing fossil fuel, rising oil prices and climate change, countries throughout the world have started realizing the significance of the role that renewable energy plays in their local economies and natural environments. Among all energy technologies, wind energy is by far the fastest growing energy source in the world. But land use restrictions have become one of the major challenges in selecting sites for turbine placement (Rodman and Meentemeyer, 2006). Adequate wind resources, proximity to power lines, absence of endangered species, long distance from populated areas are all essential criteria for screening suitable locations. Targeting optimal sites to build wind projects will reduce controversy and increase acceptance by the general public, making these projects more likely to succeed.

Geographic Information System (GIS), consisting of computer hardware and software, is a scientific method that "integrates hardware, software, and data for capturing, managing, analyzing, and displaying all forms of geographically referenced information" (Environmental Systems Research Institute, 2011: 1). By combining data layers to generate spatial information that we need, GIS is an outstanding tool for energy planning and has been used extensively in wind energy suitability analyses. The GIS results can be easily stored in digital formats shared by a wide audience (Heimiller and Haymes, 2001).

With GIS's capability to simulate necessary factors, a great many determinants can serve as criteria for screening suitable sites (S. M. Baban and Flannagan, 1998). What determinants to choose and how important a determinant is are functions of the perspectives of the user as well as the purpose of the model. For example, a wind GIS model developed by an environmentalist can look very different from one created by an energy company (Sparkes and Kidner, 1996). In this study, we focus on the state of Oregon as the study area and choose physical, environmental and human constraints based on literature and recommendations from GIS experts to generate the model.

2.3.Methodology

There are five essential steps in a GIS analysis: *data acquisition, preprocessing, data management, manipulation and analysis,* and *output generation* (See Figure 2.3.1). Data acquisition takes place after the modeler decides what data should be incorporated. Local, state, and federal government agencies are major GIS data suppliers (Foote and Lynch, 1995). Oftentimes, data layers come from a variety of sources and need to be preprocessed to make sure that the units of measurement and the coordinate system are consistent for all data, which is followed by a data management step, which ensures that all the data are ready for further manipulation and analysis and organizes them by geographic extent, original source, or planned use. Next is the manipulation and analysis step, where data will be manipulated and analyzed by the spatial functions of GIS to identify spatial relationships in the data. Lastly, GIS will produce the final outputs in formats of statistical reports, tables, charts, displays, and maps to present the results (Heimiller and Haymes, 2001). We will discuss how this project is handled in these five steps in more detail.

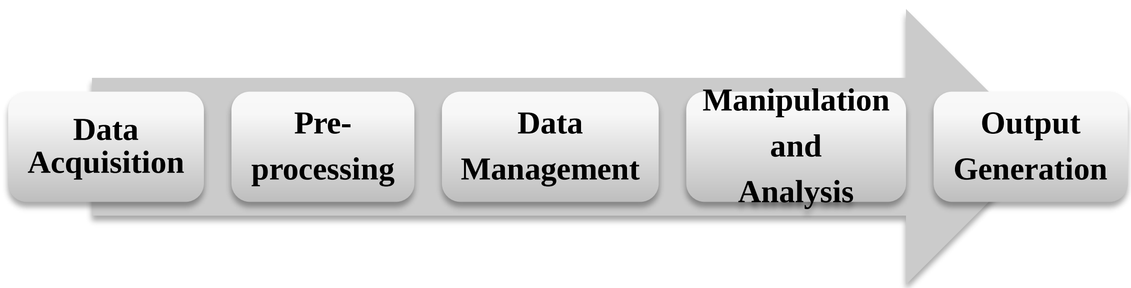

Figure 1.3.1. Five Essential Steps in GIS Analysis

Data Acquisition

Based upon a literature review and recommendations from GIS experts, we simulate the suitability model using physical factors such as wind resources and terrain characteristics, environmental factors including vegetation types, presence of lakes, and presence of wilderness areas, and human impact factors like proximity to urban areas and recreational areas. Seven data layers incorporated in the model are slope, wind speed, urban, state parks, vegetation, and wilderness areas (See Table 2.3.1). Proximity to power grid, distance to ridge, forest density, and factors in that nature are also influential determinants for a wind project, however, given the scale of the study area and the timeframe of this research, we are not capable of incorporating as many data layers as we would like to, which is the major limitation of the model. The software we use for GIS analysis is ArcMap, which is a central application of ESRI company's ArcGIS suite used for all map-based tasks and is available at Oregon State University (Environmental Systems Research Institute, 2002).

Table 2.3.1. Three Categories of Layers

Layer Categories	Data Layers
Physical Factors	Wind Speed Layer
	Slope Layer
Environmental Factors	Vegetation Layer
	Lake Layer
	Wilderness Area Layer
Human Impact Factors	Urban Growth Layer
	State Park Layer

The wind speed layer was downloaded from the National Renewable Energy Laboratory (NREL) website. NREL's GIS team provides biomass data, geothermal data, hydrogen data, solar data, and wind data in a GIS compatible format on their online server (National Renewable Energy Laboratory, 2010). I chose to download Pacific Northwest 50-Meter Wind data for the purpose of this model.

The rest of the layers, except for the Wilderness Area Layer, all came from the Oregon Geospatial Enterprise Office (GEO)'s Spatial Data Library which contains a wide range of GIS data on Oregon. The organization's responsibilities include "the development, maintenance, and hosting of Oregon's Digital Spatial Data Library, communication of GIS initiatives among local, regional, state, and federal agencies, and assistance with coordination of GIS activities for Oregon state agencies"(Oregon Geospatial Enterprise Office, 2011a: 1). Table 2.3.2 shows the sources of data as well as the unprocessed predecessor file names of all data layers.

The National Wilderness Area Layer was downloaded from the Wilderness Institute at University of Montana (Wilderness, 2011). The layer includes nationwide wilderness areas managed by the Bureau of Land Management, the Fish and Wildlife Service, Forest Service, and National Park Service.

Table 2.3.2. Data Sources, Predecessor Files, and Final Layers

Data Sources	Predecessor Files	Final Layers
NREL	Pacific Northwest 50-Meter Wind	Wind Speed Layer
GEO	Digital Elevation Model	Slope Layer
GEO	Ecological Systems	Vegetation Layer
GEO	Streams and Lakes	Lake Layer
GEO	Urban Growth Boundaries	Urban Growth Layer
GEO	State Parks	State Park Layer
Wilderness.net	National Wilderness Areas	Wilderness Area Layer

Pacific Northwest 50-Meter Wind predecessor data show the wind speed estimates at 50 meters or 164 feet above the ground and are categorized into seven classes, with Class 1 being the lowest and Class 7 the highest. Class 1 and 2 wind resources are quality enough for developing wind projects. Class 3 is considered fair wind, Class 4 is good wind, Class 5 to 7 are excellent wind resources (See Table 2.3.3) (American Wind Energy Association, 2011; National Renewable Energy Laboratory, 2009).

Table 2.3.3. Wind Classes, Wind Speed, and Wind Quality

Wind Power Class	Speed at 50 Meter (m/s)	Speed at 50 Meter (mph)	Wind Quality
1	<5.6	<12.5	Unsuitable
2	5.6~6.4	12.5~14.3	Unsuitable
3	6.4~7.0	14.3~15.7	Fair
4	7.0~7.5	15.7~16.8	Good
5	7.5~8.0	16.8~17.9	Excellent
6	8.0~8.8	17.9~19.7	Excellent
7	>8.8	>19.7	Excellent

The Digital Elevation Model (DEM) is a ground representation of land surface, where every pixel is associated with an elevation value above sea level. The spatial resolution of our DEM predecessor is 10 meters, meaning that each pixel represents a 10 meter by 10 meter area on the ground. The 10-meter DEM is used for deriving a slope layer of Oregon, which in turn will serve as a determinant in our model because the steeper an area, the less suitable it is for placing wind turbines (See Table 2.3.4) (Rodman and Meentemeyer, 2006).

Table 2.3.4. Suitability of Slopes for Wind Projects

Slope in Degrees	Suitability for Wind Projects
0~7	Excellent
7~16	Good
16~30	Fair
30~40	Poor
>40	Unsuitable

The Ecological System predecessor data provide landcover information of Oregon. Classes in the data include forested areas, volcanic areas, wetland areas, sagebrush areas, disturbed areas, cliffs, riparian areas, agricultural areas, water areas, and so on (Oregon Geospatial Enterprise Office, 2011b). Later, we will categorize the data into four major categories: farmland or barren land, grass, shrubs or chaparral, and forest wetlands or others, and transform Ecological System data into Vegetation Layer (See Table 2.3.5) (Rodman and Meentemeyer, 2006).

Table 2.3.5. Suitability of Vegetation Types for Wind Projects

Vegetation Types	**Suitability for Wind Projects**
Farmland or Barren Land	Excellent
Grass	Fair
Shrubs or Chaparral	Poor
Forest or Wetlands or Others	Unsuitable

The Streams and Lakes predecessor data come from Oregon's 2004 to 2006 Integrated Report on water quality by the Water Quality Division at Oregon Department of Environmental Quality (Oregon Geospatial Enterprise Office, 2011c). Lakes are represented as spread-out polygons (i.e. a closed two dimensional figure bounded by straight sides) in the data and will later be embedded into a map of Oregon to derive the final Lake Layer for the model based on an assumption that lakes are not suitable land for developing wind energy.

In the early 1970s, Oregon adopted the nation's first set of land use planning laws and required each city or metropolitan area in the state to have an urban growth boundary to protect farms and forests from urban sprawl (Metro, 2011). Since most of the time wind projects are built in remote areas to capture great wind resources and avoid public opposition, we will convert Urban Growth Boundaries predecessor data into Urban Growth Layer and screen for suitable locations outside the boundaries. The data are also in the format of spread-out polygons and will need to be embedded into a map of Oregon later (Oregon Geospatial Enterprise Office, 2011e).

State parks are crucial recreational areas for the general public and are not suitable for holding wind energy projects. Therefore, I download the State Parks predecessor data and then embed the polygon features into an Oregon map for further analysis (Oregon Geospatial Enterprise Office, 2011d).

Wilderness areas should be avoided because operations of commercial enterprises are not allowed in these areas (Justia, 2011). I first downloaded the National Wilderness Areas from the Wilderness Institute at the University of Montana, clipped wilderness areas within Oregon from the nationwide data, and embedded the polygon features into an Oregon map.

Preprocessing

We preprocessed the original data layers to ensure the unit of measurement, pixel size and the coordinate system are consistent in all data files. All the predecessor data layers use “feet” as the unit of measurement. Pacific Northwest 50-Meter Wind, Digital Elevation Model, and Ecological Systems are raster data (i.e. a data type consisting of pixels with assigned values) with pixel sizes of 98.425 feet, 32.808 feet, and 98.425 feet respectively, while Streams and Lakes, Urban Growth Boundaries, State Parks, and Wilderness Areas are vector data (i.e. a data type in forms of points, lines, and polygons). We first resampled 10-Meter Digital Elevation Model into 30-Meter DEM to ensure that it is consistent with two other raster data in the pixel size of 98.425 feet (30 meters) (See Figure 2.3.2). Next, we combine each vector data with a template of Oregon so that all four vector data are embedded into the template and have an Oregon background. This is followed by a conversion of those vector data into a raster format with a pixel size of 98.425 feet. At this point, all the data are raster data. For the coordinate system, all those raster data use Lambert Conic Conformal projected coordinate system and North American Datum 1983 datum.

Data Management

In this step, we manage all the data to make sure they are ready for further manipulation and analysis. We clipped the shape of Oregon from the Pacific Northwest 50-Meter Wind data and categorized wind speed into seven classes based on Table 2.3.3. Figure 2.3.3 shows different suitability levels of wind speed. We derived a Slope Layer from the 30-meter DEM and created five levels of slopes using the standards in Table 2.3.4 (See Figure 2.3.4). Similarly, we categorized Ecological Systems data into four categories: farmland or barren land, grass, shrubs or chaparral, and forest wetlands or others, and derived the Vegetation Layer from the data (See Table 2.3.5 and Figure 2.3.5). The Lake Layer is categorized into two classes: lakes and non-lakes (See Figure 2.3.6). Similarly, the Urban Growth Layer is categorized into urban and non-urban (See Figure 2.3.7), the State Park Layer into park and non-park (See Figure 2.3.8), and the Wilderness Area Layer into wilderness and non-wilderness (See Figure 2.3.9). Now, all the processed layers are imported into the software in the order of data source and are prepared for the next step.

Manipulation and Analysis

In generating the GIS model, we first need to decide if all the layers are given equal weights or if they should be graded according to perceived importance (S. M. J. Baban and Parry, 2001). Given findings of similar research and recommendations from wind energy professionals, we assigned scores to each data layer as follows (See Table 2.3.6).

1. Slope Layer, Vegetation Layer, Lake Layer, Urban Growth Layer, State Park Layer, and Wilderness Area Layer are equally important and will be assigned scores on a scale of 0~4.
2. Wind speed is a stronger determinant than other data and thus will double in weight on a scale of 0~8.

Table 2.3.6. Assigning Scores on Different Scales

Categories	Excellent	Good	Fair	Poor	Unsuitable
Wind Speed	Class 5~7 *(Score 8)*	Class 4 *(Score 6)*	Class 3 *(Score 4)*		Class 1~2 *(Score 0)*
Slope	0~7 º *(Score 4)*	7 º~16 º *(Score 3)*	16 º~30 º *(Score 2)*	30 º~40 º *(Score 1)*	>40 º *(Score 0)*
Vegetation	Farmland or Barren Land *(Score 4)*	-	Grass *(Score 2)*	Shrubs or Chaparral *(Score 1)*	Forest, Wetlands or Others *(Score 0)*
Lake	No Lakes *(Score 4)*	-	-	-	Lakes *(Score 0)*
Urban Growth	Non-urban *(Score 4)*	-	-	-	Urban *(Score 0)*
State Park	No Parks *(Score 4)*	-	-	-	Parks *(Score 0)*
Wilderness Areas	No Wilderness *(Score 4)*	-	-	-	Wilderness Areas *(Score 0)*

After each of the layer is assigned a score, we use the following equation to derive the final suitability. A spectrum of suitability is generated in the range of 0 to 32,768. If a pixel has a score of 0 in any of the layers, it will result in a final score 0 based on the calculation, meaning the pixel is unsuitable for developing wind energy projects. If a pixel gains the highest score in all the layers, the final suitability of that specific pixel will be calculated as 8×4^6=32,768.

Final Suitability=Wind Speed×Slope×Vegetation×Lake×Urban Growth×State Park×Wilderness Area

Output Generation

A map is a common output format for a GIS analysis and we therefore visualize the results of the mathematical calculation into a GIS map, which can be quickly and easily distributed to or shared by interested readers (See Figure 2.3.10). A color spectrum of the map legend illustrates the varying level of suitability with light yellow being most unsuitable and dark blue most suitable for wind energy development.

2.4. Results and Discussion

As the final wind energy suitability in Oregon map illustrates, some northern counties along the Columbia Gorge show high suitability for wind projects, which can be verified by the fact that many large wind companies such as British Petroleum, Iberdrola Renewables, Portland General Electric, and Horizon Wind have already developed wind farms in these areas (Renewable Northwest Project, 2011). In addition, southeast Oregon also reveals high suitability for wind development.

For policy makers and land use planners, this map reveals information on where wind activities are likely to take place in the future if allowed by planners and administrators of policy. If there is high suitability within their jurisdictions, it may be better for planners to take that possibility into consideration when they make plans locally. For wind developers, this map serves as a good starting point for planning a project by allowing them to concentrate on more suitable areas so that their projects are more likely to succeed. If Oregon would like to see more wind energy development, this map will be helpful for the state to make wise decisions.

However, before using this map, I highly recommend users to read the methodology discussion to be aware of the underlying assumptions upon which the model is built. For example, the factor of wind speed is more important than other factors; farmland or barren land is a desired land type for development; less steep areas are preferred; urban areas, lakes, parks, and wilderness areas should be avoided (See Table 2.3.3 through Table 2.3.6). The classification scheme and score assignment shown are based on literature review and recommendations made for Oregon. Different study areas may need different schemes that fit with their research goals and needs. In addition, we used a simple multiplication equation to generate the final suitability results. Sometimes, users may find it necessary to adopt a more complex or a simpler mathematical method to calculate wind energy suitability in their interested areas.

One of the major limitations of the model is that we are not capable of incorporating as many data layers as we would like to due to the scale of the study area and the timeframe of this research. To simulate reality more precisely, many additional layers should be included in model building, such as habitats for endangered species, proximity to power grid, distance to ridge, forest density, land ownership, public perceptions, and other factors key to successful development. To take land ownership and endangered species for example, the results indicate a large portion of land in southeast Oregon is suitable for wind energy, but most of the land in that area belongs to the Bureau of Land Management (BLM). Project developers who are interested in these areas need not only research the agency's regulations for land use, but also be aware of fact the land contains large protected habitats for endangered species such as sage-grouse. Such information is not available in the results generated by the model due to the fact that relevant layers are not incorporated. This indicates that although six information layers can provide some degree of certainty on suitability, more factors need to be considered when developing a project in the real world. After setting a geographic context for wind energy development in Oregon, I'll explore the policy context for wind projects in the state, particularly those community-scale ones in the next chapter.

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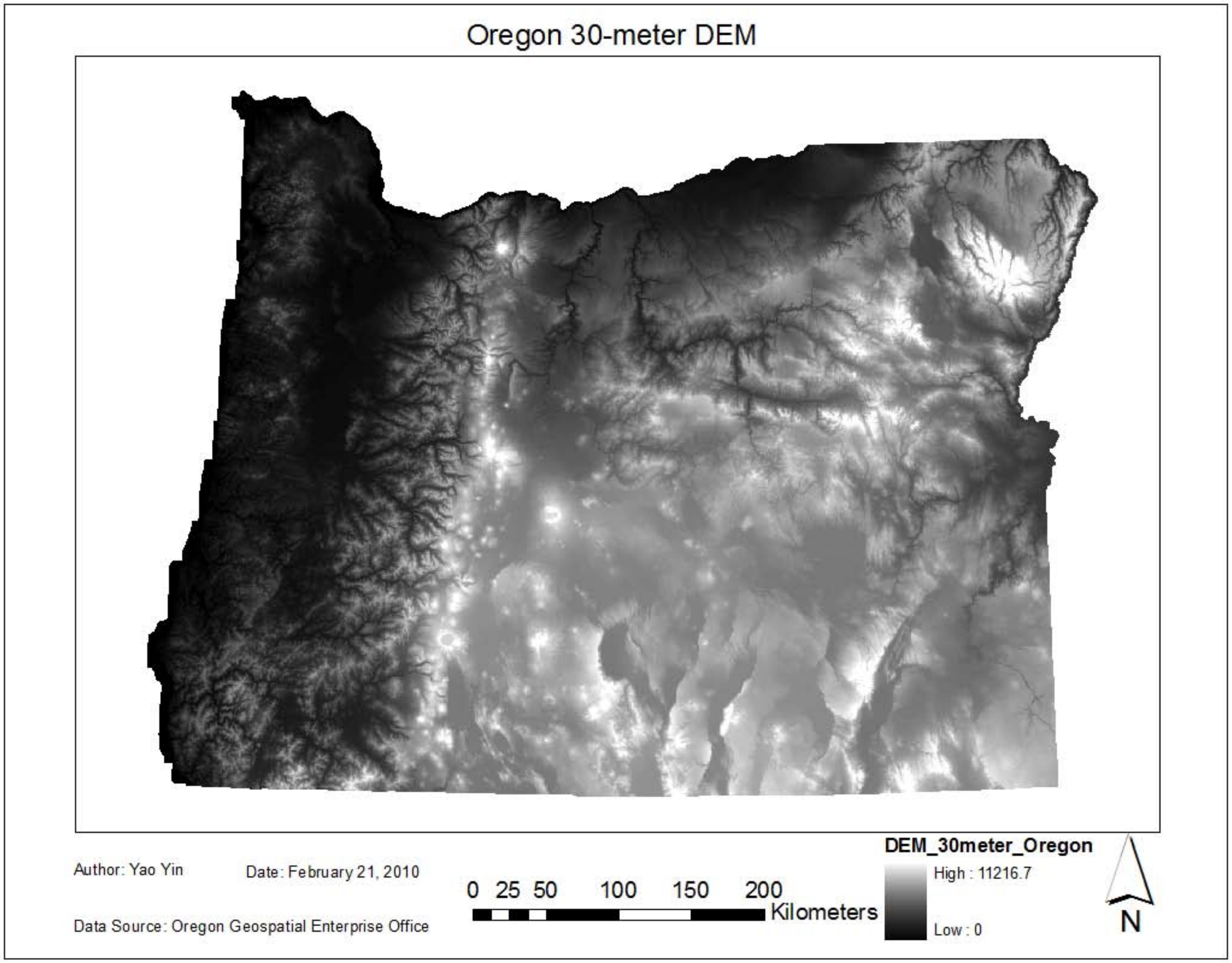


Figure 2.3.2. 30-Meter Digital Elevation Model of Oregon

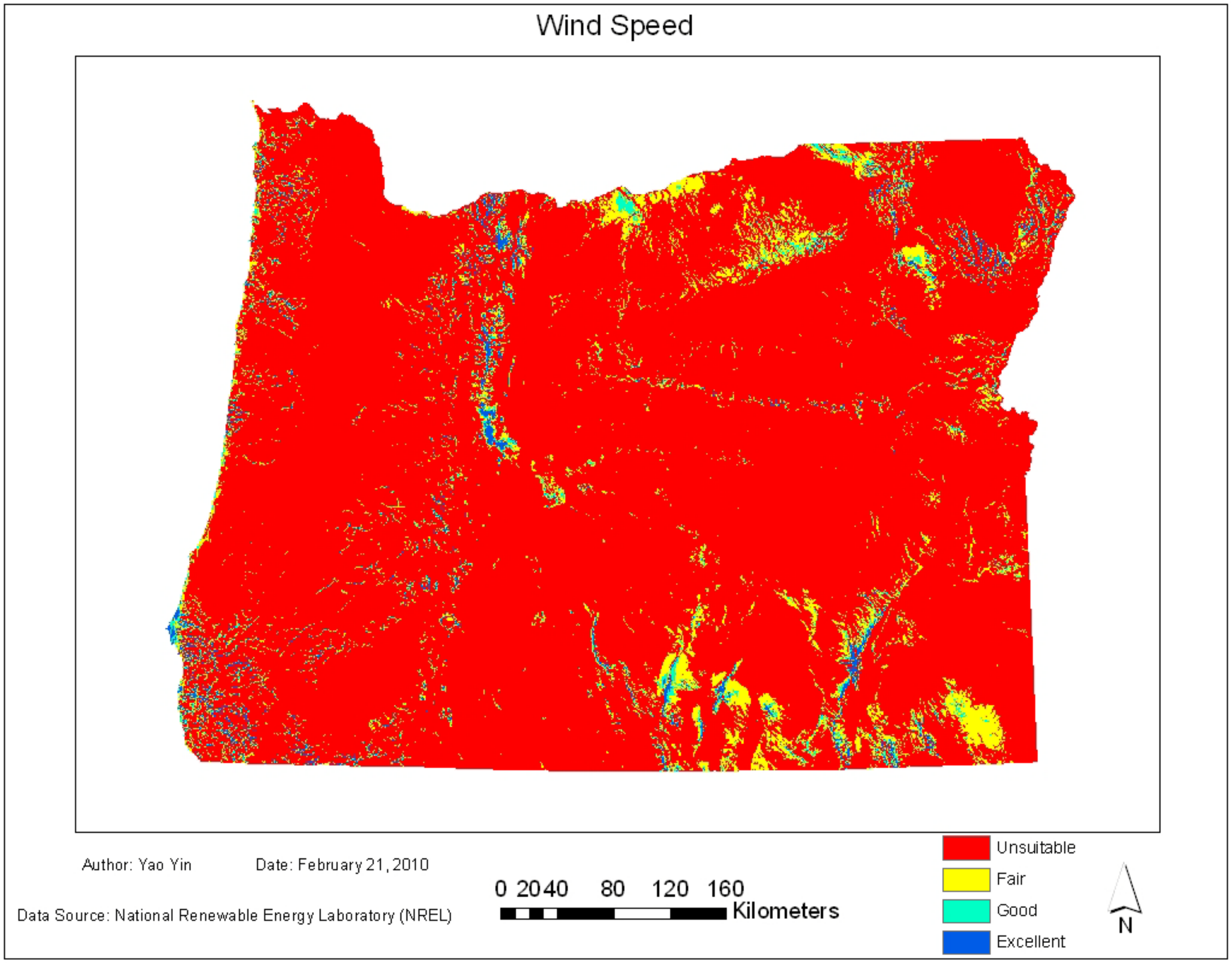


Figure 2.3.3. Wind Speed in Oregon

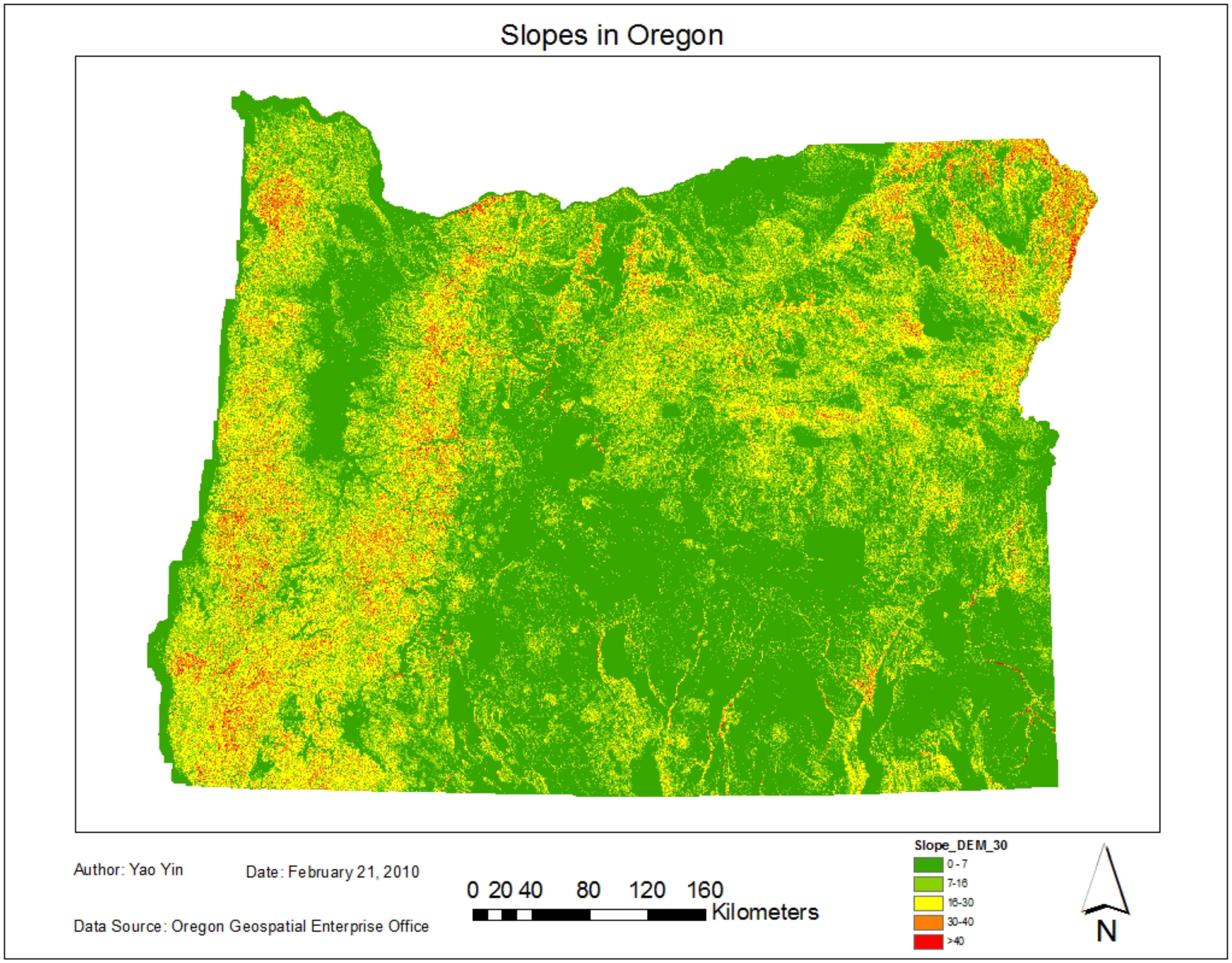


Figure 2.3.4. Slopes in Oregon

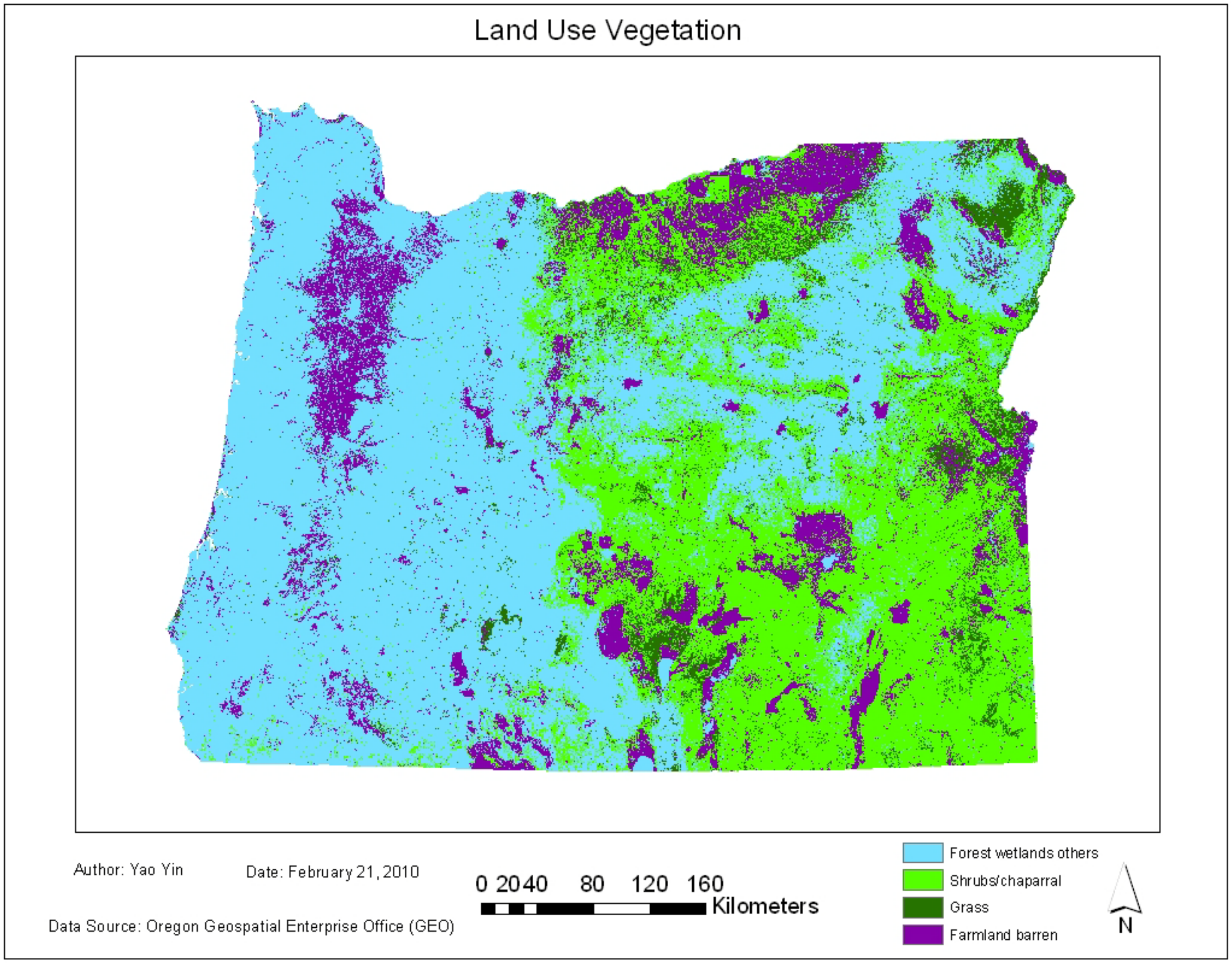


Figure 2.3.5. Vegetation Types of Oregon

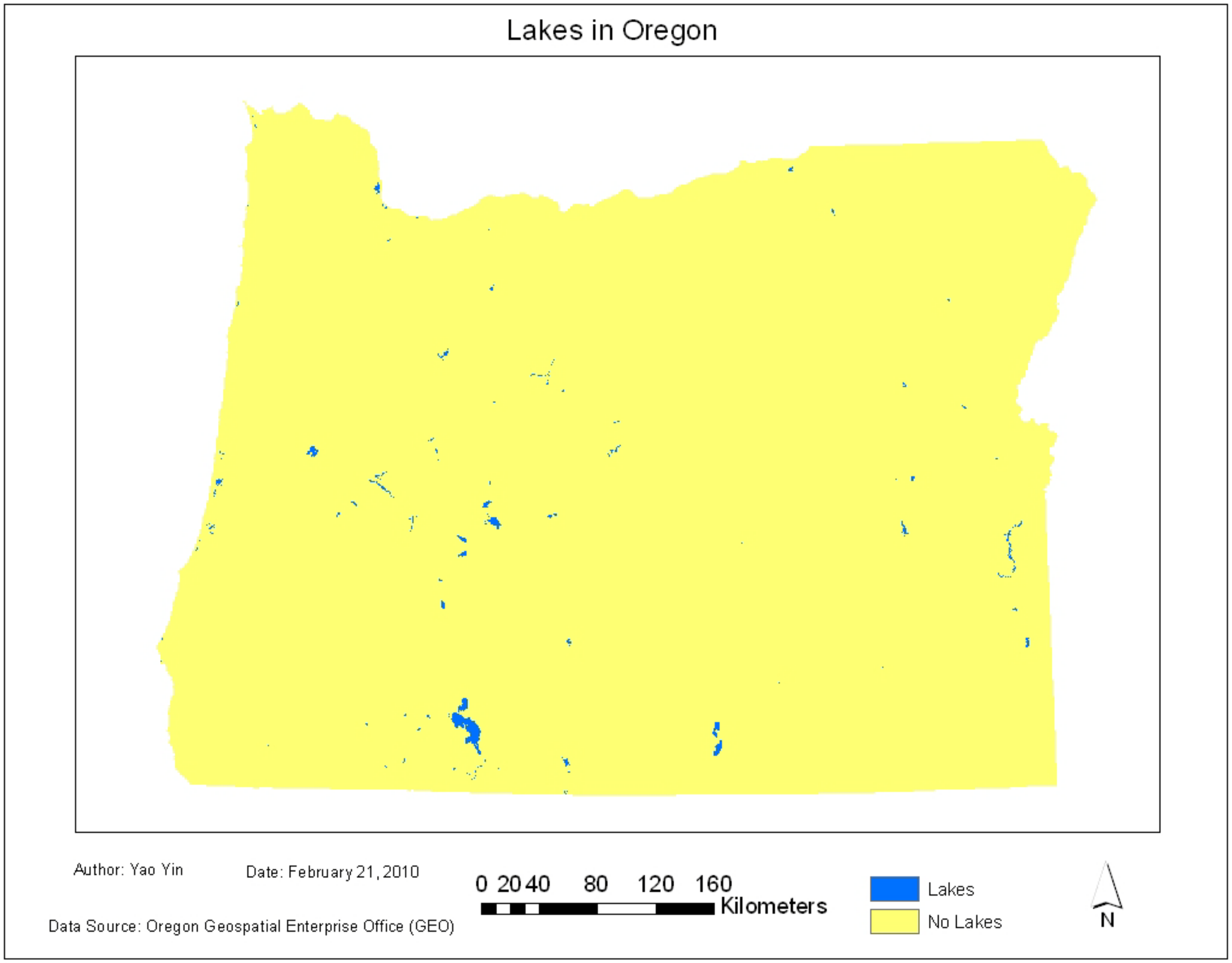


Figure 2.3.6. Lakes in Oregon

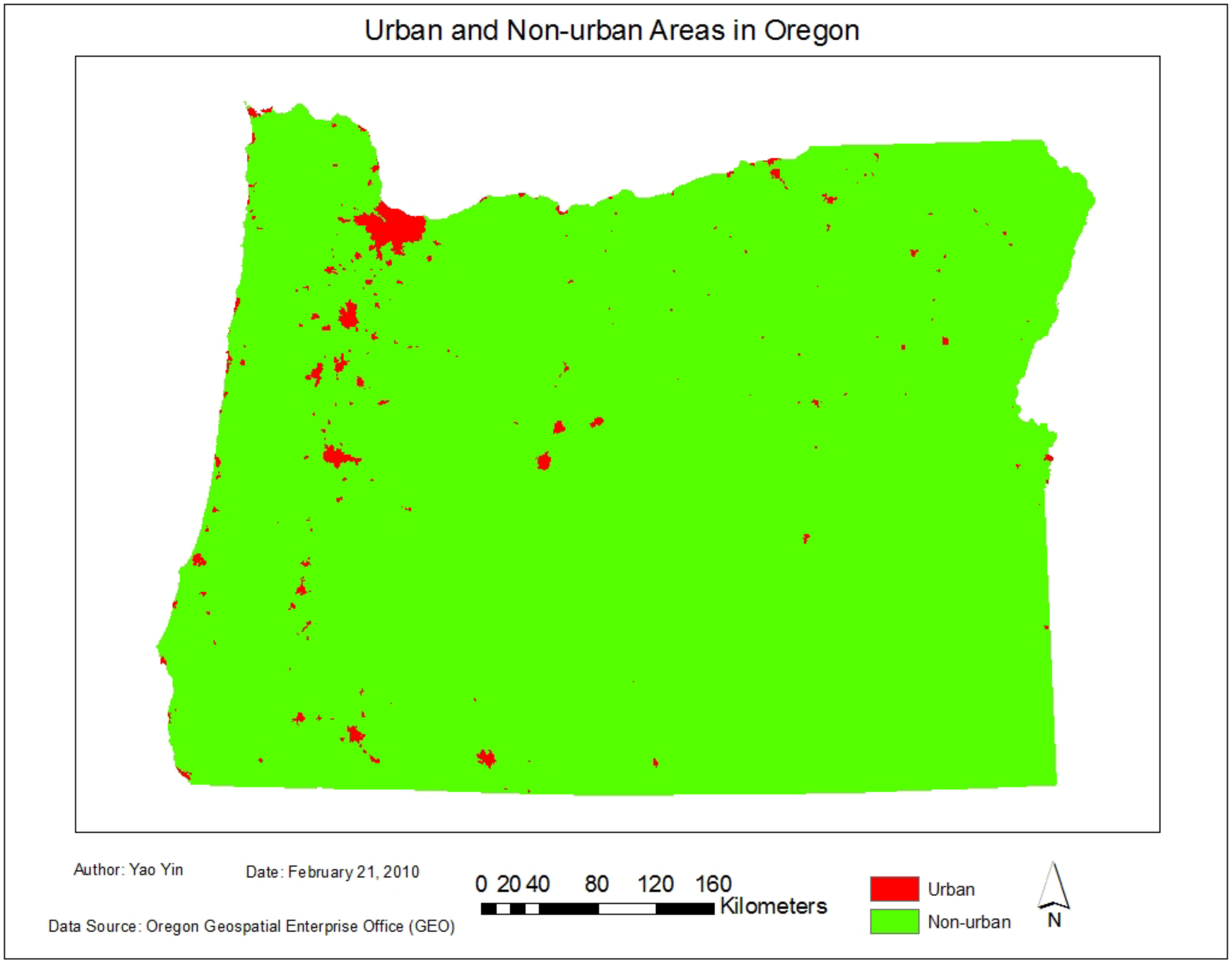


Figure 2.3.7. Urban and Non-Urban Areas in Oregon

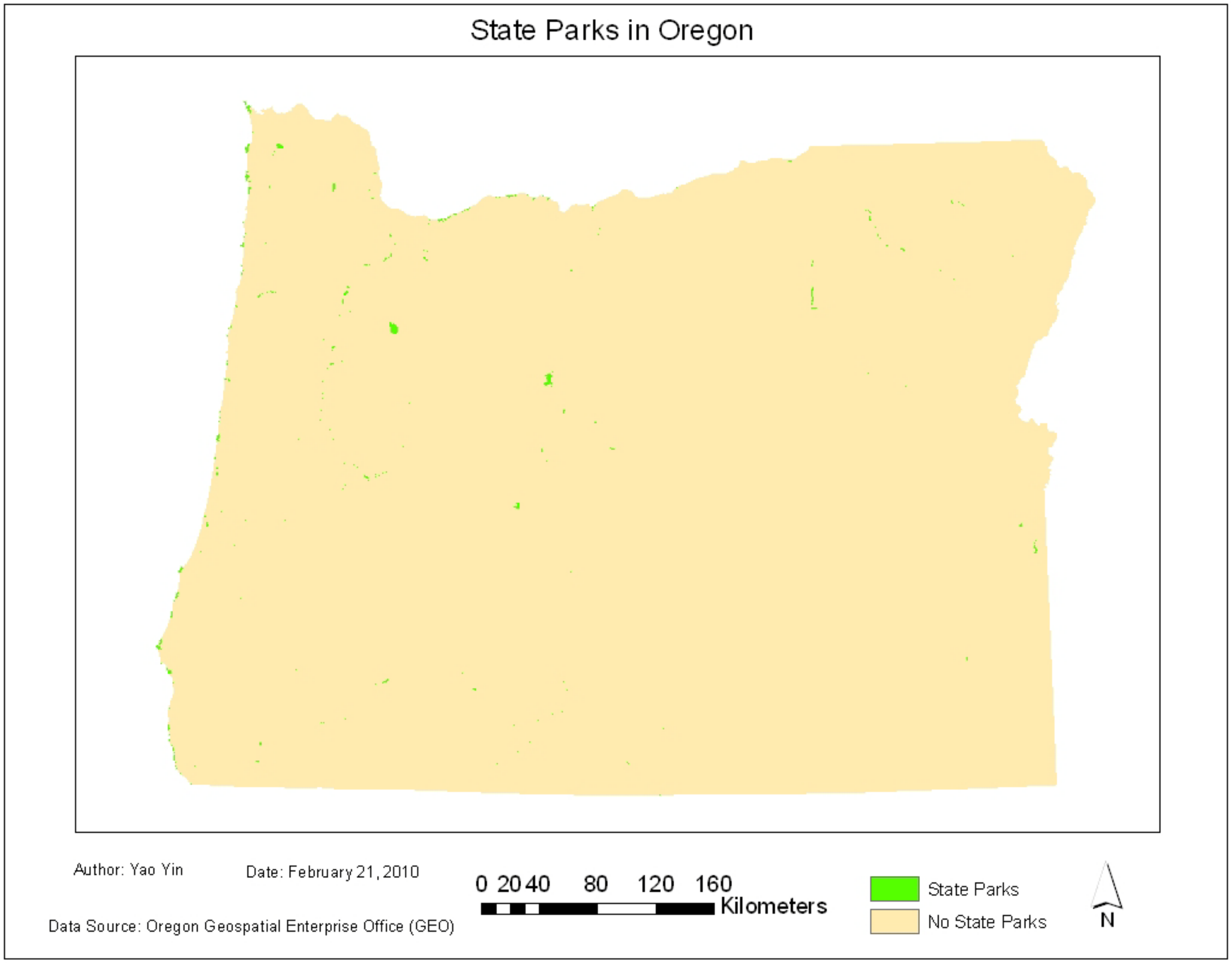


Figure 2.3.8. State Parks in Oregon

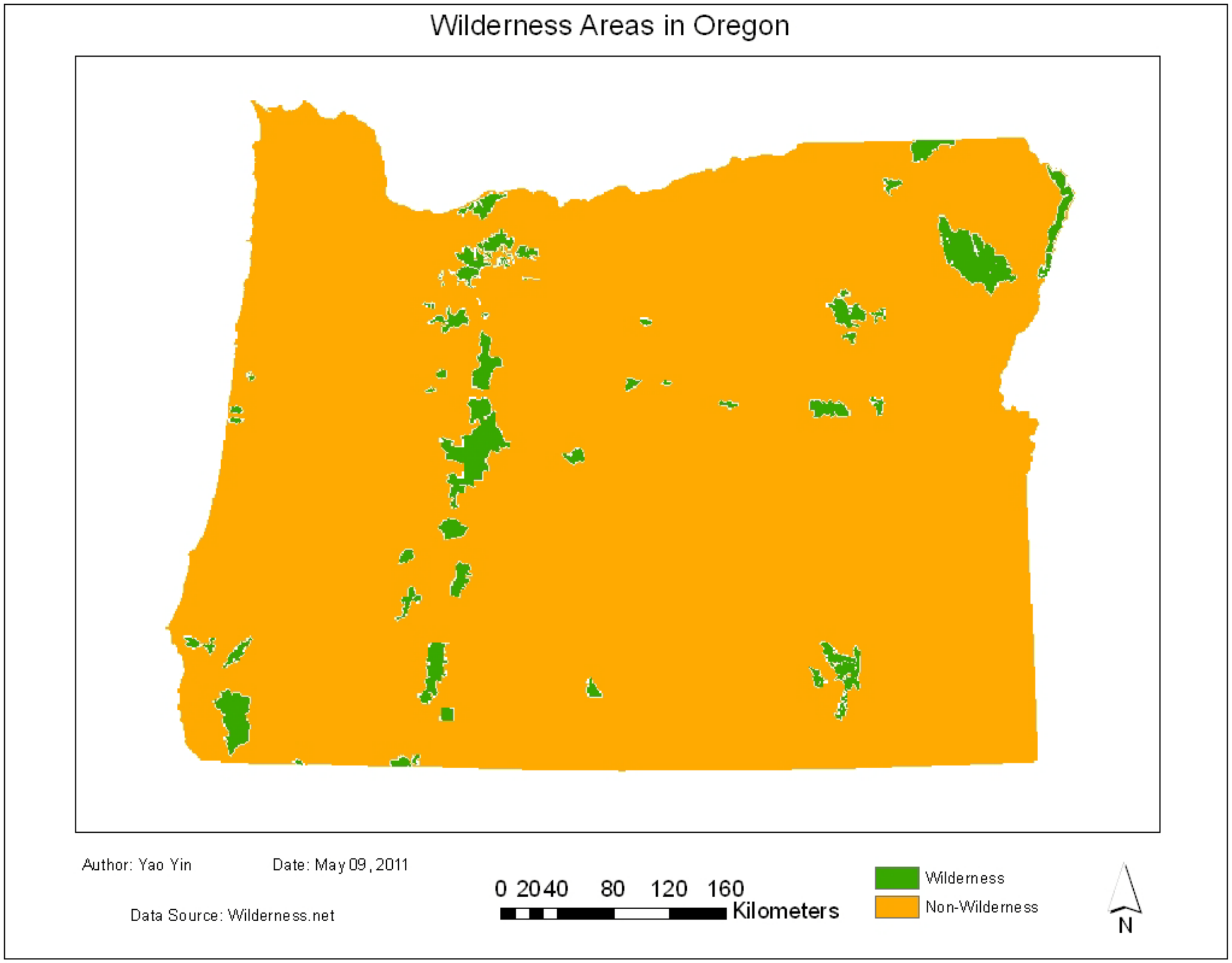


Figure 2.3.9. Wilderness Areas in Oregon

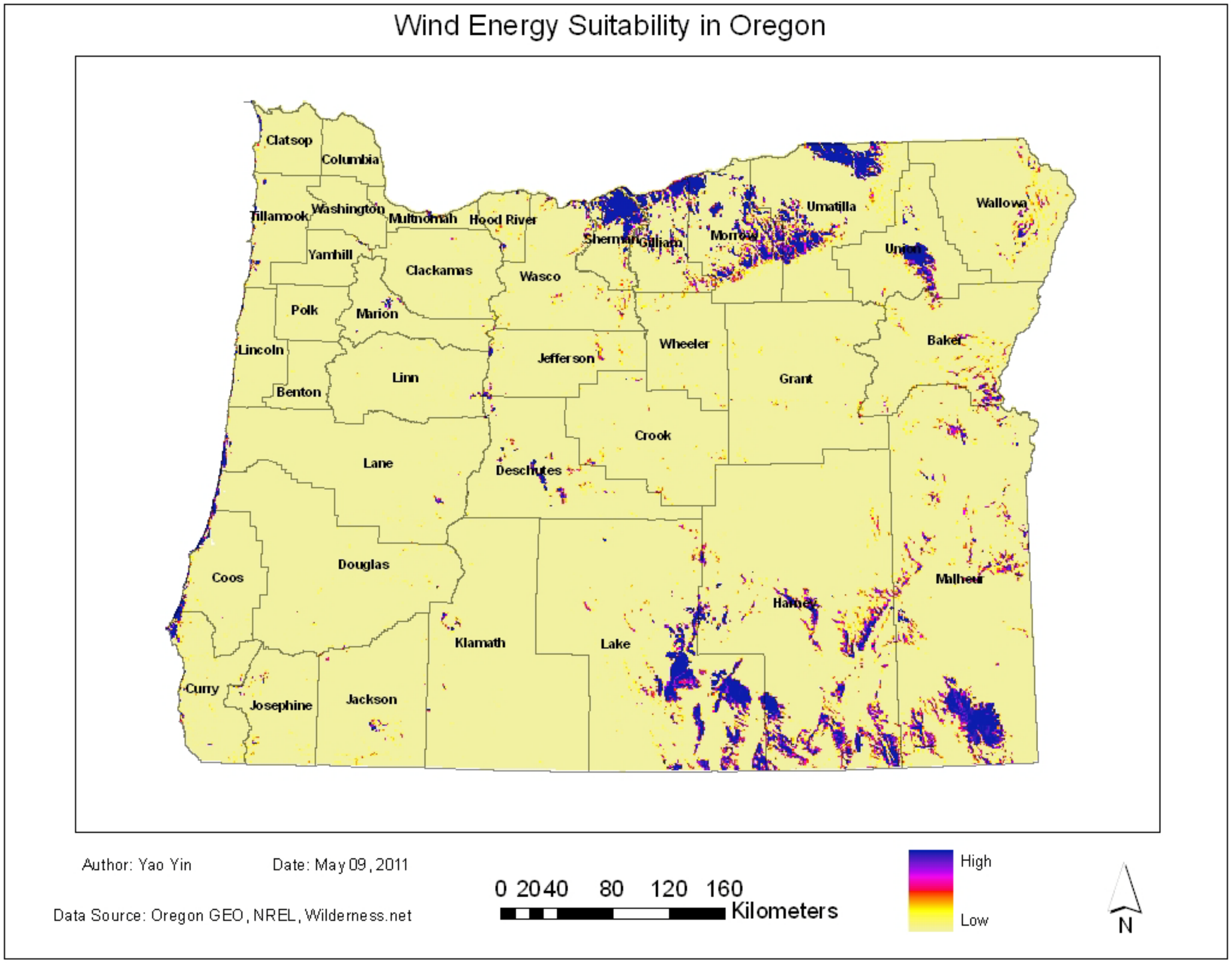


Figure 2.3.10. Wind Energy Suitability in Oregon

3. A SOCIO-POLITICAL ANALYSIS OF POLICIES AND INCENTIVES APPLICABLE TO COMMUNITY WIND IN OREGON

Keywords: policies, incentives, community wind, Oregon

3.1. Abstract

As a new type of ownership structure, community owned wind projects are becoming more and more important in today's wind energy generation in the U.S. Unlike traditional large wind farms, community wind features local ownership and small-scale generation capacity. The goal of this paper is to identify policies, incentives, and regulations in place that are applicable to community wind projects in Oregon by interviewing project representatives and governmental officials and to depict the Oregon context from strategic, tactical, and operational perspectives for researchers, farmers, private businesses, government entities, and others who are interested in learning about the community wind in the state.

3.2. Introduction

Following Denmark, Germany, the Netherlands, and the United Kingdom, the United States started to see community owned wind projects about a decade ago (Bolinger, 2001). Unlike traditional large wind farms, which frequently are owned by absentee owners, community wind is locally owned with smaller capacity. Although there are a variety of definitions from academia, energy industry, community development organizations, and government agencies in different states, ownership and scale are two key elements in defining community wind. We use a definition from a recent Lawrence Berkeley National Laboratory (LBNL) report for the purpose of this dissertation. According to the LBNL, community wind "consists of relatively small utility-scale wind power projects that sell power on the wholesale market and that are developed and owned primarily by local investors" (Bolinger, 2011: 1). Because most community wind projects we have encountered in Oregon are owned by local farmers with a capacity ranging from a couple of megawatts to 10 MW as a result of the Public Utility Regulatory Policy Act (PURPA), and their power is typically generated for commercial sale rather than on-site use (Bolinger, 2011: 1). Although the definition from the LBNL is a good fit for this dissertation, it should be noted that larger community wind projects with a capacity of hundreds of megawatts might emerge in the future. By interviewing project representatives and government officials, we seek to identify policies and incentives in place that are applicable for community wind projects in Oregon so that people with an interest in developing such projects or learning about the topic can familiarize themselves with the Oregon context from strategic, tactic, and operational perspectives.

3.3. Methodology

In December 2010, I conducted 12 ethnographic interviews in six counties in Oregon with a focus on policies and incentives applicable to community wind energy. Despite their different perspectives, all of the interviewees had rich experiences with community wind energy development; and they included one county government employee and two community wind energy developers in Sherman County, one project developer in Lake County, two county government employees in Hood River County, one project developer in Gilliam County, one project owner, one county government employee, and one United States Department of Agriculture (USDA) employee in Umatilla County, and one developer and one Bureau of Land Management (BLM) employee in Baker County. Their names were suggested by personnel at Oregon Department of Agriculture, Oregon Department of Energy, as well as the Community Renewable Energy Association. The interviews followed a semi-structured technique and were recorded using a voice recorder. I next transcribed all the interviews from the voice recorder to texts and identified common themes and important policies and incentives in place.

In evaluating energy deployment, Stephens et al. (2008) came up with the Socio-Political Evaluation of Energy Deployment (SPEED) framework which categorized laws, regulations, institutions, and policy actors into three levels: strategic level, tactical level, and operational level. Policies at strategic level are often long-term goals and objectives sets up the structure and the general context for the issue. Tactical policies are instruments for achieving the larger strategic goals such as government incentive programs. Operational policies are rules that target details of project implementation such as policies on land use, permitting process, electricity pricing, and so on (See Figure 3.3.1). We adopted this framework and categorized the policies and incentives identified into these three levels.

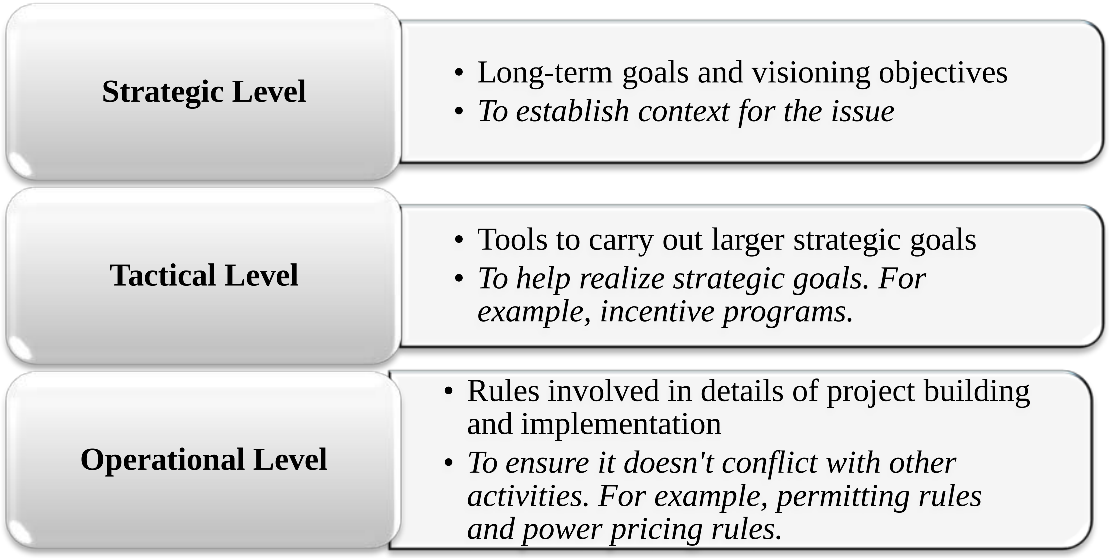


Figure 3.3.1. Three-Level Policy Framework

Lastly, we conducted policy review and analysis through archival research to study the development of the policies and incentives, and combined our results with previous interview findings to describe Oregon’s policy context for developing community wind energy projects. Please note that the policies and incentives we studied by no means represented an exhaustive list of those applicable to community wind; our efforts were concentrated on the ones that are most talked about in the interviews by project developers or owners in Oregon. This information could be helpful for anyone who is interested in developing such projects or improving policy designs for the future.

3.4. Results

Strategic Goal One: Oregon’s Renewable Portfolio Standard (RPS)

In 2007 the Oregon Legislature enacted the Oregon Renewable Portfolio Standard (RPS) through Senate Bill 838, which requires Oregon utilities to have a percentage of their retail electricity from renewable resources including biomass, geothermal, hydropower, ocean thermal, solar, tidal, wave, wind and hydrogen (74th Oregon Legislative Assembly, 2007). For example, Portland General Electric, PacifiCorp, and the Eugene Water and Electric Board, the three largest utilities in Oregon will need to meet the standards of 5% from renewable sources in 2011, 15% in 2015, 20% in 2020, and 25% in 2025. Other electric utilities in the state have varying standards of 5% or 10% depending on size (See Table 3.4.1).

Table 3.4.1 Renewable Portfolio Standard Targets (Oregon Department of Energy, 2007)

<table>
<tr><th>Size</th><th>Affected Utilities</th><th>Target in 2011</th><th>Target in 2015</th><th>Target in 2020</th><th>Target in 2025</th></tr>
<tr><td>Large Utilities</td><td>Portland General Electric, PacifiCorp, Eugene Water and Electric Board</td><td>5%</td><td>15%</td><td>20%</td><td>25%</td></tr>
<tr><td>Smaller Utilities</td><td>Central Lincoln People’s Utility District (PUD), Idaho Power, McMinnville W&L, Clatskanie PUD, Springfield Utility Board, Umatilla Electric Cooperative</td><td colspan="3">No Interim Targets</td><td>10%</td></tr>
<tr><td>Smallest Utilities</td><td>All other utilities (31 consumer-owned utilities)</td><td colspan="3">No Interim Targets</td><td>5%</td></tr>
</table>

Senate Bill 838 of 2007 also set a specific goal that by 2025 at least eight percent of Oregon’s retail electrical load comes from small-scale renewable energy projects that are 20 megawatts or less and required that all agencies of executive department establish policies and procedures to meet the goal. Nevertheless, some community wind project developers expressed disappointment with this goal due to the fact that it does not have enough enforcement:

> Oregon has renewable portfolio standard in there that says the goal of renewable portfolio standard is a certain amount and that eight percent has to come from small community-size projects. It’s in the law, but there’s no enforcement. If there’s no will to make it happen, it will not happen.

> My project from a financial standpoint is not as efficient as those large commercial projects that are hundreds of megawatts. That's the scale of economy. They are more cost-effective, but I have more benefits to bring to local community, because I live here. The investors of these projects are in Spain, in Germany, and back in east. [My community project has] less leakage, the money stays here. So Oregon needs to make a decision. Do they want to be like Minnesota [where community projects are successful] or do they want to be everyone else? Oregon needs to do something to stimulate smaller project development. That's what we want to do.

Strategic Goal Two: Energy Policy Act of 2005's Goal

The Section 211 of the Energy Policy Act of 2005 set a goal of building 10,000 MW of non-hydropower renewable energy on public lands by 2015 (109th Congress, 2005). In the same year, the Bureau of Land Management (BLM) in the U.S. Department of the Interior completed a Programmatic Environmental Impact Statement (PEIS) which "evaluated wind energy development on a large scale, established best management practices, and outlined a reasonable way to develop the nation's wind resources" (American Wind Energy Association, 2008: 16). In addition, the BLM amended 52 land use plans to facilitate wind energy development on suitable lands (Bureau of Land Management, 2009). In 2009, Secretary of the Interior Ken Salazar issued a secretarial order establishing the development of renewable energy as a priority for the Department of the Interior and creating a Departmental Task Force on Energy and Climate Change. This Order also amended and clarified Departmental roles and responsibilities in promoting renewable energy (The Secretary of the Interior, 2010). Currently, 20.6 million acres of public lands managed by BLM have wind potential. One hundred and ninety-two rights-of-ways have been authorized for using the lands as production sites. A total of 327 MW of wind energy has been installed on the BLM's lands (Bureau of Land Management, 2009).

Despite the Energy Policy Act of 2005's goal and the BLM's efforts at the federal level, personal attitudes among district managers towards wind energy development vary from district to district in Oregon. Interviews with a number of community wind developers and/or owners whose projects are on the BLM's land indicate that some district managers are very helpful and cooperative in working with wind project developers, while others are not as interested in developing wind:

> We are the first project they [the local BLM district office] pushed through in their district. They don't have much experience [with wind development], but the District Manager was a great guy to work with. When we first sat down with them and discussed the project with them, they told us sage-grouse was their main concern in their district and gave us information on sage-grouse breeding ground and growing ground so that we could find a spot that won't interfere with sage-grouse. Then we worked hand in hand with their biologists to identify an area that was suitable for us but also good for the sage-grouse. We also checked in with the archeologists, the botanists, and etc. at the BLM. They are the Resource Managers. That's what they call them at the BLM. We checked in with all the Resource Managers to make sure the place we had was suitable, so we would not run into any problems down the road. The District Manager was so helpful and gave us names of all the Resource Mangers through the District Office contacts.

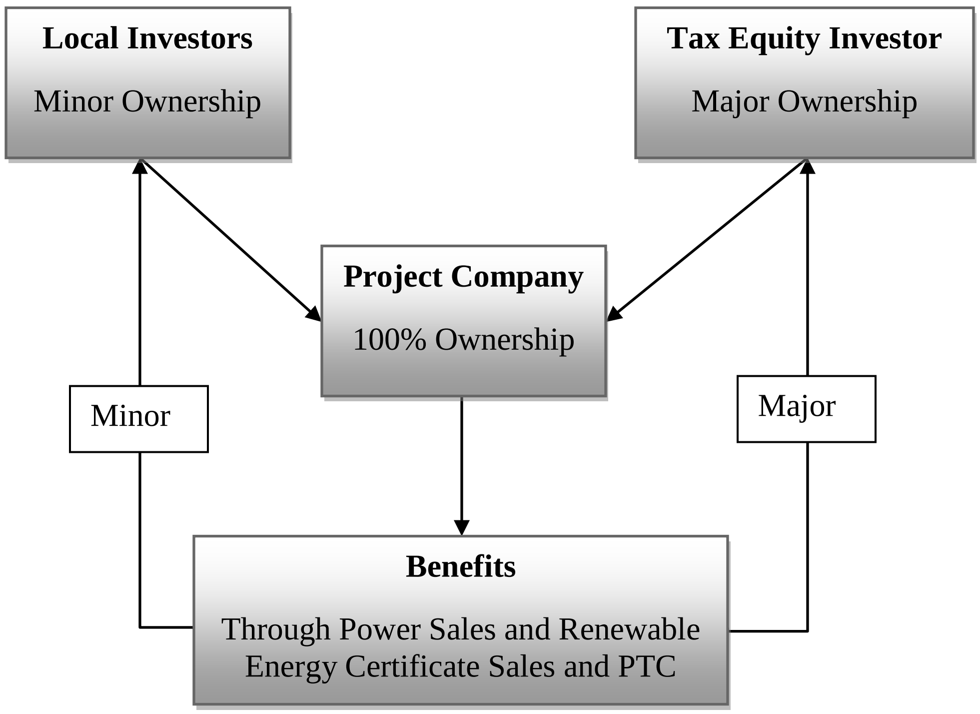
> From my experience, I don't think the BLM is interested in developing wind. At the federal level they have a goal, but at the state level I'm not sure they are interested in wind. Sometimes top-down directives from Washington take a long time to be accepted at the state level. The bureaucracy is moving in this direction and the federal changes the direction and it's slow to take impact. Oregon is very good at protecting a huge number of species under the Endangered Species Act. Everyone thinks that all these species live on every piece of the federal land. It's extremely difficult to get anyone to consider doing something on federal land because it might hurt endangered species whether they are on that site or not. I've only worked with two [BLM District Offices], so I don't know for sure if every BLM's office is the same. There might be some differences on acceptance of wind or other things based on the personalities in that office.

With the strategic goals set, I will explore what the tactical incentives are there to help achieve the goals at federal and state levels? What challenges do they face? I will try to address these questions in the next section.

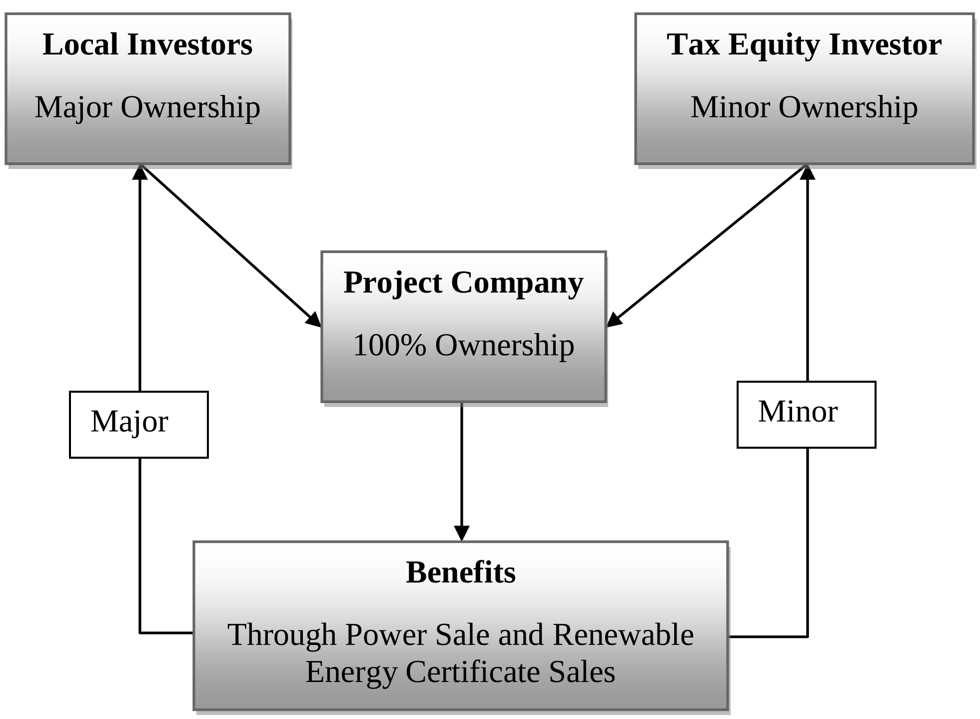
Tactical Incentive One: The Production Tax Credit

The federal Production Tax Credit (PTC) was established by the Energy Policy Act of 1992 to promote renewable energy. At the time of writing, the incentive provides 2.2 cents per kWh for electricity produced from renewable sources, including wind, for the first ten years of operation, which serves as an important financial incentive for renewable energy development (Database of State Incentives for Renewables and Efficiency, 2011).

However, to fully take advantage of PTC, local investors often need to partner with a tax equity investor (often a corporation with large tax credits appetite) and use a "flip" financing structure. In a typical scenario, the tax equity investor provides the majority of the equity for building the project, and receives the majority of the cash and tax benefits out of the project. Once the target internal rate of return has been achieved, which often occurs after the tenth year when the PTC is no longer available, the tax equity investor flips the major ownership of the project back to the local investors and let them receive the major benefits for the remainder of the project life (See Figure 3.4.1) (Bolinger, 2011).



Before the “flip”



After the “flip”

Figure 3.4.1. Ownership Before and After the “Flip”

Since Oregon's Public Utility Regulatory Policy Act (discussed later) provides incentives to community wind projects at 10 MW or less, while their project costs typically don't exceed 25 million dollars, it is difficult to attract large corporations with sufficient tax liability to invest in such small projects. One project developer said in our interview:

> they [the tax equity investors] are a guy in a suit with a lot of money, such as banks. They just say here's our money, you give me your ownership. [After] I used up the tax credits, I give you back your ownership. It's virtually impossible for little projects like mine to find equity investors. [They say] bring me some 30-40 million dollar projects, don't bring me anything less. Don't bring me 5, or 6, or 20 million dollar projects, because nobody wants to mess with it.

A community wind project in Umatilla County has successfully taken advantage of the PTC and used a "flip" structure by bundling a cluster of smaller projects into a large package to attract a tax equity investor. A farmer involved said:

> This wind farm consists of nine smaller projects. So there are actually nine investor groups that own this 64 MW wind farm. There are 32 MW on my farm, and 32 on my neighbor's farm. Of those 32 MW on my farm, I own 5 MW. They [the tax equity investor] own 99% of it and we own 1% of it. After they make a certain return on their investment, internal rate on their investment, then we flip positions. At that point, we will own 95% and they will own 5%. That'll happen in about 12 years supposedly.

It is necessary to note that not every local investor is interested in partnering with outside tax equity investors to utilize the PTC and develop a community wind project jointly. In order to maximize their profits, many local investors want to develop it on their own:

> A lot of companies approached me and said we can develop the project for you, but what they really wanted to do was to own it. I was not interested in that at all. That's not what I wanted. I know more about the project than

> those who are sitting in New York. I cannot see how you can manage the project being back in New York.

Tactical Incentive Two: The Business Energy Investment Tax Credit (ITC) and Section 1603 Grants

The American Recovery and Reinvestment Act of 2009 (ARRA) allows wind energy projects eligible for the PTC to receive either the 30% investment tax credit (ITC) or a 30% Section 1603 cash grant of the total project costs in lieu of PTC for new installations (Database of State Incentives for Renewables and Efficiency, 2010). While the PTC is awarded based on the amount of electricity a project produces, the ITC and the Section 1603 grants don't have to do with the project performance but depend only on how much investors have invested into the project. Since the ARRA, especially the Section 1603 program, had been critically important to community wind projects, many project developers and/or owners were considerably nervous at the end of 2010 when we conducted our interviews, because that was the time when this program was scheduled to expire. Eventually, however, a one-year extension was passed by the Congress as part of the Tax Relief, Unemployment Insurance Reauthorization, and Job Creation Act of 2010 and signed into law by President Barack Obama on December 17, 2010 (Internal Revenue Service, 2011). Some project developers compared the PTC and the 1603 grants and commented:

> The 1603 grant is simple. You just fill out the form and send it in and say I got through building this project and just send me the money. For PTC, you not only have to find somebody who owes so many taxes, but also they got to understand your project well enough to agree to be a partner. And the grant is not based on production; you don't have to be highly productive, so it kind of favors the project that doesn't have as good resources or does not produce that many kilowatts. [For the PTC] if you

> have a very productive site, you produce a lot of kilowatt, and the production tax credits went up. The more you produce, the more tax credits you got. So the grant definitely favors smaller projects. [Due to the expiration of the grant], that's another uncertainty right now. I don't know if it is going to be there a month from now or not.
>
> One-year extension on the 1603 grant option will be huge for us. The grant is up in the air right now, but having a grant option for small wind project is huge. Instead of us having to find a tax equity partner to take advantage of the Production Tax Credits, through the U.S. Treasure Department we can have a grant equal to 30% of the project value. For us, we estimate our project to be 20 to 25 million dollars that's 7 million dollars upfront. The Treasure Department writes us a check upfront. That's huge money upfront, which you don't have to find financing for.
>
> The 1603 grant allows me to go forward when it turns into a grant without bringing in somebody with a lot of money, who is very difficult for small projects to find. They don't want to mess with somebody as small as me.

However, it should be noted that most of the 1603 grants since September 2009 have gone to large foreign corporations such as the Spanish company Iberdrola, and many community wind project developers believe it is those smaller projects that need the grants most (Investigative Reporting Workshop, 2010):

> It's been a huge stimulus in the industry. Unfortunately, a good portion is going to go to large developers. In fact the first two rounds they [the Treasury Department] distribute it, they distributed most of the money to foreign owned companies. It's good to see if we can keep this grant program for community projects, because they don't need that grant as much as we do.

Tactical Incentive Three: Rural Energy for America Program (REAP)

The Rural Energy for America Program (REAP) was enacted by the 2008 Farm Bill and is administered by the U.S. Department of Agriculture (USDA). The program provides grants and/or loan guarantees for the purchase and installation of renewable energy generating systems and for energy efficiency improvements (U.S. Department of

Agriculture, 2010b). The grant program provides up to 25% of the project costs with a maximum of $500,000 per project (U.S. Department of Agriculture, 2010a). The loan guarantee program does not lend but offers loan guarantees to a commercial lender who seeks it, and it can guarantee up to 75% of total project costs with a maximum loan size of $25 million (U.S. Department of Agriculture, 2011b). The REAP program, as mentioned by many project developers in rural Oregon, has been of great help for community wind development. A USDA employee in Oregon commented on the grants and loan guarantees of the REAP program:

> Nationwide, on the grant side, we are overly subscribed, meaning I get more applications than I have money. On the guaranteed loan side, [it's] not the case. I have enough money to fund all these applications in the past several years. [Since] grants are just free money, everybody wants a grant. It is competitive, and we do compete nationwide. And I try to get the money into Oregon you know. That's my job. That's what I get paid to do. I try my best to get that grant money into Oregon to reduce our dependence on fossil fuels in Oregon.

Tactical Incentive Four: The Oregon Business Energy Tax Credits (BETC)

The Oregon Department of Energy offers the Business Energy Tax Credits (BETC) to renewable resource, energy conservation, as well as renewable energy resource equipment manufacturing. For renewable energy projects, the BETC program provides 50 percent of the eligible project costs and is generally taken over five years at ten percent per year (Oregon Department of Energy, 2011b). This incentive had been historically significant in promoting renewable energy including community wind in Oregon until 2010 when the Oregon Legislature made substantial changes through HB 3680 to curtail the program. Major changes included setting tight sunset provisions, imposing caps on overall BETC awards, placing limits on wind facilities, requiring

ODOE to develop a tier system to renewable energy facilities based on cost with a closer scrutiny of higher-cost facilities (Eller, 2010; Stoel Rives, 2010). Almost all the community wind project developers and/or owners in our interviews expressed their disappointment with the current BETC.

> The BETC had been totally a given for years. But now the BETC cannot be used for community wind. Officially the program is still there, but to apply and qualify for it and get it [is very difficult].
>
> Right now the biggest hurdle on my project is the BETC. I applied for the BETC, but got rejected, and now the economics just doesn't work. I cannot build it without the support of BETC.
>
> The community wind in Oregon is dead. There's no way to go forward, [because] the BETC is dead. Basically the system is a lottery system. They put your name in the hat and they pick a couple out. So most of the projects are not going forward.
>
> I think the Legislature just has a short vision. They closed the door on BETC. They just don't understand the value. If they were to give me the 5 million dollars of tax credits to build the project, there's going to be a 25-million dollar project built here that's going to pay property taxes for ever more. It's going to pay taxes for years and years and years. And it'll employ a lot of people over the time. Those are new jobs, and our area doesn't have a lot of jobs. Taxes are paid. I think those benefits will definitely repay the 5 million dollars over time. Their short sightedness is that they need the revenue now.

A project owner felt that some decision makers in the Legislature were confused about how the difference between tax liability and a grant incentive. He stressed that the BETC program reduces a taxpayer's liability, not allocating grant money to renewable energy projects.

> It's narrow vision of politicians who don't understand what the BETC really is. A lot of them think BETC is going to take money out of the general fund and give it back to you. We are saying no you are not doing that. We are just going to give you 50% of our tax liability instead of 100%. Instead of giving you a dollar worth of taxes, because we built this business in Oregon, we are going to give you 50 cents. But isn't 50 cents

> still adding business in Oregon, hiring Oregon employees, building Oregon things? Isn't that a whole lot better than not having built it at all?

In addition to commenting on existing applicable incentives, one project developer also came up with an innovative incentive for policy makers to consider. Two unique characteristics of the proposed incentive include an expanded local ownership and a lower risk associated with the investment. Firstly, the incentive will allow people to buy shares of a wind farm, and they will receive a guaranteed return on their investment. However, it offers differing rates of return to investors depending on their zip codes. Essentially, the closer the investor is to the wind project, the higher rate of return he or she will receive; the further away an investor is located, the lower rate he or she is able to get. This way, the project will be more community-driven because local investment is stimulated and encouraged. Secondly, instead of letting people directly invest into the project, the incentive invites people to invest in the State, and then the State uses that money to loan the wind project, so that people will be more comfortable with the level of risks, because the government will guarantee the investment. The developer explains why it is better and easier for the incentive to be administered by the government rather than by a private company:

> It's hard because it has to be something in the realm of securities. So for us to do this on our own as a company, we'd be subject to the federal Securities and Exchange Commission. That becomes very complicated and very expensive to administer. Also, people will be more comfortable with investing with the State or a government agency, [where] they basically have no risks because the state will back the investment. [The incentive] is a good way to get local people involved, and it's a secure way for people to invest.

Having discussed strategic and operational policies and incentives, I will explore operational, administrative rules that will be encountered in the process of building a community wind project, such as rules about electricity pricing and permitting.

Operational Policy One: The Public Utility Regulatory Policy Act (PURPA)

The 1978 federal Public Utility Regulatory Policy requires that utilities purchase energy from qualifying facilities at avoided cost rates. A qualifying facility refers to a small power production facility of 80 MW or less or a cogeneration facility (Federal Energy Regulatory Commission, 2010). An avoided cost refers to the cost the utility would incur if it were to generate or purchase the same amount of electricity from another source. In 2005, the Oregon Public Utility Commission (OPUC) issued Order 05-584 related to PURPA policies, requiring the three Investor-Owned Utilities (IOUs)-PacifiCorp, Portland General Electric (PGE), and Idaho Power-to provide standard rates and a Commission-approved 20-year standard contract for facilities up to 10 MW (Oregon Public Utility Commission, 2005). Although the Consumer-Owned Utilities (COUs) need to follow the federal PURPA, they are not bound to Order 05-584 and can file their current avoided cost at the Bonneville Power Administration (BPA) rate, which is much lower than the avoided costs filed by Investor-Owned Utilities (IOUs) (Northwest Community Energy, 2011). Since 2005, Oregon has witnessed substantial efforts in building community wind with a capacity of no more than 10 MW and selling power to the IOUs. Some project developers described:

> In the PURPA laws there’s a guaranteed power purchase agreement for projects 10 MW or under so you don’t have to go through a negotiation process. That’s very enticing. That’s just the main reason we are looking at 10 MW projects.
>
> It’s good if you didn’t have the ability to insist that they buy your power. [Due to the small capacity], you may not get them even consider buying your power.

With regard to power pricing, the OPUC Order requires the IOUs to provide three pricing options for eligible projects (with an exception that PGE has to offer a fourth one): the Fixed Price Method, the Deadband Method, and the Gas Market Method. Under the Fixed Price Method, the utility will pay a fixed price based on a single set of forecasted natural gas prices in the utility’s last approved avoided cost filing. The other two methods based the rates on monthly natural gas price indexes, but the Deadband method bounds the rates within 90 percent and 110 percent of the natural gas price forecast used in the Fixed Price Method, whereas the Gas Market Method uses a monthly indexed price with no natural gas price forecast (Oregon Public Utility Commission, 2005). It is apparent that in Oregon the “avoided costs” are based on how much costs are avoided if the power is generated from natural gas, and thus the profitability of community wind depends on how the natural gas market functions. Two project developers felt lucky about the timing of their power purchase agreements with the IOUs.

> Oregon PUC told PGE that they had to file the avoided cost pricing based on the cost of energy from natural gas fired plant. When my agreement with [PGE] was made in 2008, natural gas price was high. Now the natural gas price is very low, and it’s projected to be low for many years. Every 2 years, PGE will re-file and update avoided costs every two years. So the next file you see, it’ll be much lower avoided cost.
>
> The [avoided cost] rates have set back down since the natural gas price dropped. We got the power purchase agreement when natural gas was going up. I didn’t negotiate with Idaho Power. It’s a standard rate schedule that is submitted to the OPUC for approval. That’s done every two years.

> If you look at the natural gas graph over the past few years, you will see it shot up very high, and I got in on that schedule. Now it just adopted a new schedule that has a slight reduction based on natural gases price coming back down.

Some project developers suggested that a feed-in tariff may work better than the PURPA payments. Feed-in tariff policies are available in more than 40 countries and have successfully stimulated renewable energy development particularly in Europe with Germany and Denmark at the forefront (Cory et al., 2009). Typically, a feed-in tariff guarantees grid access, long-term contracts, and power prices based on the cost of renewable energy generation plus a reasonable profit, instead of an avoided cost associated with another traditional source such as natural gas. Under PURPA, pricing is based on the projection of avoided costs, which oftentimes diverges greatly from actual prices (Couture, 2009). Currently the feed-in tariff is available in Oregon only for solar energy on a limited, pilot-scale basis for projects within PGE, Pacific Power, and Idaho Power service territory, but in order to promote renewable energy, policy-makers should consider applying feed-in tariff to other renewable energy types such as wind energy.

Operational Policy Two: Conditional Use Permit (CUP) vs. Energy Facility Siting Council (EFSC) Certificate

Once a community wind project identifies a suitable location with good wind resources, it will need to pursue permits from the permitting authority to be allowed to build the project at the chosen site. In Oregon, county governments are authorized to approve wind energy projects up to 104 MW. Community wind projects with less than a 10 MW capacity, therefore, are typically permitted under the County’s jurisdictions. The process typically involves compliance with land use zoning regulations, applying for a

Conditional Use Permit (CUP), as well as applying for building, road, and other permits (Northwest Sustainable Energy for Economic Development, 2006). To apply for the CUP, wind projects oftentimes need to submit Project Description, Project Map including transmission route, potential impacts to accepted farm and forest practices on surrounding areas, avian impact monitoring plan, Fire Protection and Emergency Response Plan, Erosion Control Plan, Weed Control Plan, impacts on affected communities or individuals, impacts to wetlands, wildlife, wildlife habitat, criminal activities, dismantling and decommissioning plan, bond or irrevocable letter of credit for the decommissioning fund, etc (Northwest Sustainable Energy for Economic Development, 2006). Then, a public hearing will be held by the County Planning Commission to solicit public feedback on the proposed project. The County will also notify other related departments or agencies and coordinate their responses to the project (Land Conservation and Development Deparment, 2011). An experienced County Planner explained how the coordination works as follows. In the end, if certain conditions are met, a CUP will be issued to grant permission to build the project.

> The way land use works in Oregon is that they will make an application for a land use permit, and we then notify any state and local agency that would have any involvement, so even though we issue the land use permit, it’s kind of a comprehensive review of the permitting for the project. It could be the Water Resources Department, the Department of State Lands, the Department of Environmental Quality, the local Soil Water Conservation District, the Watershed Council, the state Highway Division, the County Transportation, etc. Particularly during construction, there are a lot of activities with quite a bit impact. We do some coordination through the State Agency Coordination Program. [In terms of which agency to notify], we gave an educated guess on what agencies will be involved. [But now] we have had enough experience and a general idea which agency [to notify]. It also varies depending on the project.

Despite the fact that wind projects 105 MW or larger in size fall into the Oregon Energy Facility Siting Council (EFSC)'s jurisdiction to be sited, smaller projects like community wind may also opt into the state siting process, rather than pursuing a CUP through a county government (Oregon Department of Energy, 2011c). The project will then need to go through a formal process to obtain a Site Certificate issued by the EFSC. For projects facing significant public opposition, it may be safer to permit with the EFSC, because the "permitting is more objective, being standards-based rather than politically-based, and there is a clear and more expeditious appeal path" (Northwest Sustainable Energy for Economic Development, 2006: 43). However, the costs associated with the EFSC prevent small-scale community wind projects from choosing the option. Some government employees compared the costs of a CUP and an EFSC Site Certificate.

> The down side of going EFSC is that it's a minimum of 100,000 dollars, because you have to pay for their time. What EFSC does is that they build the case, so it's ready to go to the Oregon Supreme Court [in case the other party appeals]. What it means is that it's very expensive. Legal fees, staff costs, you have to pay for them to put together a package. It is very expensive, whereas a Conditional Use Permit here is less than 1000 dollars.

An example of a golf course was used to show how tedious and lengthy the appeal process can be in the CUP process and why the EFSC is more expeditious for siting a project.

> One of the reasons is that the conditional use permit can be appealed to LUBA which is the Land Use Board of Appeals. It can go from LUBA to the Court of Appeals. If the Supreme Court wants to take it, you can go all the way to the Supreme Court. Many times it goes to the LUBA and it gets rejected and sent back to the County under remand. The County has to have a hearing over again. And then it goes back to LUBA and maybe up to the Court of Appeals. The Court of Appeals sent back to LUBA. The LUBA sends it back to the County. We did that for a golf course. It took seven years. But if you go to EFSC, there's only one appeal that directly

> goes to the Oregon Supreme Court. And they [the wind projects] have never lost a case in the Supreme Court [because] they build their case so well. It'll give you much time certainly. And much more chance to win. Especially you have an area that is not so crazing about having the project. If a Conditional Use Permit goes well, it's much cheaper and much faster. But if you know there are people who are going to fight you for the rest of your life, and you have the money, then you probably would want the EFSC.

The extent to which public input is involved also distinguishes the CUP and the EFSC Certificate. The CUP is issued by a County government that is held accountable to local people, whereas the Certificate is issued by the EFSC, which consists of seven members who are appointed by the governor and confirmed by the Oregon Senate (Oregon Department of Energy, 2011d). A county government employee said:

> The whole purpose of the Conditional Use Permit is to gather input. So that particular application process factors in citizens' input more than any other things of that type, whereas the EFSC they'll hold hearings but you got to point to something very specific in the law or they'll just discard the community. Just because people don't like it doesn't matter, [because] the EFSC people are not elected by the local people.

Operational Policy Three: National Environmental Policy Act (NEPA) Review

As private land suitable for developing wind energy diminishes in Oregon, community wind developers start exploring federal land for ideal locations to site their projects. Pursuant to federal law, when federal agencies site a project within their jurisdictions, they are required to evaluate the impacts of the construction, operation, and maintenance of the project on the human environment through the National Environmental Policy Act (NEPA) review before decisions are made (Stoel Rives, 2009). In Oregon, the BLM manages more than 15 million acres of public land and has been involved in permitting wind project more than other federal agencies, and efforts in building community wind have increasingly emerged on their land. A BLM employee describes the balance between renewable energy development and the NEPA process as follows:

> Our authorizations for the land disturbing activities have to go through the National Environmental Protection Act [NEPA]. That's the biggest thing we have to do. So every office [at BLM] has to follow the NEPA process. Who is proposing a project, any project, what they are planning on doing, and why… we run that through the NEPA process, which includes public input, decision making and everything. Every BLM office has to do that. Now there are maybe a few differences in policy between districts and offices based on their Resources Management Plan as to what may be allowed in a certain area or not , but we try to be as consistent as possible. In other words, we try to be consistent, but we also try to look at individual sites. It's hard to balance. We have to mitigate the environmental impacts and weigh the resources that may be affected with the other direction we are given, which is to facilitate renewable energy development. So we are trying to balance that.

In the NEPA review there are two types of documents: Environmental Assessments (EAs) and Environmental Impact Statements (EISs), both of which involve public input. If certain proposed actions fall under the categories that have been determined to have insignificant effects on the human environment, they can be categorically excluded from further NEPA review and will be documented in the Categorical Exclusion (CX) review, which typically is not subject to public review (See Figure 3.4.2) (Bureau of Land Management, 2011). A wind project often starts with an application for a short-term right-of-way through a CX review for testing sites where meteorological towers are put on.

> Usually, they first file an application for testing. That's considered a Right-Of-Way Grant, so we are giving you an authorization. It's usually used to set up meteorological towers to test an area. Now we only allow one company in one area, so we won't let another company come in to this area while they are testing. But they cannot hold testing forever. Within 2

> years, they either have to say we are going to develop it, or we are going to get out. So that would be the first step. But if they want to do a more intensive testing or disturb any land, you'll have to go through the NEPA process.

If the testing results turn out to be positive, the company will need to turn in a preliminary Plan Of Development (POD) to tell the BLM what they intend to do and how they are going to carry out the plan. Next, the BLM will analyze the POD to see how significant their impacts are and whether they need to do an EA or an EIS. The difference between the two documents lies in the degree of impacts the project will have on the human environment. A BLM employee explained:

> If their proposed impacts are what we call Significant Impact, which is a legal term under the NEPA, they'll have to go through the EIS, which is a much more in-depth NEPA document. If the impact is not likely to be significant or is not certain, they'll do the EA. The EIS takes longer and has more public involvement. We will send out both drafts and final EIS to the public to get comments before we make a decision called Record of Decision. Under the EA, you don't have a draft, just an EA, and then make a decision called the Decision Record. The key difference eventually is that in the EA there's no significant impact, whereas in the EIS we actually see there's a significant impact, but we are ok with it, because we make all these mitigations, and we are willing to accept it. Sometimes when we get appealed, people appeal because as we are doing the EA, they think we should have done the EIS, because they think there's a significant impact.

With community wind in Oregon typically being 10 MW or less, their impacts are generally considered insignificant on the environment by the BLM standards. Therefore, they are allowed to do the EA rather than the EIS for the NEPA review (See Figure 3.4.2). Two project developers talked about their experiences with the EA:

> Environmental Impact Study is much more detailed and much more involved. Environmental Assessment is a little bit less involved for projects with a smaller impact. The BLM has told us that they believe

we’ll be able to use the Environmental Assessment for our project, but now we haven’t started the NEPA process yet.

The EIS is more restricted than the EA. I cannot afford to do the EIS. It is for larger projects. Generally the EA requires we study the impacts of what we would have. So you look if you are going to have any archeological, historical, or environmental impacts. Are you going to have impacts on wildlife to birds? You look at all of those, and you analyze as best as you can what impacts you are going to have. If the impacts are not significant and the EA is approved, you receive what they refer to as FONSI, the Finding Of No Significant Impacts, and a Decision Record. The next step is to request a ROW, the Right-Of-Way.

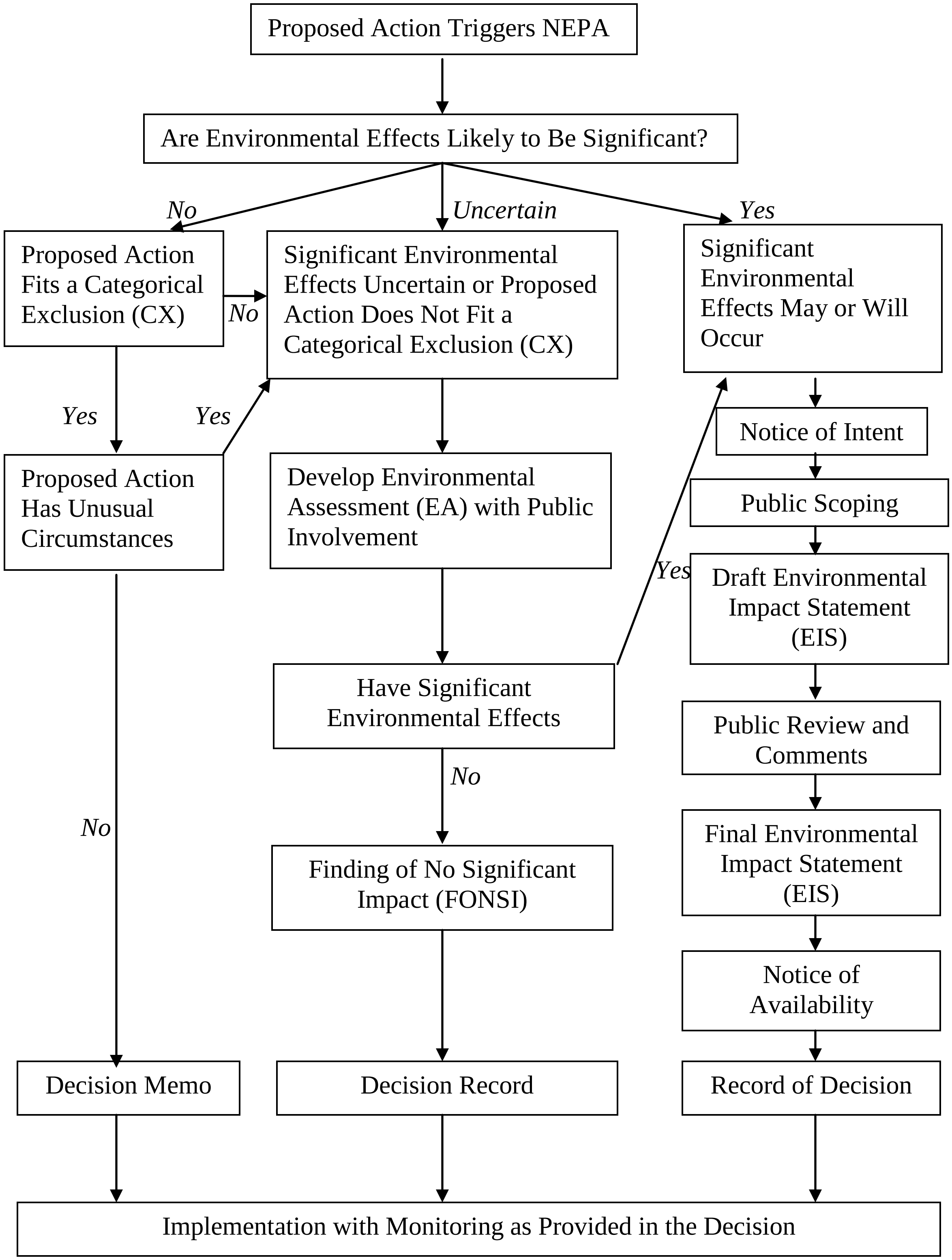


Figure 3.4.2. The National Environmental Policy Act (NEPA) Process (Bureau of Land Management, 2011)

3.5. Discussion

This chapter has analyzed important policies and incentives applicable to community wind in Oregon from strategic, tactical and operational perspectives using the framework developed by Stephens et al. (See Figure 3.5.1). The methodology utilizes semi-structured interviews with project developers and/or owners, as well as government officials who have profound experience with wind development at a community scale.

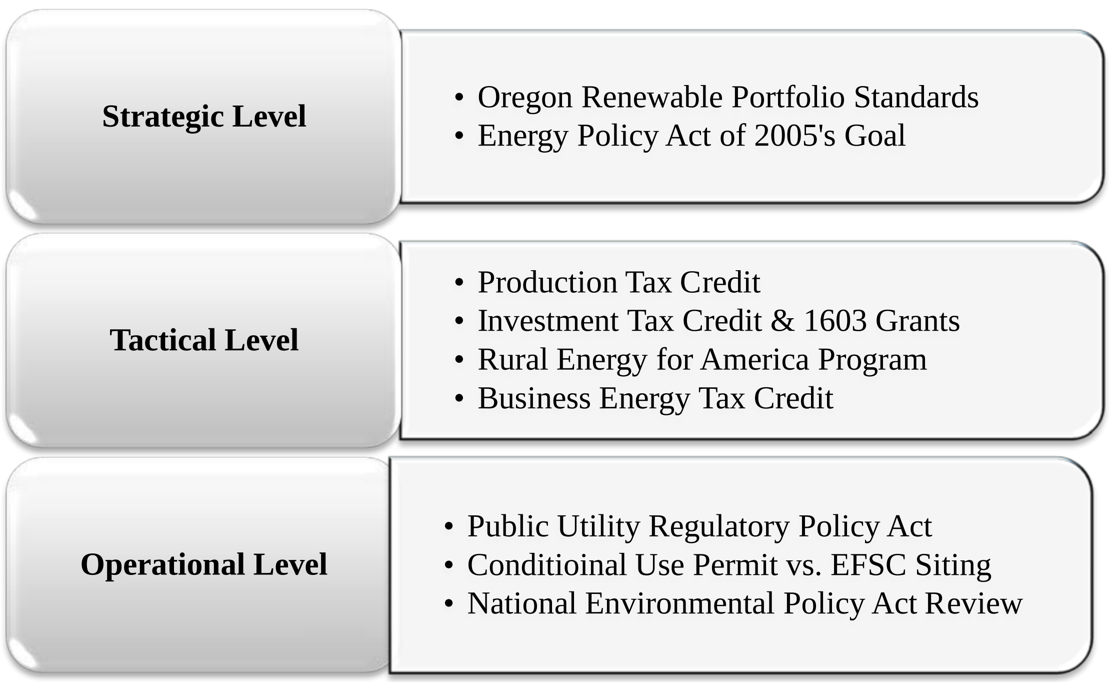


Figure 3.5.1. Policies and Incentives Analyzed

It should be noted that this chapter does not present an exhaustive list of policies and incentives in place for community wind, but is focused upon the most often recurring ones identified in the interviews. Many other important incentives and policies, which the author does not have an opportunity to discuss here, include the Renewable Energy Production Incentive (REPI), Accelerated Depreciation, Property Tax Exemptions, Oregon State Energy Loan Program (SELP), Oregon Community Renewable Energy

Feasibility Fund (CREFF), and so on. However, the results included in the chapter convey some essential messages to policy makers as well as those who are interested in developing community wind. Those are:

- *The Oregon Renewable Portfolio Standard* will need more enforcement to be able to achieve its goal that eight percent of Oregon's retail electrical load comes from small-scale renewable energy projects by 2025.
- *The Energy Policy Act of 2005* set a goal for public lands to have 10,000 MW of non-hydropower renewable energy by 2015, but local offices of federal agencies, such as the BLM, vary in attitudes towards renewable energy.
- *The Production Tax Credit* is difficult to be used by community wind projects due to the fact that tax equity investors are not very attracted by projects at a small scale.
- *The 1603 Grant* option based on the cost of a project rather than the project performance has been extremely helpful for community wind.
- *The Rural Energy for America Program* faces insufficient funding for its grant option and receives many more grant applications than it has the ability to fund.
- *The Oregon Business Energy Tax Credits* has substantially changed over the past few years from being a "given" to a "lottery system" where community wind has little or no chance of receiving the credits because other renewable energy types such as solar and geothermal are given more priority.
- *The Public Utility Regulatory Policy Act with the Oregon Order 05-584* links prices of wind power to the forecasted price of natural gas. Feed-in tariff may be a

good option to avoid inaccurate forecast and recognize positive externalities of renewable energy production by basing prices on the cost of wind generation.

- Community wind developers may prefer pursuing a *Conditional Use Permit* from their County government to applying for a *Site Certificate* from the Energy Facility Siting Council.
- Siting a project on the BLM's land requires going through the *National Environmental Policy Act* review process, and a community wind project is likely to use the Environmental Assessment rather than the Environmental Impact Statement because of limited impacts on human environment.

In addition, allowing people to invest in community wind projects through state government and guaranteeing them with different rates of return depending on their zip codes may be an effective way to expand local ownership and increase acceptance for wind projects by local communities, because the closer a resident, the higher return he receives.

To summarize, the SPEED framework is a useful framework to structure policies and incentives applicable to community wind in Oregon. If we would like to see more distributed, locally owned, small-scale wind projects, the governments, both federal and state, will need to have more enforcement at the strategic level, more incentives at the tactical level, and more streamlined policies at the operational level. Otherwise, it is difficult for such projects to survive in today's policy context.

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4. AN ANALYSIS OF EMPIRICAL CASES OF COMMUNITY WIND IN OREGON

Keywords: empirical, cases, community wind, Oregon

4.1. Abstract

Recently, a new type of ownership has emerged in the wind energy sector in the U.S. that is referred to as community wind. With the fact that there is little literature on empirical experience of such smaller community based projects, this chapter attempts to present seven community wind cases in Oregon to identify opportunities and barriers and so to provide practical information to those who are interested in developing community wind.

4.2. Introduction

Global concerns with climate change, energy security, and public health have substantially driven the boom of wind industry over the past few years. But until recently, the U.S. had not witnessed a unconventional structure of wind farms referred to as community wind, which on the other hand has been around in Denmark, Germany, the Netherlands, and the United Kingdom, and many other European countries for a long time (Bolinger, 2001). Due to the young age of the ownership structure, little empirical research has been conducted on community wind, not to mention such projects specifically in Oregon. Therefore, this chapter attempts to present Oregon's experience by showcasing seven projects and discussing opportunities and barriers that community wind faces.

Unlike traditional absentee-owned large wind farms, community wind typically is characterized by local ownership and a small size. It often "consists of relatively small utility-scale wind power projects that sell power on the wholesale market and that are developed and owned primarily by local investors" (Bolinger, 2011: 1). We use this definition for the purpose of this chapter, and make sure all the cases selected fit with the definition. It is necessary to point out that by local investors, we mean investors from within Oregon. There is no doubt it will be economically better for a project to be owned by members from the same town, city, or county, because profits will stay in the same town, city, or county. However, we don't discriminate against projects that are owned by members from a different location within Oregon. For example, one case in this chapter is about a project located in Lake County but owned by a company based in Portland since the profits will still stay in Oregon, we consider it as owned by local investors.

4.3. Methodology

In December 2010, I conducted 12 ethnographic interviews with project developers, project owners, and governmental officials in Oregon for seven empirical case studies discussed next. The case studies were intended to identify opportunities and barriers for community wind energy development. The seven projects include PáTu Wind Farm and Sayrs Wind Farm in Sherman County, Middle Mountain Project in Hood River County, Mid-Columbia Council of Government's Project in Gilliam County, Big Valley Wind Project in Lake County, Lime Wind in Baker County, and Butter Creek Power in Umatilla County, and they were suggested by personnel at Oregon Department of Agriculture, Oregon Department of Energy, as well as the Community Renewable Energy Association. The interviews followed a semi-structured technique and were recorded using a voice recorder. I next transcribed all the interviews from the voice recorder to texts.

I utilize the Actor-Network Theory (ANT) to analyze all the interview results. The theory is a qualitative social approach that emphasizes surrounding factors, both human and non-human, involved in the interaction between technology and society. According to the ANT, every factor has different interests and constantly seeks to persuade others to agree with his or her own interests so as to form an alignment with him. As the persuasive process takes place, the relationship between actors is created, and an actor-network is produced, which captures the “technicalities’ and the ‘socialities’ in the local context (Jolivet and Heiskanen, 2010; Ryder, 2011).

Traditionally, the ANT was applied only to situations involving technological innovation, but recently the theory has been successfully applied to the field of technological deployment, such as wind energy (Loring, 2007). For example, a study on a wind farm project in southern France used the ANT to look at the material aspects of the technology, the characteristics of the construction site, the public participation process, as well as the social dynamics around the project to examine the non-human and human factors that can determine success or failure of the project (Jolivet and Heiskanen, 2010). The authors explained why the ANT worked very well for wind energy analysis:

> Setting up a wind turbine is a hybrid engineering problem as it touches on the technology of the wind turbines, the geo-physics of various possible locations, the geo-chemistry of climate change, the technology of wind turbines, the economics of wind farming, but also human engineering in the form of the legal intricacies of permitting processes, as well as the psychologies and sociologies of the people involved in the project management, and the acceptance of local actors (Jolivet and Heiskanen, 2010: 6748).

Also, another research project has adopted the ANT to specifically analyze community wind development in Japan, and Figure 4.3.1. illustrates the major factors and their relationships identified by the study (Maruyama et al., 2007). Similar to these previous studies, this chapter attempts to apply the ANT to identify major factors which significantly influence the outcome of each case, and the relationships between the major factors.

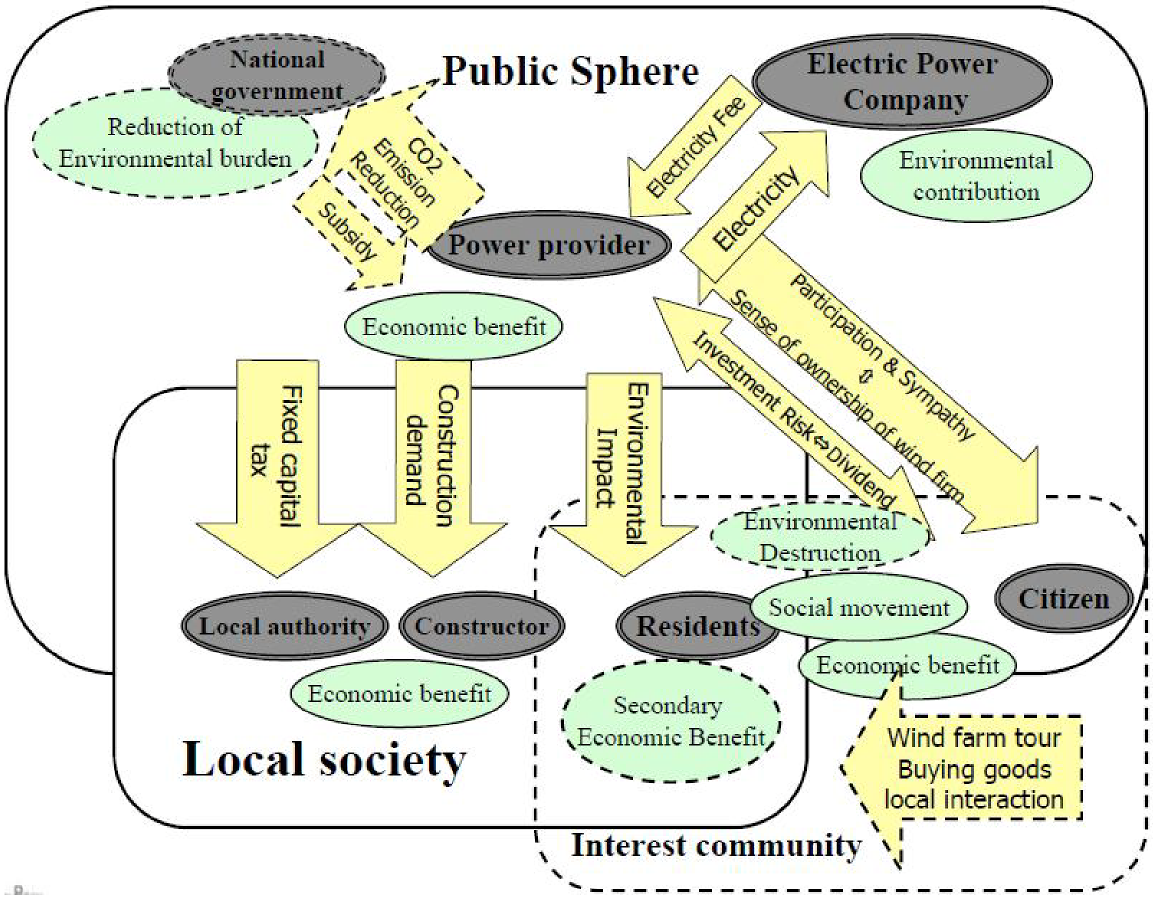

Figure 4.3.1. An Example of Applying Actor-Network Theory (ANT) to Community Wind in Japan (Maruyama et al., 2007) (Permission to cite from author obtained on April 10, 2011)

4.4. Results

Case One: PáTu Wind Farm, LLC

Project Description

By December 1, 2010, the PáTu Wind Farm was up and running on Hilderbrand family's farmland in Wasco, Sherman County, Oregon. Brothers Ormand Hilderbrand

and Jeff Hilderbrand are the owners and developers of the project. PáTu's capacity is nine MW in total, consisting of six General Electric 1.5 MW turbines. The wind farm has created over 40 jobs during the construction phase and will hire approximately 15 part time employees during Operations and Maintenance phase. It is projected that the PáTu Wind Farm will pay $1.2 million in property taxes to the local government over the next 15 year period.

In 2001, the Hilderbrand family leased the wind rights of their land to a company called PPM Energy (the predecessor of Iberdrola, the world's leading provider of wind power), who wanted to develop wind energy projects Klondike I, Klondike II, and Klondike III in Sherman County (Iberdrola Renewables, 2011). After hundreds of megawatts of turbines were installed, the company decided not to develop a small portion of Hilderbrand's land in 2005 due to uncertainty of renewal of the Production Tax Credit (PTC) at that time. The Hilderbrand brothers grasped this opportunity, gained back the wind rights associated with the small piece of land, and formed the Oregon Trail Wind Farm, LLC. With that, their long and rough journey of developing community wind had begun.

In early 2008, the Oregon Trail Wind Farm, LLC, and MMA Renewable Ventures (who would help find tax equity investors with a need for the PTC and also help put together the construction financing for the project) established a partnership and created the PáTu Wind Farm, LLC (Bolinger, 2011). Their original plan was to take advantage of the PTC and use a "flip" structure for financing. In a "flip" model, PáTu needs to find a tax equity investor who provides the majority of the equity for building the project and receives the majority of the cash and tax benefits (i.e. the PTC) from the project.

However, once the target internal rate of return has been achieved, which often occurs after the tenth year when the PTC is no longer available, the tax equity investor flips the major ownership of the project back to PáTu and let them receive the major benefits for the remainder of the project life.

Around July 2008, it was unclear whether the U.S. Congress would renew the PTC which was scheduled to expire on December 31 of that year. Therefore, many large wind developers such as Iberdrola pressed manufacturers very hard to get their turbines delivered as early as possible so that their projects could start generating power and qualify for the PTC before it expired. Unfortunately, small projects like PáTu would not be able to influence manufacturers and have their turbines delivered early enough to make the PTC deadline. Not knowing when the PTC would be extended, but knowing PáTu would not receive the PTC of 2008, one of the primary tax equity investors pulled out.

In the second half of 2008, the financial crisis broke. Although the PTC was eventually extended in October, potential tax equity investors who would provide money for the PTC from PáTu, such as Lehman Brothers, Wells Fargo and Bear Stearns, were wiped out by the crisis. Furthermore, the parent company of MMA Renewable Ventures (one component of PáTu), MMA, did not survive the financial hit, and thus sold the subsidiary to a Spanish company Fotowatio (Wang, 2009). Since MMA Renewable Ventures specialized more in solar energy, and in fact PáTu was the first wind project that they were going to do, Fotowatio was more interested in their solar assets, not wind. The Oregon Trail Wind Farm, LLC, decided to buy the assets back from Fotowatio in early 2009, and abandoned the traditional "flip" structure for an innovative financing solution (Morrigan, 2010).

Factors that Lead to Success

Put aside the financing piece for a moment and look at other basic elements available that are necessary for the success of PáTu in the future.

- **Land availability:** Since the Hilderbrand family owned the land that the PáTu Wind Farm was going to sit on, the project did not have to worry about securing land.
- **Good Wind Resources:** The site had good wind resources, which was verified by the success of surrounding large wind projects such as Klondike and Biglow. PáTu obtained a two-year wind data collected by PPM Energy who eventually decided not to develop wind energy on the site. To analyze the data, PáTu hired an internationally known analyst so that banks will find the results more reliable.
- **Access to Transmission Line:** PáTu was fortunate to apply early for the transmission through Bonneville Power Administration (BPA) to sell power to Portland General Electric (PGE), because later the space on BPA's transmission was used up quickly. First, the power generated by PáTu comes out of the on-site substation and interconnects to the Wasco Electric Cooperative. From there, it goes to BPA's DeMoss Substation and then travels through BPA's transmission line to BPA's Big Eddy Substation in The Dalles. Next, it'll be delivered to Troutdale Substation, which is the point of delivery for both PGE and PacifiCorp (See Figure 4.4.1).

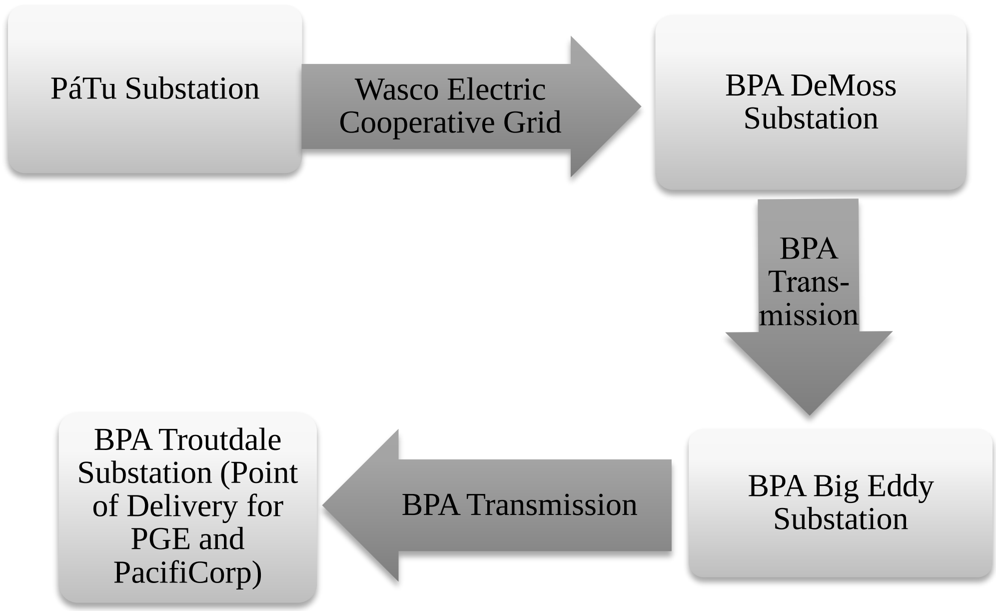

Figure 4.4.1. Delivery Path of PáTu Power

- **Power Sale to PGE:** In 2005, the Oregon Public Utility Commission (OPUC) issued Order 05-584, requiring the three Investor-Owned Utilities (IOUs)-PacifiCorp, Portland General Electric (PGE), and Idaho Power-to provide standard rates and a Commission-approved 20-year standard contract for facilities up to 10 MW (Oregon Public Utility Commission, 2005). PáTu secured the power sale with PGE through this rule. The project developer commented on the significance of Order 05-584:

  That's a huge deal, because I don't have to go out and find buyers. I know what my sales are going to be. I know what my wind resources are going to be. We have very reliable wind turbines with GE. So we can take a lot of risk out of the project.

- **Free of Wildlife Habitats:** Sherman County does not have significant wildlife habitats, and therefore there are few environmental concerns associated with energy development (Brenner, 2010).
- **Social Acceptance:** The county has been a home of many large wind energy projects, such as Klondike I, II, and III. Residents in the county are supportive of wind energy development. The project developer recalled the public hearing involved in PáTu's application for the Conditional Use Permit from the County:

  > The public hearing for our project was very easy. The county wants renewable energy. So our county has been very receptive to the development. Other counties are different. Here is much better. The land use permitting was approved in 2006. And the local residents are supportive of the project. The major benefit of project is taxes and employment.

- **Securing Oregon Business Energy Tax Credits (BETC):** Oregon BETC program provides 50 percent of the eligible project costs and is generally taken over five years at ten percent per year (Oregon Department of Energy, 2011b). The BETC also has a "pass-through" option that allows a project owner to transfer the tax credits to a pass-through partner in return for a lump-sum, discounted cash payment upon completion of the project (Oregon Department of Energy, 2011a). PáTu received the pre-certification of the BETC in December 2006 and will use the Pass-Through option to build its financing structure. Although the state government later made substantial changes to the BETC, PáTu would not be affected for the reason that it had been pre-certified under the old rules.
- **Securing State Energy Loan Program (SELP):** PáTu also was approved for a $12 million loan from Oregon's SELP program, which provides long-term

financing for renewable energy projects by issuing bonds. PáTu is the first utility-scale wind project that receives SELP's loan (Bolinger, 2011).

- **Grant in lieu of Investment Tax Credit (ITC):** The immediate factor that allowed PáTu to give up the Production Tax Credits (which is prone to the instability of financial sector) and abandon the conventional "flip" structure was the passage of the American Recovery and Reinvestment Act of 2009 (ARRA) in February, 2009. The ARRA let wind energy projects eligible for the PTC receive either the 30% investment tax credit (ITC) or a 30% cash grant in lieu of the ITC from the Treasury Department. While the PTC is awarded based on the amount of electricity a project produces, the ITC and the grants don't have to do with the project performance but depend only on how much investors have invested into a project. With this, it will be much easier for PáTu to attract investors and finance itself. The project developer commented on the ARRA 2009:

  > The Congress passed the ARRA 2009 which enabled us to utilize the Investment Tax Credit instead of the Production Tax Credit. That was absolutely critical, because the ITC is based on how much you invest, not how much you produce. So it's much easier to find people who can value the investment tax credits. More importantly, they have what is called Grant in lieu of the ITC. It meant instead of me trying to find people who would purchase that tax credit, I can get a direct grant for the value of ITC directly from the U.S. Department of Treasury. That was a huge help.

- **Construction Financing:** The government incentives that PáTu lined up (i.e. the BETC, the SELP, the ITC grants) for long-term finance, however, will not be available until the project is completed and operational. So the big piece PáTu lacked was construction financing. PáTu attempted to ask banks for a construction loan, but the efforts only ended up in frustration due to the size of the project. The project developer said:

> I can show banks that I have a lot of pieces in place. But still people like California Banks, U.S. Banks, Wells Fargo, Bank of America…any bank I talked to, felt the project was too small for them. I wanted to borrow 20 million dollars for construction finance, and one person in U.S. Bank in Denver said we would like to work with you but you need to borrow at least 200 million. It's not worth our time and effort to do a 20 million dollar loan. Too small. Even though I had all the pieces back here after-construction finance, I still cannot have the construction finance.

Fortunately, the Section 6108 in the 2008 Farm Bill created a critical opportunity for PáTu. The new rule authorizes the USDA to make loans for renewable energy projects that serve rural and non-rural residents. Traditionally, these kinds of loans targeted projects serving rural areas only, but with the modification, projects like PáTu who sell power to investor-owned utilities can qualify (U.S. Department of Agriculture, 2011a). Therefore, PáTu received a construction loan from CoBank, a cooperative bank in the Farm Credit System, which typically lends to rural cooperatives. The project developer mentioned:

> CoBank in the past could only lend to rural cooperatives, and they lent a lot of money to rural electrification cooperatives. Our small cooperative here, Wasco Electrical Cooperative, borrowed money from CoBank. Cobank also lends money for wind energy in the Midwest, so they understand renewable energy. But they couldn't loan to me directly, because I'm not a rural cooperative. When the U.S. Congress passed the Farm Bill in there with the provision, we went forward discussing with CoBank how to make all these pieces fit. In October 2009, we got a $16.5 million loan for the construction.

Despite the $16.5 million from CoBank, to be able to construct this $22 million project, PáTu still needed to find another $5.5 million from other sources. The gap was eventually filled by two wealthy families willing to provide equity investment as well as a loan offered by the project developer. The Hilderbrand brothers will try to buy out the equity investors at the end of the fifth year of operations (Bolinger, 2011).

Summarizing Barriers and Opportunities

In 2001, the Hilderbrand family leased the wind rights of their land to a company called PPM Energy. In 2005, the company decided not to develop a small portion of Hilderbrand's land, and the landowners became interested in developing wind energy on their own so they established Oregon Trail Wind Farm, LLC. In 2006, the wind farm applied for the BETC and received preliminary certification of the tax credits in the December of the same year. In 2008, Oregon Trail Wind Farm partnered with MMA Renewable Ventures, and the partnership company is known as PáTu Wind Farm, LLC. Their original plan was to use the Production Tax Credit, but the financial crisis broke in late 2008, and MMA Renewable Ventures was sold to Fotowatio in March 2009. In addition, the tax equity investors that PáTu attempted to seek, such as Lehman Brothers, collapsed during the crisis. Fortunately, in February 2009, the Congress passed the ARRA 2009, which enabled PáTu to utilize of the Investment Tax Credit grant option instead of Production Tax Credit. In July 2009, CoBank was authorized to provide construction loans to renewable energy projects in rural America. In October of the same year, CoBank agreed to provide a 16.5-million construction loan to PáTu. Not long after, two families with investment capital offered a five-million equity, and the project developer also provided a small loan to the project. Since December 2010, the PáTu Wind Farm has been generating wind energy.

The biggest challenge for PáTu has come from financing. Difficulties associated with the PTC, disappearance of potential investors due to collapse of financial sector and changed ownership of the partner company MMA Renewable Ventures have all created tremendous barriers to this community wind project. Also, when PáTu decided to give up the “flip” structure and develop the project on its own, big banks were not interested in lending a construction loan to the project due to its small size (See Figure 4.4.2).

However, on the other hand, there were opportunities that emerged in the course of building PáTu, which turned out to be definitely critical for the success the project. For example, passage of ARRA 2009 and the Section 6108 in the 2008 Farm Bill, as well as having two wealthy families as equity investors, provided timely and great relief to PáTu, for both long-term financing and short-term financing. In addition, being surrounded by other large wind energy projects gave PáTu substantial advantages. The developer said:

> I couldn’t have done this project without the larger ones already being here. Even just the basic operations. The availability of large cranes to erect towers. The cranes that erect towers took 27 trucks to bring in here and cost more than one million dollars just to transport them and set it up. The cranes are already here because of the big projects. If I were the only one project here, it would not have happened. Also, I’m not qualified to maintain the equipment. I had to hire people to maintain that. The maintenance company is now based in here. They are French company that specializes in renewable energy. So they have a basic operation here right now. They would not have been here without those larger projects being here. The bank would not have financed me if I could not maintain the equipment on a reliable basis.

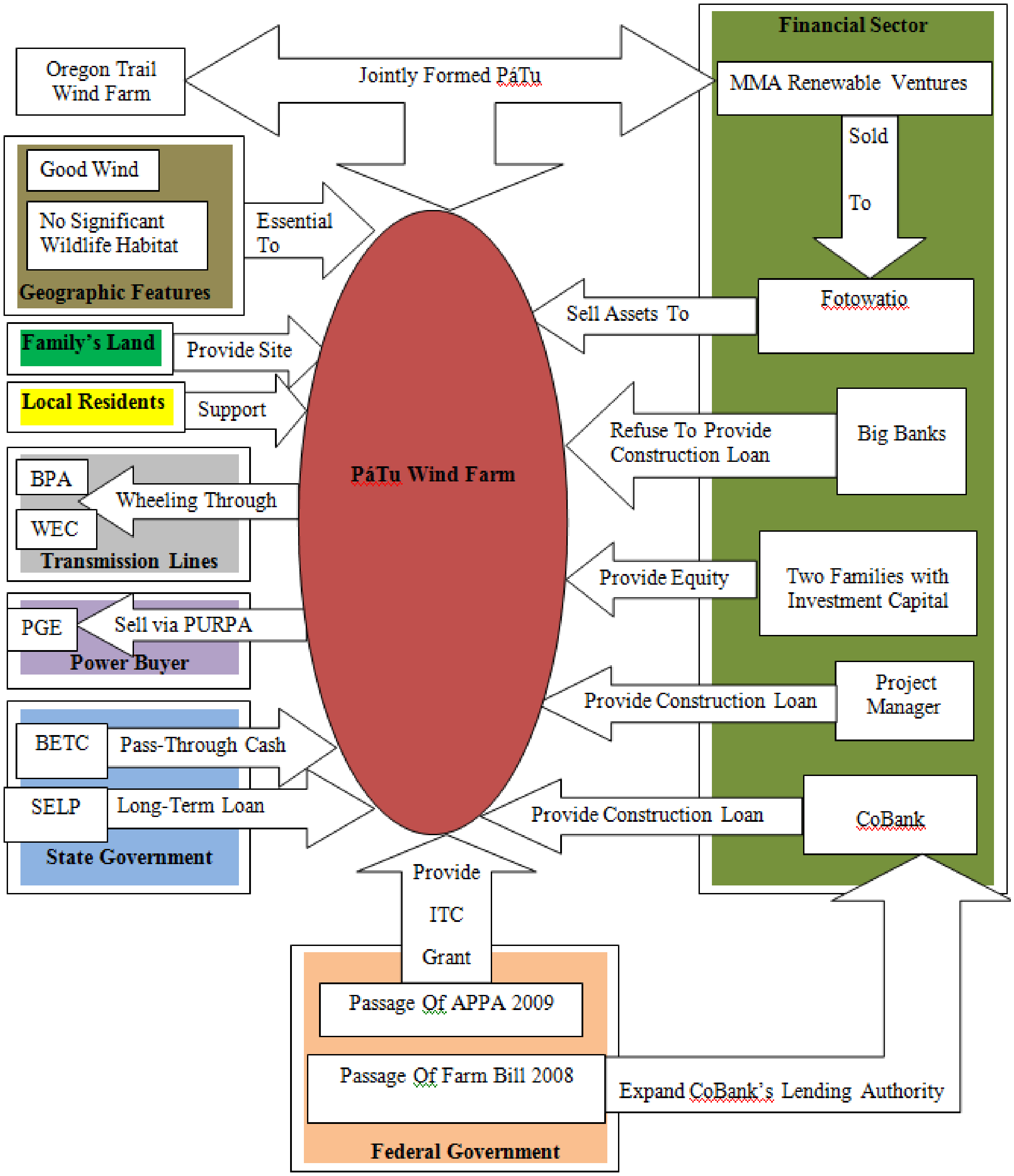

Figure 4.4.2 Actor-Network Analysis of PáTu Wind Farm

Case Two: Sayrs Wind Farm

Project Description

A fourth-generation wheat farmer in Sherman County, Oregon, attempted to build a wind project called "Sayrs Wind Farm" on his family's farmland about three miles west of Moro. The plan was to have five turbines, with each being two MW in capacity. However, due to lack of the BETC in place, the project was not successful, and would be turned over to a large commercial developer by the time of this writing.

The wheat farmer's interest in wind development was originally inspired by a commercial wind developer who came to Sherman County wanting to secure properties for development of a large wind farm. The developer showed an example of wind project in Wyoming to the local land owners, and the wheat farmer found the idea fascinating, because he had hated the wind in the field and never thought it could be turned into something useful. However, instead of just leasing the land to commercial development, he decided to study the wind industry and build a project on his own.

Factors Involved in Sayrs Wind Farm

When we analyze the Sayrs Wind Farm with the Actor-Network Theory framework, we identify some of the factors involved were similar to those in the PáTu Wind Farm in Case One. For example, both wind farms secured sites with good wind by using their family farmlands; both enjoyed the fact that Sherman County does not have significant wildlife habitat and that the local support was strong; both tried to sell power to PGE; both had similar financing structures in construction phase and post-construction phase. The wheat farmer discussed about his construction financing experience:

> I was hoping to follow PáTu's lead. One of his equity participants was willing to be an equity participant in my project. Then the CoBank, which financed PáTu, was interested in doing more if our project was going to work. They'd be a prime candidate to jump into another project because they just went through it, and they understand how it should work. It should be a lot easier on the second project.

For the post-construction financing, Sayrs would use the ITC grant and probably a SELP loan to pay off the construction costs.

Sayrs also needed to use BPA's transmission line, which bordered the family's property, to wheel its power to PGE as PáTu did. But instead of approaching BPA to reserve capacity on the line on its behalf, Sayrs was able to use some of the capacity that the County has already reserved for community wind projects since 2007 (PáTu is not utilizing any of the reserved space for its reservation with BPA was earlier than the County's). The wheat farmer described the reservation made by the County:

> What happened was that when the big developer Iberdrola took power off of the BPA line and moved it into a different line, it left a hole in this line with some capacity there. Sherman County secured that 50 MW worth of capacity. The County reserved it for guys like me. Their intension was to make it available for community projects. Their vision was that we will have five separate ten MW projects utilizing that transmission.

Interestingly, although the general public in the county are supportive of wind energy development, very few are interested in participating in building wind projects by themselves. Therefore, the transmission reservation made by the County didn't stimulate the projects it hoped to see happening. The wheat farmer commented:

> The space is open to anybody who is interested in doing community wind. But we don't have a lot of people who are interested. The County has held it for community type of projects, and it costs them 70,000 dollars a year to hold this reservation from BPA. Now there were some commercial developers who would like to take it, so they had the discussions. The

> County said we'd like to see you provide the ability for these landowners to have some ownership somehow. There's a million different ways to structure the ownership, and we haven't finished that discussion yet.

Missing Piece: The BETC

At first glance, Sayrs had almost exactly the same elements that PáTu did, but a closer scrutiny revealed a significant missing piece that eventually prevented the project from proceeding further: the Business Energy Tax Credits. The BETC were a given when PáTu applied for the tax credits, but by the time Sayrs applied for the incentive in 2009, the state government had started to change the rules of the BETC. The new rules make it much more difficult for community wind projects to receive the incentives. The wheat farmer commented on the BETC:

> I got rejected [on the BETC] a couple of months ago. Now the economics just doesn't work, because I cannot build it without the support of the BETC. With the five million dollar incentive, it would reduce the cost of the project from $25 million down to $20 million. At $20 million, I can make it work. But at $25 million, it won't. So the biggest hurdle on this project was the BETC. Next, I'm meeting with them [a large commercial developer] on Wednesday to firm up some of legal agreements basically to sell them the development, the Sayrs Wind Farm, I put together. There are some values in what I have here. I have the wind data, have access to transmission line, etc.

Summarizing Barriers and Opportunities

Sherman County reserved 50-MW capacity on BPA's transmission line in around 2006. The wheat farmer started planning for the Sayrs Wind Farm in August 2008. He applied for the BETC in 2009, and the incentive had been historically significant in promoting renewable energy including community wind in Oregon until the second half of 2009 when the program started to change from being a given to one with very limited budget. In 2010, the Oregon Legislature made official changes through HB 3680 to curtail the program. Major changes included setting tight sunset provisions, imposing caps on overall BETC awards, placing limits on wind facilities, requiring ODOE to develop a tier system to renewable energy facilities based on cost with a closer scrutiny of higher-cost facilities (Eller, 2010; Stoel Rives, 2010). As anticipated, the Sayrs was rejected by the BETC program in 2010. As of the time of this writing, the wheat farmer was about to sell the development work of Sayrs to a large commercial developer.

Having a successful wind farm, PáTu Wind Farm**,** nearby provides valuable insights into how to develop a similar project in Sherman County. In addition, the local government's efforts of securing transmission capacity on BPA's lines were also considerably helpful. However, the missing piece of the BETC eventually stopped the Sayrs Wind Farm. Figure 4.4.3 summarizes major factors involved in this case and their relationships.

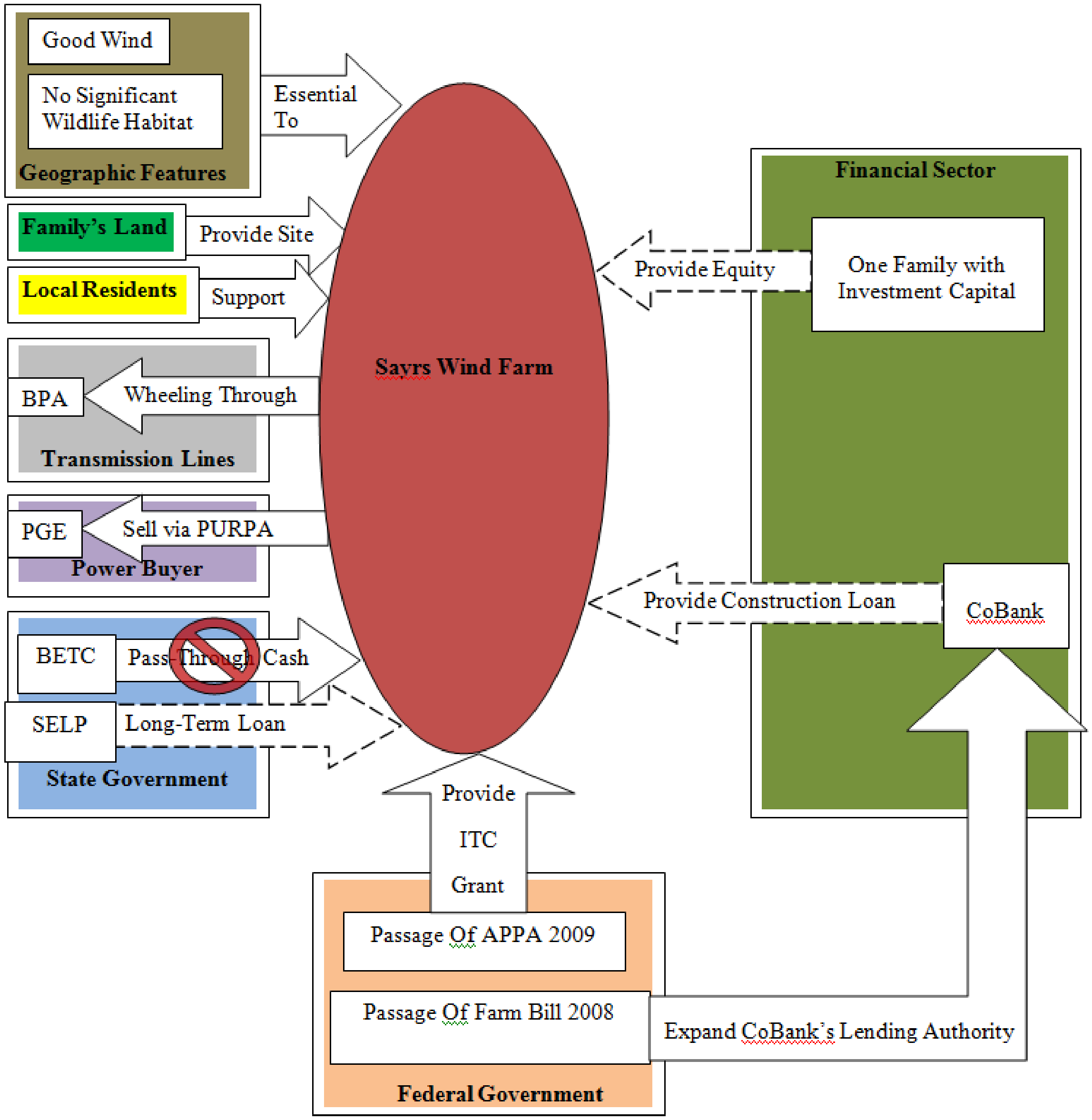

Figure 4.4.3 Actor-Network Analysis of Sayrs Wind Farm

Case Three: Middle Mountain Wind Project

Project Description

Hood River County was exploring the possibility of building a nine MW wind project with six turbines on the Middle Mountain, a north-south trending ridgeline. However, due to strong local opposition, the County Commission decided to stop pursuing the project in May, 2010.

Faced with a decline in timber revenue from the County's 31,000-acre forestland (which provided nearly 44 percent of the general fund), an anticipated loss of federal timber payments, in addition to the state law on limitations of property tax collection, Hood River County attempted to increase the revenue by diversifying its economy (Fashing, 2010; Hood River Soil and Water Conservation District, 2008; Oregon Department of Revenue, 2011). Renewable energy development is one of the solutions identified, and the County has looked at small hydro, solar, biomass, and wind energy projects to date (Fashing, 2010).

On the other hand, Hood River County is renowned for its natural beauty: some portions of the Columbia River Gorge National Scenic Area are located in the county; Mount Hood, the tallest peak in Oregon, lies on the south border of the county; and over 14,000 acres of orchards in the county provide pears, apples, and cherries. Each year, the county attracts tourists from all over the world, and tourism now has been one of the principal sectors in local economy. Conceivably, having wind energy development in such a place would be extremely controversial because some people believe turbines are visually intrusive and are likely to affect tourism negatively. Others, however, believe that wind turbines can be an attraction.

Factors Involved in the Middle Mountain Project

The County has identified several potential wind sites for consideration, and one of them is the Middle Mountain. Major factors affecting the project are listed as follows:

- **Geographic Features:** The project would sit on the ridgeline of the mountain, which is comparatively unobtrusive to the majority of the local residents in the county but with strong wind resources (Woodin, 2011).
- **Land Availability:** Hood River County owns the Middle Mountain area and did not have to worry about securing the land.
- **Power Sale to PacifiCorp:** The project was planning to connect directly to its power purchaser PacifiCorp without going through other utilities' grid, so additional wheeling charges could be avoided (Woodin, 2011).
- **Local Opposition:** Before officially pursuing the project, the County organized several public meetings to present information and also to gather input from the local residents. Some people voiced their concerns about visual pollution and consequent impacts on tourism during the meetings. A County employee explained what he believed accounted for the local opposition:

  > There's always going to be some people that are opposed to whatever project you try to do in Hood River. One of the reasons is because Hood River is considered so scenic. We have this beautiful Mount Hood, which is considered the state treasure. All the people in Oregon consider it their mountain. They want to look at the mountain without seeing a bunch of wind towers in the horizon. In Hood River County you have to do things differently than in all other counties because we are scenic, and everyone desires to preserve our scenic values. That's why the commissioners took

> the time to go out to the people with all these little meetings and listen to the people.
>
> [Another reason may be that] Hood River is probably too small. It's the second smallest county in Oregon. Most of the land in Hood River County is owned by the government [like] Forest Services. That doesn't leave a lot of land left over for private development. It's pretty closely zoned and regulated, and any place where you have smaller divisions of land, people are usually opposed to wind turbines, because the wind towers are close to populations. It's not like those eastern counties where people own 3000-acre ranch, you don't care if there's a few towers on your land. Farmers in Sherman County don't mind the wind mills. They can still raise wheat around the wind mill and they get paid the rent by leasing the land that the windmill sits on. So they can make maybe a couple of hundred thousand a year off leasing to a wind mill and make the money still off the wheat. So it's a good thing for them. That's why people are really in favor of it. But if you own only 5 acres or 40 acres [like us here], there isn't much benefit you can get from the wind. So you are not in favor of these big towers with a red light blinking on top of it.

- **Economic Return:** An economic analysis of the Middle Mountain project indicated that the County would not receive significant economic gains until 2025, which eventually led the Commissioners to drop the plan (Clarity Analytical LLC, 2011). The County employee commented:

  > The County Commissioners felt that [if we were to] have something that affects our scenic [views], it had to be tremendous return on investment. As it turned out, there wasn't a significant return on the investment. There were too many unknowns. [For example], the BETC may be going away. And the community was pretty upset about it. So they canceled the project and essentially do not wish to allow any projects in Hood River County. Basically if somebody wanted a wind farm even a small one, say 10 MW, when they will apply for the Conditional Use Permit [from us], we will counsel them ahead of time that it would be very, very difficult for us to approve one.

- **Local Conservation Groups:** There are two local conservation groups, Friends of the Columbia Gorge and Hood River Valley Residents Committee (HRVRC), and both groups did not take a position on the project. Friends of the Columbia Gorge did not adopt a stance because the proposed project site-Middle Mountain-is outside of the Columbia River Gorge National Scenic Area (See Figure 4.4.11 at the end of this section) (Eileen, 2009). The HRVRC has two missions: first, protecting farm and forestland, and second, promoting livable communities in the Hood River Valley. Since the project contradicts the first mission but supports the second mission, overall, the organization decided to remain neutral.

Summarizing Barriers and Opportunities

The idea of the Middle Mountain project began in around 2005, when the Hood River County started considering development of renewable energy as a strategy to diversify the local economy. If successful, the County would have been the owner of the project, and the profits generated by the wind farm would have been revenue for the government. Therefore, the County had been very supportive of the Middle Mountain project, which was considered a major opportunity for the project. However, the economic return from the project was estimated to be lower than expected by a study in 2010. In the meantime, the general public voiced strong opposition against the wind farm in several public meetings. Given these two major considerations, the Hood River County Commission unanimously decided to stop pursuing the project on May 17^{th}, 2010. An important lesson of this case is that before anything, developers need to assure that there will be strong economic return from a wind energy project located in a scenic area; otherwise it is very likely that local residents would not allow such projects to happen at the expense of affecting scenic views (See Figure 4.4.4).

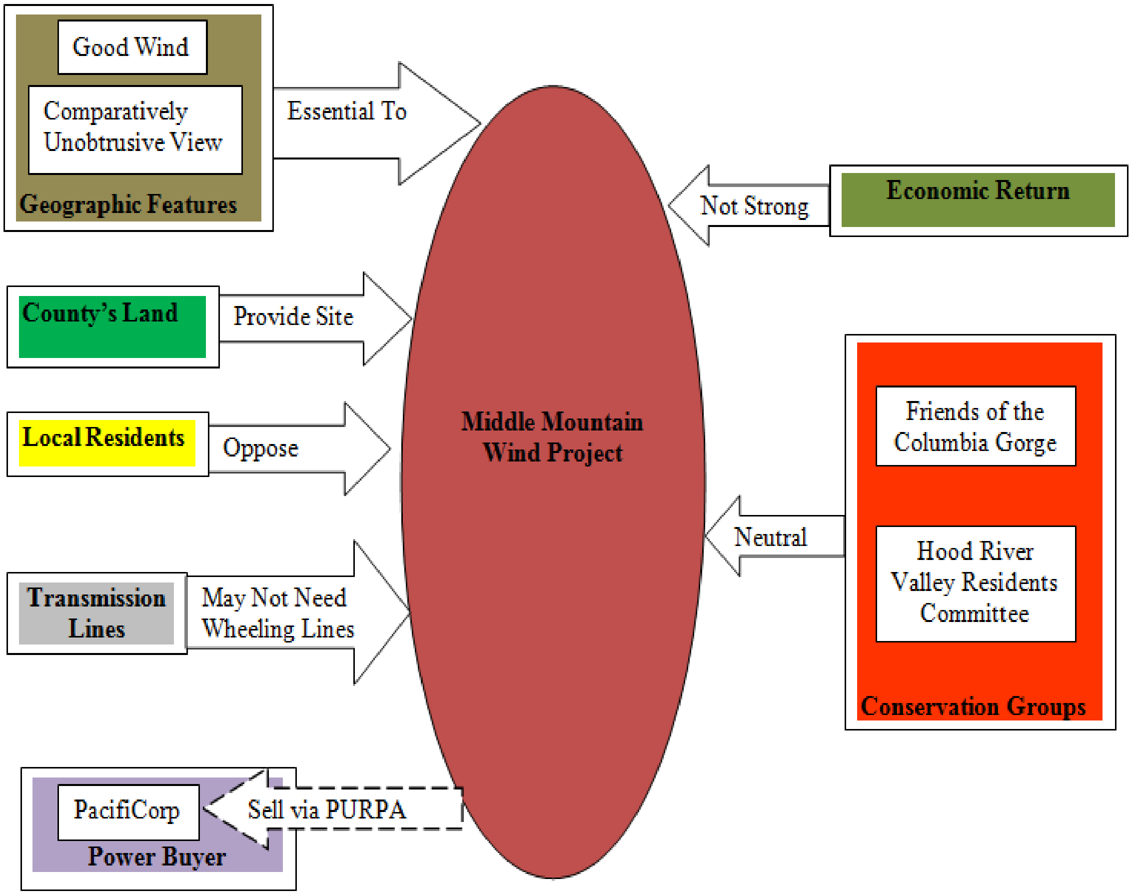

Figure 4.4.4. Actor-Network Analysis of Middle Mountain Wind Project

Case Four: MCCOG's Wind Project

Project Description

Under the leadership of the Mid Columbia Council of Governments (MCCOG), several counties in the mid-Columbia region are seeking to cooperatively develop and own community wind projects on BLM land at Horn Butte in Gilliam County, Oregon or another site in the region. As of the time of this writing (early 2011), the project is in the early planning stage.

As a Council of Governments, the MCCOG is "an entity organized by units of local government under an intergovernmental agreement under ORS 190.003 to 190.130, which does not act under the direction and control of any single member government and does provide services directly to individuals" (MCCOG, 2011: 1). Originally, the MCCOG had three member governments when it was first created: Wasco County, Hood River County and Sherman County. In 1992, Gilliam County and Wheeler County joined the council, which expanded its services to the five-county region. One important purpose of the MCCOG is to promote intergovernmental cooperation for greater efficiency. Rather than each member government suffering from duplicate efforts, the council "consolidated five counties and streamlined the costs of running the programs operating under one entity-MCCOG" (MCCOG, 2011: 1). An MCCOG employee said:

> [The point is that] local governments can get together to form another organization that can do something cheaper than each individual organization does themselves.

Another MCCOG employee described the entity's responsibility:

> We worked with these local governments in the five-county area in a variety of ways to support their efforts. We are an economic region and we are all in one together. If one of them is doing well, it helps all the rest.

Factors Involved in MCCOG's Wind Project

Currently, the Council is working with its member counties to try to build a wind project on BLM's land at Horn Butte in Gilliam County or other more viable sites. The intent is to develop five to six projects below 10 MW size. Each project would be owned by a different government entity. Since it is still in the planning stage, there are many unknowns associated with how the final project will be built, but I'd like to share some factors identified below:

- **Project Owners:** It is likely that the MCCOG will partner with its member counties to coordinate development of the wind projects. An MCCOG employee responsible for the project envisioned how the ownership structure may look like:

  > We've been looking at land in eastern Oregon for the last several years trying to find possible sites that might work out for six 10 MW projects, so maybe 60 MW in total. We'll build it 10 MW each. The hope would be that Sherman county would own one, the Hood River County would own one, Wasco County would own one, Gilliam County would own one…a piece of one or all of one. That was the kind of idea. We are trying to do something of coordinated efforts where more than one county can participate. But now it is still up in the air. We don't know if we can do six 10 MW projects, maybe two, or three, or four. If we find a site that will work for six projects, we may do six projects. If it's big enough for three projects, we may do three projects. [For the BLM's site at Horn Butte], we don't know exactly how big [a site we can permit] and how much wind it has. We haven't applied to the BLM yet. So there're still lots of questions and issues regarding what the ownership would look like. At this point we are not far enough to know what it will look like. We have a long way to go.

- **Land Availability:** The Horn Butte area, owned by the BLM, is surrounded by private land where several wind energy projects have been developed (See Figure

4.4.12 at the end of the section). However, due to environmental concerns about the endangered species on the site, such as pygmy rabbits and curlews, the BLM would not let the developers build any wind projects there. The MCCOG employees were not optimistic about securing the land from the BLM:

> All other big wind companies are on all sides of it [Horn Butte], but the BLM would not let them develop anything on the federal land. We thought we could maybe go talk to the government to get them to allow the County governments to have a project out there. We've even been talking about trading them some land and let them put the curlews on other land.

> We are still looking [for potential sites]. We thought this site would work, but we had difficulty getting BLM to agree that it's viable site. They are saying they are constrained with the environmental endangered species. So we'll see.

Summarizing Barriers and Opportunities

Due to the fact that the MCCOG's project is still in its early planning stage, many aspects have not been finalized as of the time of writing. However, the benefits it will probably have as a joint, intergovernmental effort is a wide range of support financially, economically, and administratively. The major barrier so far has been securing the Horn Butte site from the BLM, which contains habitats for the endangered species (See Figure 4.4.5). Despite this, the project expected to start an application to BLM for permission to put meteorological towers up in early 2011 and monitor wind speeds for a year or two before they have enough information to know whether it is feasible to build a project. In this case, the BLM district office did not seem to act very cooperatively to help develop wind energy projects, but in two other cases (Big Valley Wind Project and Lime Wind) the BLM was of great help. Therefore, it should be noted that the attitudes of federal agencies towards community wind energy can vary from district to district.

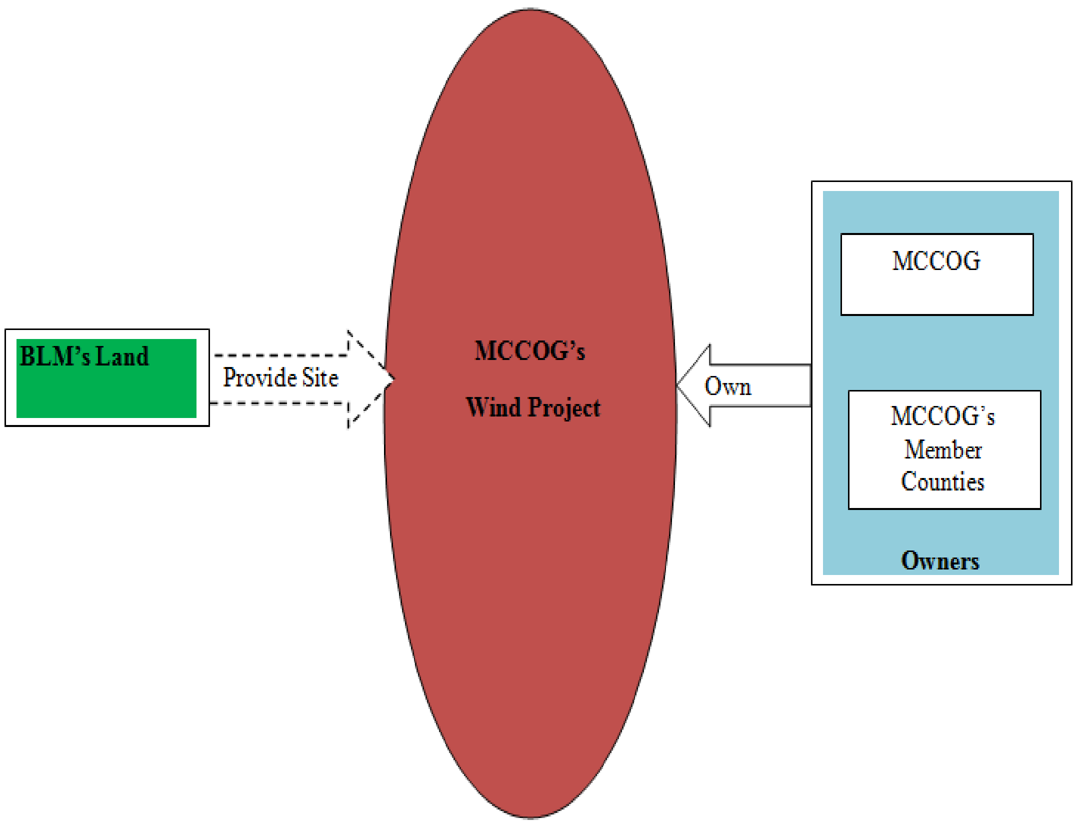

Figure 4.4.5. Actor-Network Analysis of MCCOG's Wind Project

Case Five: Big Valley Wind Energy Project

Project Description

The Oregon Community Wind (ORCWind), LLC, a community wind development company based in Portland, is planning to develop a 10 MW wind project consisting of five turbines on BLM land in Lake County, Oregon. The project has collected wind data using meteorological towers since June, 2010.

Established in March 2009, the ORCWind has been focused on small-scale community wind energy projects. The project developer introduced how the company started:

> There are four of us in total that are partners in the firm: myself, a finance person, and two wind siting engineers. After several years of talking about the different concepts, how we wanted to structure the business, we looked at several different options on types of projects we are going to develop. We came to the conclusion that community wind level was what we really wanted. So we established the firm in March 2009. We wanted to be able to bring wind power into small areas. Also we want to figure out a way to engage local people in the projects a little bit more.

Although the company is based in Portland and is not owned by community members from where their projects are located, I still consider their wind farms “community wind” because of four reasons: First, in terms of scale, the company target smaller-sized projects, typically less than 20 MW (ORCWind, 2011). Second, their profits will stay in Oregon, and thus they are more “local” than other large commercial developers from outside the state or even outside the country. Third, the Big Valley wind energy project was awarded the Community Renewable Energy Feasibility Fund (CREFF) in 2010 from the Oregon Department of Energy as a qualified community renewable energy project (Oregon Department of Energy, 2011e). Fourth, the company aims to utilize local resources and engage the local community as much as possible. The project developer said:

> We are going to source local contractors, local labor, and local resources. We look at different options to have the community to invest [into the project]. Also, if we establish a wind farm here, we'll give away scholarships to attend a credited program to become a wind turbine technician, a solar panel technician, a geothermal technician, and those kinds of things.

In order to find a suitable spot to develop community wind energy, ORCWind toured the state in January, 2009, and finally, they found a site on BLM's land in Lake County (See Figure 4.4.13 at the end of the section). Next, I'll explore the major factors involved in this project.

Factors Involved in Big Valley Wind Energy Project

- **Meteorological Towers:** The Big Valley project received its 50-meter anemometer towers to collect wind data through the Energy Trust of Oregon's Anemometer Loan Program. According to the requirements of the program, the wind data collected are shared with the public.
- **Community Engagement:** The project started its community engagement very early by communicating with the Lake County Commissioners, having a Lakeview Town Council Meeting, cooperating with Sustainable Lake County Oregon and Lake County Resource Initiative, and meeting with the adjacent property owner and other local residents (Slack, 2010). The project developer said:

> Before we put our met towers up, before we signed the lease [with the BLM], we went down, we started meeting people in the community. We first got introduced to the community through some renewable initiative group in Lake County called the Lake County Resources Initiative. These guys are trying to make Lake County the top renewable county in the state. [Then I was introduced] to the only adjacent private land owner for the project. He was very supportive of the project. We will need to cross his land [to construct the project], so we need to get an easement to come cross some of his land. Another thing is he has a rock quarry on his ranch. We are going to use his quarry to supply rocks for our roads, possibly rocks for portable or a batch of cement we establish for the foundation. We introduced our project to the County Commissioners, and we went to a Lakeview town hall meeting.

- **Local Support:** After the close interactions and engagement, the project has gained considerable support from the local community. As the project developer stated:

> We got the letters of support from both of them [the Town and the County]. We have not found any opposition yet. They were very supportive of the project.

- **Land Availability:** Securing the land from the BLM for site testing has been a tough journey for the Big Valley wind project. The first difficulty was the existence of habitats for sage-grouse on the BLM's land. Fortunately, the local BLM office was very helpful in guiding the project to avoid the environmentally sensitive areas. The project developer said:

> We worked hand in hand with their [the BLM's] biologists to identify an area that was suitable for us but also good for the sage-grouse so we could avoid sage-grouse upfront because it is a big issue in their district down there. They gave us information on the sage-grouse lichen site, the breeding ground. So we used that information to site. That was the biggest concern they have as far as wildlife impacts. We also checked in with their archeologists, botanists…their resource managers. We checked with all the resource managers to make sure the place we had was suitable, so down the road we wouldn't run into any problems.

Despite the lack of sage-grouse, the final selected site had an unexpected problem: it ended up in the military training route. In July 2008, to ensure compatibility of wind energy development with military activities, the Department of Defense (DOD) and the BLM developed a wind energy protocol, the purpose of which was to improve communication and coordination process between the two agencies in the review of proposed wind energy right-of-way (ROW) applications on the BLM's land (Bureau of Land Management, 2008). Although the protocol established a process for the DOD to review and comment on proposed applications, the BLM has the ultimate responsibility to determine whether or not to grant the right-of-way. According to the comments of the DOD on the Big Valley wind project, the proposed wind turbines would be in the Military Training Route (MTR) IR 300. Horizontally, the MTR is eight miles wide, and the project is parallel to and two miles off the centerline of the route (See Figure 4.4.6). Vertically, the route has a 100-feet floor, which means the military can train down to 100 feet off the ground, and the highest point of the turbine blades are 426 feet above the ground (Figure 4.4.7).

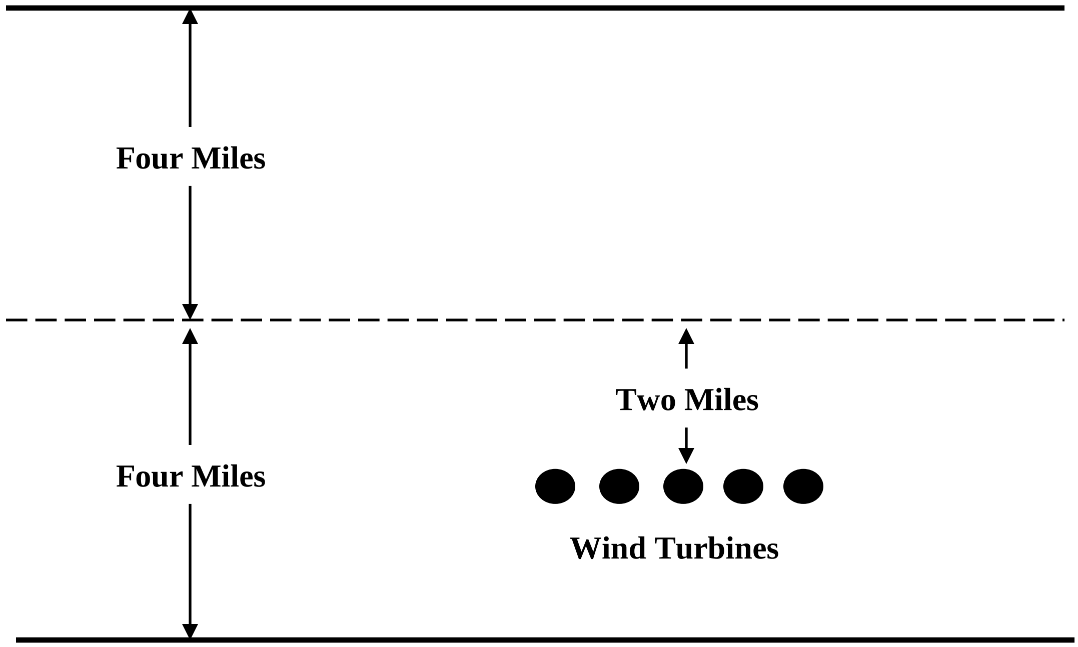

Figure 4.4.6. Vertical View of the Military Training Route

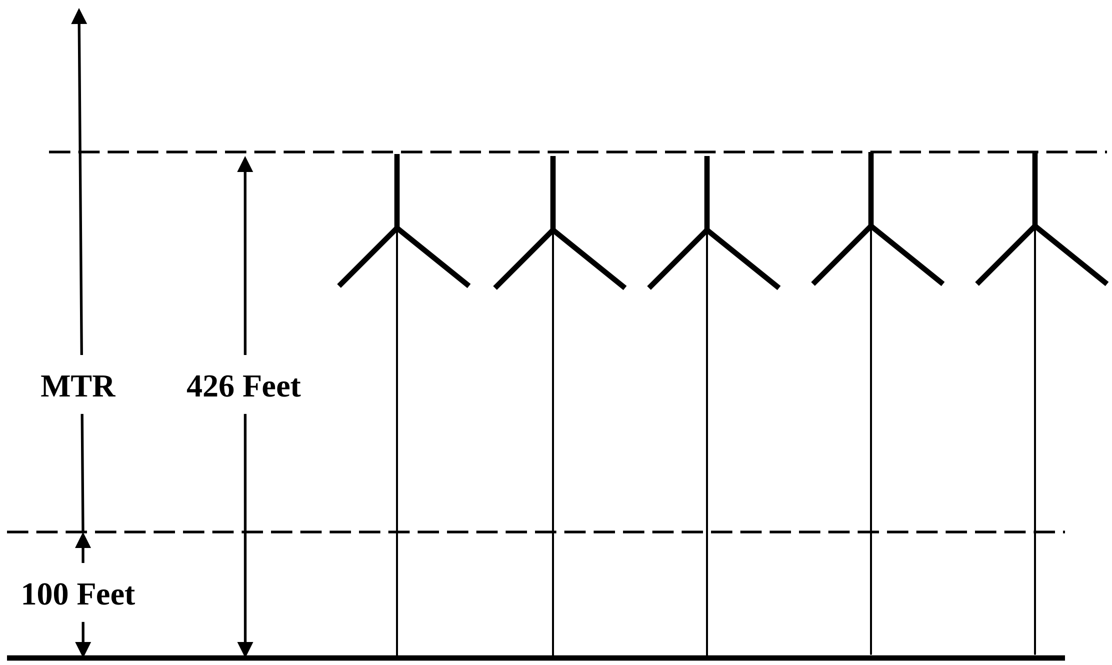

Figure 4.4.7. Horizontal View of the Military Training Route

Nevertheless, in reality, the military training is not likely to take place in this designated route not only due to the complicated terrain but also because there is a 1,000 kv DC line running through the route and the tower for the line is 125 feet high. The project developer said:

> They are not flying anywhere nearby. The Defense [Department] went back and looked at it again, and they came back with "No" again for the second time, and it went all the way to DC to the headquarters of the Department of Defense and the headquarters of BLM. So I was talking to a very high-level person of the BLM in DC. The BLM came back the December of last year and said the DOD agreed you can develop it as long as you [keep] as far from the centerline as you possibly can, which we [already] have because right next to us there's a huge canyon and we cannot move it over anymore. Plus we are stuck in this corner because there's sage-grouse all over the place. The thing is the BLM doesn't have to take the recommendations. It's not the DOD saying you cannot develop it. The DOD came back with the recommendations, and the BLM can ignore it, but generally they won't. So it went to DC, went to high levels, and there's some pressure from [the headquarters of] the BLM and DOD to say, look, this is a five-turbine project. The BLM has a goal to establish 10,000 MW on their land by 2015, and if you want a 10,000MW, you cannot have this kind of [obstacles].
>
> We were originally supposed to install our met tower in June of 2009, and we were all ready to go with it, and this stuff came in. It was until the December 16 of 2009 for them to finally say yeah you can go ahead. But snow started, and you cannot put up a met tower until the snow is gone, and the land is drying out. You need to get your equipment out there. It took us to June 2010 to actually get luck because the snow was gone. So we were delayed for basically a year. Now we are collecting wind data.

In September 2010, however, another unexpected problem occurred to the Big Valley wind project. In order to properly design the wind turbine foundations and also to determine whether a transmission line can be buried underground, a geotechnical study will be required to collect data on soil, bedrock, groundwater, and other geotechnical conditions. In the meantime, the Fort Bidwell Indian Community in California filed a petition to the Ninth Circuit of the U.S. Court of

Appeals for review over the BLM's approved right-of-way for the Ruby Pipeline, a natural gas pipeline project that runs from Wyoming to Oregon, because the Indian Community believed the BLM didn’t protect cultural resources adequately on the traditional cultural property (Justia, 2010). So the BLM asked the Big Valley wind project to stop the geotechnical study due to its proximity to the area that the Indian Community was referring to. The wind project developer said:

> We had scheduled to do the geo-tech study in September this year. We had a contractor to come in, and they were going to take work samples at each one of the turbine locations. We were also looking at burying our transmission line. So we would go down transmission corridor and test it along the way to see what the soils look like, to see if we can bury a line. So we had all that lined up. And three days before we were supposed to start, a Native American Tribe, Ford Bidwell Tribe, wrote a letter to BLM saying they were going to take the BLM to the federal court and sue them over the Ruby Pipeline project. This project runs about eight miles from my project. This tribe felt they weren’t properly consulted through the NEPA process. The NEPA process was already approved, but this tribe felt they weren’t consulted. They were going to take the BLM to the federal court because this is what is called Traditional Cultural Property for the tribe. What that means is basically that land is used for traditional practices for hundreds of years by this tribe. However, they didn’t give the defined area. The BLM got freaked out and said your wind project is near here. We have to stop your project, and we cannot let you do your geotechnical study.

Fortunately, the Big Valley project later found out that the Fort Bidwell Indian Community was more concerned with the valley area below the wind farm, not where the turbines will be located. Eventually, therefore, the BLM allowed the project to proceed with the geotechnical study. By the time they lined up with their equipment, however, wind had come and snow had started. At the time of the interview [December 2010], the geotechnical study was put on hold until the snow melts away.

- **Financing:** As mentioned earlier, the project received the Community Renewable Energy Feasibility Fund (CREFF) in 2010 from the Oregon Department of Energy to conduct suitability study. With respect to the construction, the project hasn't finalized its funding sources yet. The state government is likely to finance construction of small renewable projects in the near future, but it is up in the air at this moment. As far as the overall financing goes, the project is considering the BETC, ITC Grants, USDA REAP Grants, USDA Guaranteed Loans, U.S. Department of Energy Guaranteed Loans, property tax exemptions from the Lake County's Enterprise Zone Program, as well as private investment and traditional debt.
- **Transmissions and Power Sale:** The Big Valley wind project will need to build a segment of transmission line (overhead or underground depending on the results of the geotechnical study) to interconnect to the Surprise Valley Electrification Corp., the local non-profit rural electric cooperative. Then, the Surprise Valley will wheel the power to the PacifiCorp, the buyer of the power of the wind project.

Summarizing Barriers and Opportunities

Oregon Community Wind, LLC, identified the site on BLM land in February 2009, and intended to install the meteorological towers in June of the same year. But it wasn't until December 2009 that the Department of Defense finally agreed to let the project proceed. Then the snow started, and the installation was postponed until June 2010, when the snow was gone. So the meteorological towers have started collecting data since then. In September 2010, the Fort Bidwell Indian Community in California filed a petition for review over the BLM's approved right-of-way for the Ruby Pipeline, which crossed their Traditional Cultural Property. Due to close proximity to the Ruby Pipeline, the Big Valley was stopped by the BLM. Several months later, the Big Valley found out that the Fort Bidwell Indian Community was not concerned with the wind farm, and project should be able to proceed. Unfortunately, in December 2010 winter season started again, and the Big Valley had to wait until snow melts.

As discussed in this case, environmental concerns for sage-grouse, existence of the Military Training Routes, and proximity to traditional tribal cultural property have created enormous difficulty for the Big Valley wind project, which eventually resolved all these issues successfully. On the other hand, the Energy Trust of Oregon's Anemometer Loan Program and the state government's Community Renewable Energy Feasibility Fund have been helpful. Last but not least, local support is an important factor that made the project possible (See Figure 4.4.8). An important experience from the Big Valley was that engaging with the local community in the early stage and getting local people involved in development would lead to increased acceptance of a project.

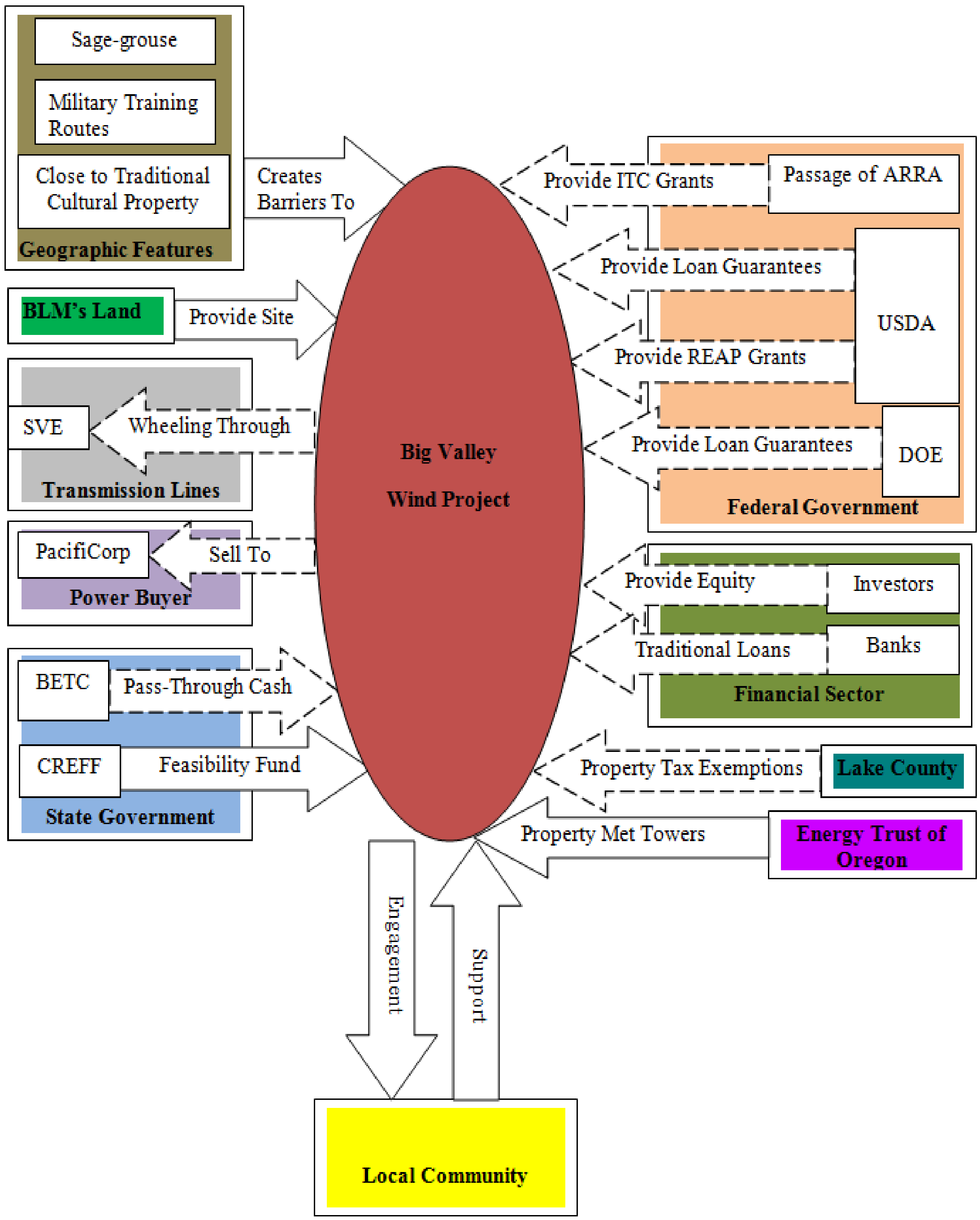

Figure 4.4.8 Actor-Network Analysis of Big Valley Wind Project

Case Six: Lime Wind

Project Description

Lime Wind is a three-MW wind farm, consisting of six refurnished 500-kW turbines, on the BLM's land near Lime in Baker County, Oregon. The project has been approved by the BLM and expects to start construction in July, 2011.

The owner (and also developer) of the Lime Wind is a wood worker and cattle rancher in Baker County. In 2004, he went to the Harvesting Clean Energy Conference in Portland and became intrigued by a new concept brought by the speakers: community wind. As the project owner described:

> I thought this is great. This is what we need. Rural economy, rural development. Use our resources to create income for rural communities and to have local ownership? That'll be fantastic. Maybe this is something I can do on my ranch.

With that in mind, he bought a meteorological tower and start testing wind on his ranch. Unfortunately, the wind didn't seem to be promising for a wind farm. But that didn't stop him. In 2005, the BLM issued the Wind Energy Programmatic Environmental Impact Statement (EIS) to assess the environmental, social, and economic impacts associated with wind energy development on BLM-administered land (Bureau of Land Management, 2005). This inspired our developer to explore the possibility of building his wind project on the BLM's land.

> After reading it [the Wind Energy Programmatic EIS], we thought oh we can do this on federal land. They were kind of soliciting companies to come and do that. So I got the wind maps out. We got the BLM map out. We put one over the other. Then we looked at where the transmission line was. We chose three sites, all on BLM's land. But we dropped one site

> because of sage-grouse. So we located two sites, very far apart, 40 miles apart. We tested it. Both of them have good wind. But this site had, from our perspectives, the best chance of being developed, because the other site is very visual. Actually Magpie Peak is right out there. You can see the turbines on a clear day. It was possibly a little bit controversial because of these aspects. (Figure 4.4.14 at the end of the section shows the location of the project.)

Due to budget constraints and road conditions, Lime Wind decided from the very beginning to develop three MW capacity and use mid-sized refurnished turbines.

> We figured we'll be three MW. That'll be two big turbines [if we use the large ones]. Access to this specific site is up a steep and windy road. It's very difficult to get large turbines up that hill. And my budget was not sufficient for new turbines, so budget and road require us to use refurnished mid-sized turbines.

However, securing mid-sized refurnished turbines was not easy nor was securing construction finance. I'll identify these major factors involved as well as other elements in much detail using actor-network theory in the next section.

Factors Involved in Lime Wind Project

- **Securing Turbines:** Originally, Lime Wind intended to buy mid-sized used turbines from a wind project in California, who was considering replacing the turbines with new, larger ones. However, it did not work out and those turbines never became available to Lime Wind. The project developer recalled the experience:

> There were 600 of these Mitsubishi turbines down there in California. They were half the price of new turbines. I said oh, that sounds great. So I went down to California to look at the turbines. I meet this guy and I meet that guy. So we designed our project around using twelve 250kW Mitsubishi turbines. But the turbines never became available out of California like they thought they would have. They thought they are going to take out the small turbines and put in new bigger ones because the site

> will end up with fewer turbines and more production. These guys suspected that they are going to take out 600 of them, and somebody is going to buy them, but none of that happened. By that time [around August 2009], I was pretty far down the road. I invested all my own money to that point, which became pretty substantial.

Frightened of not being able to secure turbines, the developer started looking for turbine suppliers again. Through luck and perseverance, he eventually found some turbines in Europe that fit the budget and size requirements.

> When we were talking about substituting other turbines, I went home and really freaked out. So I went on the internet, and I started looking at every turbine that's out there. Anything I could find. I really started looking much deeper into how the turbines work. I didn't pay much attention before. But now we were through the Environmental Assessment [with the BLM], and received the REAP grant, and we've done all that paper work. I sent out hundreds of emails across the globe and started filtering the responses. [Finally,] I found some turbines in Europe that looked like they would work. I went to Europe last December [December 2009], located the turbines, and made the deal.

- **Securing Construction Financing:** Another big hurtle that Lime Wind needed to overcome was to find ways to finance its construction. Lime Wind did not want to bring in equity investors, and therefore was focused on construction loans. The project developer commented:

> We looked at the ownership, [and decided to go with the loans], not because we want to own it, but because we were reluctant to bring anybody else's money into something that we really didn't know what the outcome was.

Therefore, the project applied for a construction loan from the Oregon Department of Energy's State Energy Loan Program (SELP), which was designed to provide both short-term construction loan and long-term loan at that time.

Suddenly, the financial sector collapsed, and the state government decided to eliminate the short-term loan for construction from the SELP program.

> Originally, I had a construction loan and a long-term loan from the ODOE, because you cannot find construction financing with these projects. [It's] very, very difficult, especially with the conventional lenders. Then, the loan officer pretty much told [me] they could not do any more construction projects. I was one of them who got cut off. Ever since, the SELP no longer does construction loans.

After contacting over 100 institutions and investors during a one-year continuous search for a construction lender, Lime Wind finally found one-Seminole Financial Services-who would provide loans to cover the majority of the seven-million dollar total costs. In addition, the developer himself will provide 0.6 million dollars in forms of equity and personal loans to the project. Also, the turbine supplier, the rebuilders, and the vendors will defer their profits without lien on the project until it is completed and post-construction funds become available, which is a substantial help to Lime Wind.

- **Other Incentives:** Other incentives the project will receive include the ITC Grant authorized by the ARRA 2009, the REAP Grant from the USDA, the BETC and a long-term SELP loan (guaranteed by the REAP program) from the Oregon Department of Energy.
- **Transmission and Power Sale:** The power generated by Lime Wind will interconnect to Idaho Power's grid and sell the power to Idaho Power as well. Currently, the existing distribution line and substation will need to be upgraded to carry the three-MW capacity.

- **BLM's Land:** The local BLM office has guided Lime Wind through the NEPA process with patience and fairness. The project went through the Environmental Assessment option rather than the Environmental Impact Statement because of its small scale and impact.

Summarizing Barriers and Opportunities

The developer and owner of Lime Wind became interested in community wind energy in 2004. Originally, he intended to build a wind energy project on his own ranch, but the wind resources were not adequate enough. In 2005, the BLM issued the Wind Energy Programmatic Environmental Impact Statement (EIS), which inspired our developer to explore the possibility of building a wind project on the BLM land. In 2006, he decided to build this Lime Wind project on BLM land in Baker County. Due to budget constraints and road conditions, the project needed to use mid-sized refurnished turbines. He expected to buy used turbines from California, but unfortunately those turbines never became available. In September 2009, the developer realized that he would have to substitute turbines from other sources, and started looking intensively for refurnished turbines. In December 2009, the developer went to the Europe and found the type of turbines he needed. By the time he came back from Europe, the Oregon Department of Energy's SELP had stopped providing construction loans, which created another barrier to Lime Wind. After one-year continuous search for a construction lender, the developer finally found one-Seminole Financial Services-who would provide construction loans.

For Lime Wind, securing mid-sized refurnished turbines that fit the budget and road conditions and finding out a construction lender are the major barriers that the project has experienced. Eventually, the developer’s perseverance led to the resolution of the two obstacles. In the meantime, the government incentives, manufacturers’ contributions, as well as the BLM’s guidance were significantly important for the success of the project (See Figure 4.4.9).

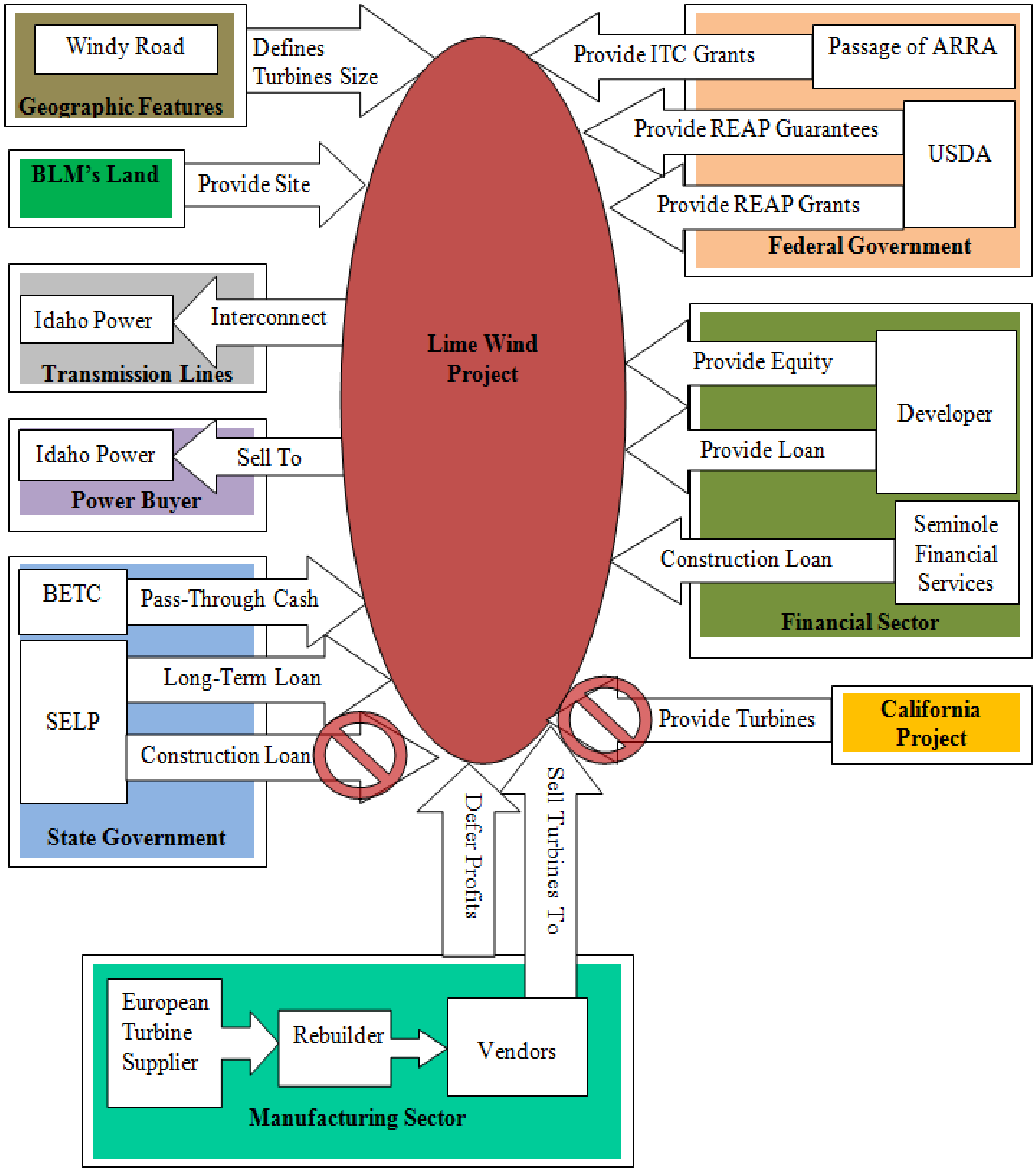

Figure 4.4.9. Actor-Network Analysis of Lime Wind Project

Case Seven: Butter Creek Power, LLC

Project Description

The Echo Wind Farms, located in Umatilla County and Morrow County, consist of nine wind projects with a total capacity of 64.5 MW (John Deere, 2011). Three of the projects involve local ownership and are considered community wind projects by this dissertation's definition. My research is focused on the Butter Creek Power, LLC, one of the three community projects, which has been operational since October, 2009.

Several years ago, a wind energy development company Oregon Wind, LLC approached the Mader-Rust family and their neighbors, the Madison family, to explore the possibility of building wind projects on both families' farmland. The local landowners liked the idea of generating clean power from wind and in the meantime creating extra revenues in ways that do not affect farming. In order to best utilize government incentives for community wind such as the PURPA , the developer designed nine projects on the two farmlands with each one no more than 10 MW. With this nine-project package, Oregon Wind searched for interested investment partners who would bring equity to build the cluster of projects. Eventually, the developer secured a partnership with John Deere Renewables which had a need for the Production Tax Credits (PTC) associated with renewable energy generation. Typically, the tax equity investor provides the majority of the equity for building the project, and receives the majority of the cash and tax benefits out of the project. As noted earlier, once the target internal rate of return has been achieved, which generally occurs after the tenth year when the PTC is no longer available, the tax equity investor flips the major ownership of the project back to the local investors and let them receive the major benefits for the remainder of the project life. The turbine arrangements of the Echo Wind Farms are shown below in Table 4.4.1 and Table 4.4.2 (Pacific Power, 2011).

Table 4.4.1. Wind Turbines on Mader-Rust Farms

On Mader-Rust Farms	Owners	Turbines	Capacity
Big Top	Landowners and John Deere	1×1.65MW	1.65 MW
Wagon Trail	Landowners and John Deere	2 ×1.65MW	3.3 MW
Pacific Canyon Windfarm	A Group of Individuals and John Deere	5 ×1.65MW	8.25 MW
Sand Ranch Windfarm	Oregon Wind and John Deere	6×1.65MW	9.9 MW
Four Mile Canyon Windfarm	John Deere	5×2MW	10 MW

Table 4.4.2. Wind Turbines on Madison's Farm

On Madison's Farms	Owners	Turbines	Capacity
Butter Creek Power	Landowners and John Deere	3 ×1.65MW	4.95 MW
Ward Butte Windfarm	Same Group of Individuals as in Pacific Canyon Windfarm and John Deere	4 ×1.65MW	6.6 MW
Oregon Trail Windfarm	Oregon Wind and John Deere	6 ×1.65MW	9.9 MW
Four Corners Windfarm	John Deere	5×2MW	10 MW

The whole Echo Wind Farms consist of 27 1.65MW turbines and 10 2MW turbines, for a total capacity of 64.5MW on Mader-Rust Farms and Madison Farms. Each project is an individual, legal LLC entity with no more than 10 MW in order to qualify for the PURPA. PacifiCorp is the buyer of the power generated. Except for the Four Mile Canyon Windfarm and Four Corners Windfarm which are solely owned by John Deere, all the projects have a partnership between John Deere and other investors. Big Top, Wagon Trail, and Butter Creek Power involve local ownership and are considered community wind projects according to this dissertation's definition. I interviewed the landowner of Madison's Farm who is also the owner (with John Deere) and manager of

Butter Creek Power, LLC. He described how the “flip” and “management” worked for the project:

> We all have the partnership with John Deere. John Deere owns 99% [of the project], and we own 1% of it. After John Deere makes a certain return on their investment at an internal rate on their investment, then we flip positions. At that point, we will own 95% and John Deere will own 5%. That’ll happen in about 12 years supposedly depending on how good the wind blows and that kind of stuff. [However], we own 51% of the management control, and John Deere owns [49% of it]. Basically, John Deere came in and said I’m going to build it and have the tax credits for it. I’m going to get an internal rate of return on my investment. In exchange, I’ll let you manage it. The better you can manage it, the better I can make it productive, the more profits it makes each year. So the more productive we are as managers, the sooner John Deere makes their rate of return and at that point of time they flip it over to us.

In 2010, Exelon Corporation acquired John Deere Renewables’ wind energy assets and thus became the investment partners in the Echo Wind Farms in lieu of John Deere (Exelon, 2010). Therefore, the Butter Creek Power will have its flip between the manager and Exelon.

Factors Involved in the Butter Creek Power Project

- **Government Incentives:** There were several government incentives to make this project happen, such as the PTC, the REAP grant, and the BETC. Among all, the BETC was the most difficult one to get due to the fact that the state government did not expect a cluster of wind projects to happen like the Echo Wind Farms. That is, they were not sure if the Echo Wind Farms should be treated as one project or multiple projects for the purpose of BETC.

  In the very beginning, the developers made sure in the arrangements of the wind turbines that projects owned by the same owners were five miles apart from each other so that they would not be deemed to be a single project by BETC's standards back then. Therefore, each project of the Echo Wind Farms planned to claim its own BETC credits independently. The manager recalled his experience with BETC:

> Because we are each individual legal entities, we claim our own BETC. We played by the rules there were by the time. We built the project by the rules Oregon had on the book by the time. But the BETC people weren't happy because no one had ever done this before. They never thought about it. But we thought about it, and we did it because that's what the rule said. But they said we cannot let you do that, because you guys are too close together. Yours and these guys' [projects] kind of line up, and we are going to call that one project. We said wait a minute. It's like if I park my car in the street, and a neighbor parks his car in front of my car. Just because we are lined up, it doesn't mean the neighbor owns my car. They just both happened to park in the same street. They feel a pain about it.

Eventually, the Echo Wind Farms did not receive as much credit as expected because the state government decided to change the way that BETC had worked and to apply the new rule to the wind farms. The manager continued:

> They didn't give us as much as the law says they should at the time. They said we are going to change the law, and they were going to make it retroactive before our projects. We said wait a second, we financed it, and we did everything based on Oregon's rules at the time. They said tough luck. That's just the way it is. So they changed the rules.

The reason the state government was able to change the rule and make it retroactive was that the Echo Wind Farms by that time had not been issued a final certificate and thus were still in the application phase. If the wind farms had been issued a final certificate, the state government could not have changed the rule to work against them.

- **Transmission Lines:** Each project of the Echo Wind Farms owns a certain percentage of the substation and the transmission line depending on their percentage of total power capacity each accounts for. For Butter Creek Power, the manager explained:

  > The transmission line and the substation are ours. We built them, we own them, and we maintain them. I own roughly 7.7%, [because] I own 4.95 MW and if you divide it by 64.5 MW, it is 7.7% would be my share. It [the transmission line] goes down [along] Highway 207, and connects to a PacifiCorp substation at Hinkle.

  The route of the transmission line was a bit controversial. Originally, the line was planned to cross some private properties owned by the neighbors. However, the neighbors did not like to see the power poles in their backyard and thus opposed the route. Eventually, the line had to use a different route which exhausted the Oregon Department of Transportation's public Right-Of-Way for Highway 207 in the area. A local government employee recalled:

  > They [the Echo Wind Farms] filed for a Land Use Decision (LUD) application for the transmission line. That decision was appealed by the neighbors, and the Board of Commissioners ultimately approved the appeal. That second line used up the balance of the State's Right-Of-Way.

  The Echo Wind Farms attempted to pay a neighbor $75,000, which was seven times more than what a utility would normally pay, for putting the transmission line along the edge of her property with the power poles being one-foot inside the property. The neighbor rejected the offer, and left the wind farms with no options other than using the public Right-Of-Way. Ironically, one of the power poles under the Right-Of-Way was placed right in front of her house. The manager said:

  > It would be a lot simpler to go the original way, because the State's easement was crooked, and the public Right-Of-Way was longer and more

> expensive. We would like to offer the neighbor $75,000, but now they did not get a piece of pie. We took the last space on that Right-Of-Way, so nobody else in the future can do anything, because we used it. A good foresight would have been that let's allow you to build this project by using as much private property as we can, and save that public corridor for somebody else that doesn't have the ability. So basically we used the public resources we didn't need to.

Summarizing Barriers and Opportunities

Several years ago, Oregon Wind, LLC, approached the Mader-Rust family and the Madison family to explore the possibility of building wind projects on both families' farmland. With the permission from both families, the developer started searching for equity investors and eventually secured a partnership with John Deere Renewables. The whole Echo Wind Farms was approved for a transmission line route in 2008. However, some neighbors appealed against County Planning Commission's approval for the transmission route. In the end, the project had to use ODOT's public Right-Of-Way for Highway 207 to build the transmission line. The Echo Wind Farms started generating electricity in 2009. Exelon Corporation acquired John Deere Renewables' wind energy assets and thus became the investment partners in the Echo Wind Farms in 2010.

Having professional developers (Oregon Wind, LLC) develop the project and secure investment partners was key to the success of Butter Creek Power. Plus, government incentives also helped the project considerably, and availability of the public Right-Of-Way made the transmission possible. However, the State's change of how BETC should be applied and lack of local support for the original transmission route created substantial barriers to the project (See Figure 4.4.10).

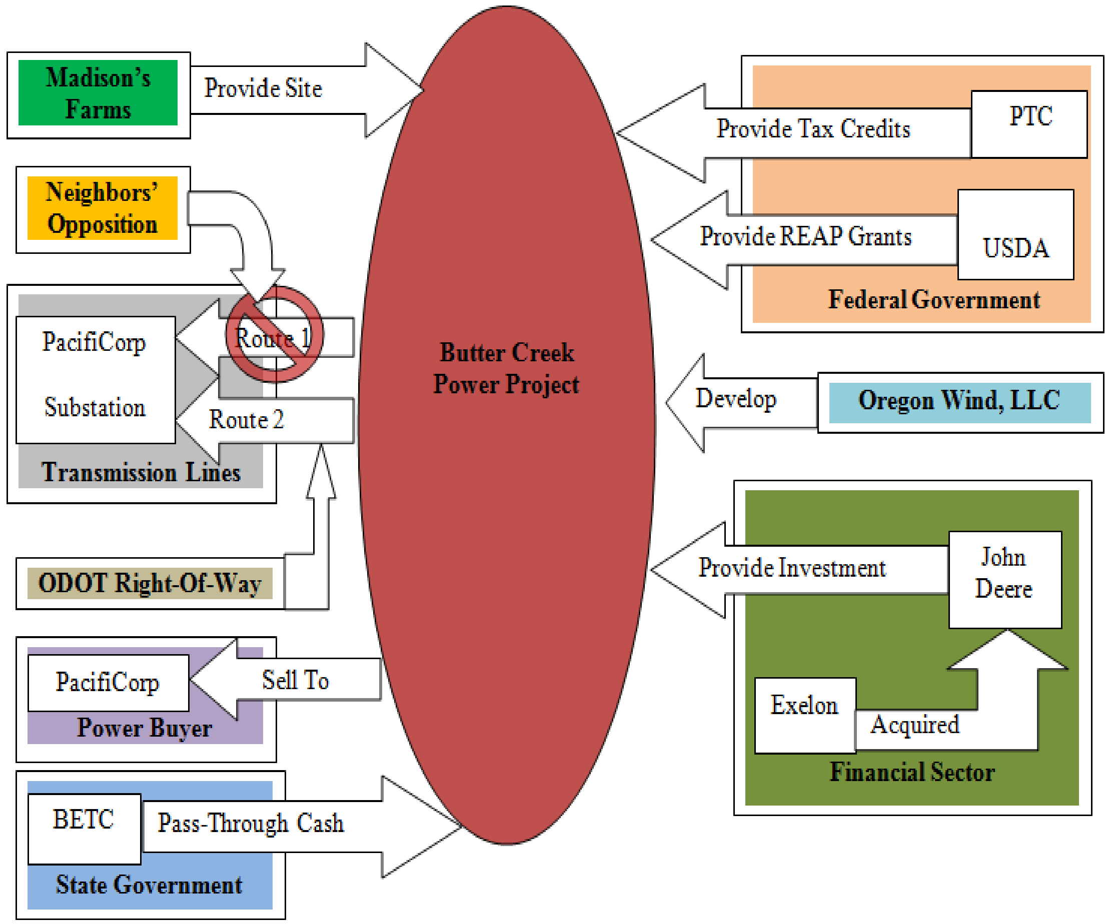

Figure 4.4.10. Actor-Network Analysis of Butter Creek Power Project

4.5. Discussion

As demonstrated in the seven case studies, the actor-network theory is a useful tool to analyze wind energy projects from multiple perspectives, such as the material aspects of wind technology, the geographic characteristics of the location, the community's attitudes towards the facilities, as well as the political climate in which they are embedded (Jolivet and Heiskanen, 2010). Combining the technical dimensions and the social dimensions, the approach provides a holistic snapshot of major factors involved and relationships between them. Applying this theory to the seven empirical cases in Oregon has helped our understanding of the natural-technical-financial-political environment for community wind energy projects.

Based upon the results in Section 4.4, common factors that emerged include geographic features, land ownership, attitudes of the local residents, wheeling utilities, power buyer, county incentives, state incentives, federal incentives, other incentives, financing sources, developers, conservation groups, and manufacturers. Table 4.5.1 summarizes examples from the seven cases for each major factor. Geographically, project developers or owners should pay enough attention not only to the wind resources, but also whether there are wildlife habitats, scenic landscapes, military training routes, or traditional cultural properties nearby. In terms of land ownership, community wind energy often takes place on farmland, BLM's land, and county government's land. Socially, local residents may support or oppose wind energy in general or only form an opinion about the location of the project or transmission lines. To deliver the power to the buyer, wheeling utilities might be involved and a fee will be charged for using their transmission lines. Under the PURPA law, investor-owned utilities, which in Oregon include PacifiCorp, PGE, and Idaho Power, are required to purchase renewable energy no more than 10 MW. Some counties have the enterprise zone programs where businesses will be exempt from property taxes. At the state level, BETC, SELP, and CREFF have been substantially helpful for community wind energy development. At the federal level, most often used incentives include the PTC, ITC Grant, USDA’s Loan Guarantees, REAP Grant, REAP Loan Guarantees, and DOE’s Loan Guarantees. In addition, the Energy Trust of Oregon has an Anemometer Loan Program to help finance meteorological towers. Financing sources for the whole project can come from companies, banks, wealthy families, and even personal investment. With regard to manufacturing, there are both new turbine suppliers and used turbine suppliers in the sector, and the used turbine suppliers often work with rebuilders and vendors to sell their turbines. For community wind energy, developers can be outside professional developers; they can also be landowners themselves. Last but not least, conservation groups may support, oppose or stay neutral on wind energy, depending on its interests, primary missions, and factors in that nature. Identifying these factors can advance understanding of different views on the wind project and predict the outcome of projects that have similarities with the case studies. Essentially, the actor-network theory has answered three questions for us: who is involved? What interests are represented? How do these interests interact? (Jolivet and Heiskanen, 2010).

Table 4.5.1. Common Factors Emerged from Seven Cases

Common Factors	**Examples from Case Studies**
Geographic Features	Wind Resources; Presence of Wildlife Habitats; Presence of Scenic Landscape; Presence of Military Training Routes; Proximity to Traditional Cultural Property
Land Ownership	Family's Farmland; BLM's Land; County's Land
Local Attitudes	Support or Oppose Wind Energy; Suppose or Oppose Location of Facilities
Wheeling Utilities	BPA; Wasco Electric Cooperative; Surprise Valley Electrification Corp; Build Their Own Transmission Lines
Power Buyer	PacifiCorp; PGE; Idaho Power
County Incentives	Lake County's Property Tax Exemptions
State Incentives	BETC; SELP; CREFF
Federal Incentives	PTC; ITC Grant; USDA Loan Guarantees; REAP Grant; REAP Loan Guarantees; DOE's Loan Guarantees
Other Incentives	Energy Trust of Oregon's Anemometer Loan program
Financing Sources	Companies; Wealthy Families; Banks; Personal Investment
Manufacturers	Turbine Suppliers; Turbine Rebuilders; Vendors
Developers	Outside Professional Developers; Landowners Themselves
Conservation Groups	Friends of the Columbia Gorge; Hood River Valley Residents Committee

In order to identify the similarities and differences of the seven projects, I compared and contrasted the cases in terms of project size, land ownership, results, major opportunities and major barriers. It showed that they are similar in size (i.e. they are all no more than 10 MW to be able to meet the PURPA requirements). The lands the projects were built on have different ownership: private farmland, county's land, or federal land. The results were different: some have been up and running, some may be stopped, while others may still be in development or about to start construction. Also, the major opportunities and barriers they each experienced can be time-specific and/or location-specific. For example, the financial market and policy institutions change over time, and depending on the time point a project starts, the wind farm may face a very different set of financial and policy opportunities and barriers. Location-wise, the existence of Military Training Route or proximity to scenic areas should be noted in planning the development. It is suggested by the results that a developer needs to pay attention to both temporal and spatial factors in planning a wind farm. A summary of project attributes and major factors is presented at the end of this section (See Table 4.5.2).

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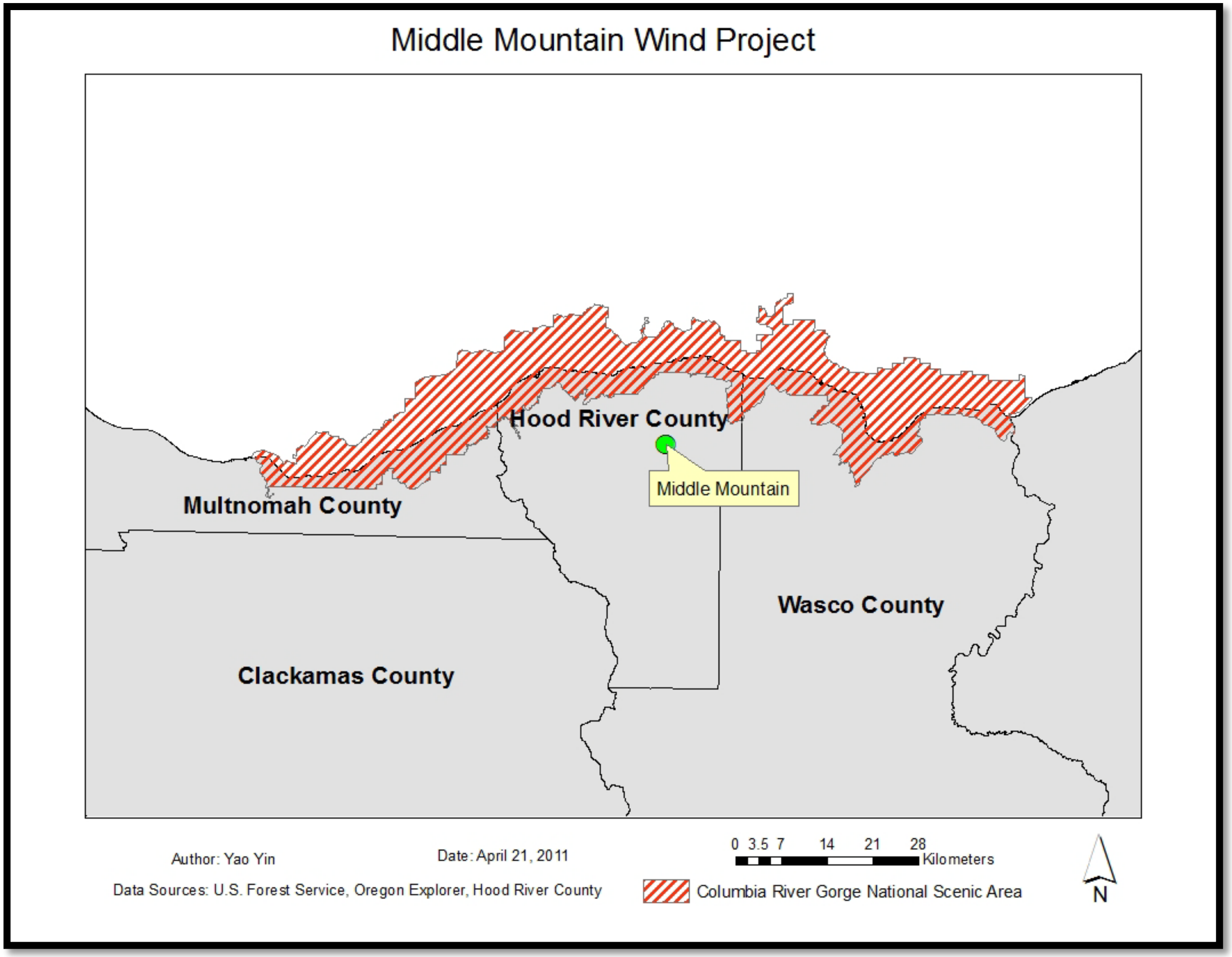

Figure 4.4.11. Middle Mountain Project Is Outside of the Columbia River Gorge National Scenic Area

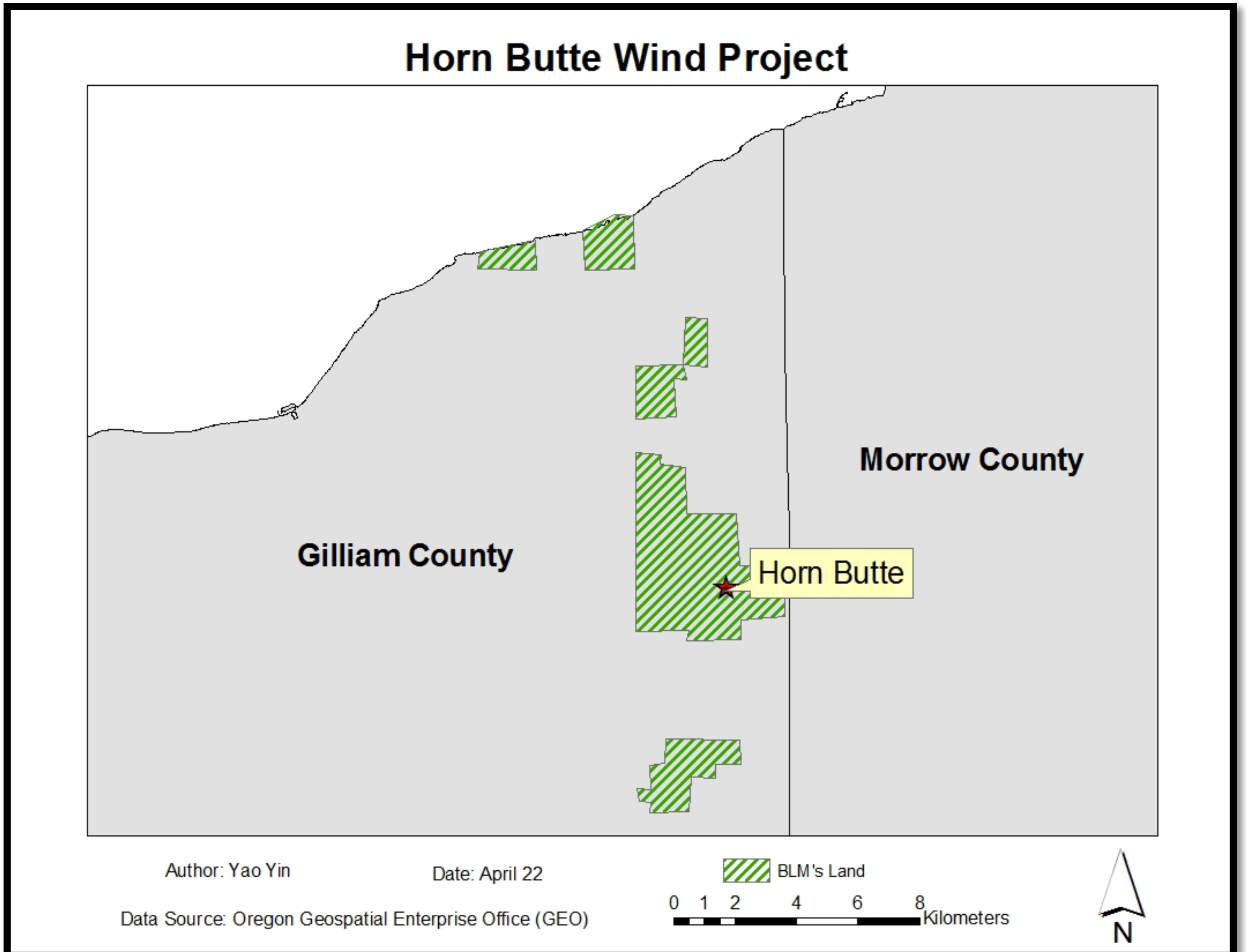

Figure 4.4.12. Horn Butte Wind Project

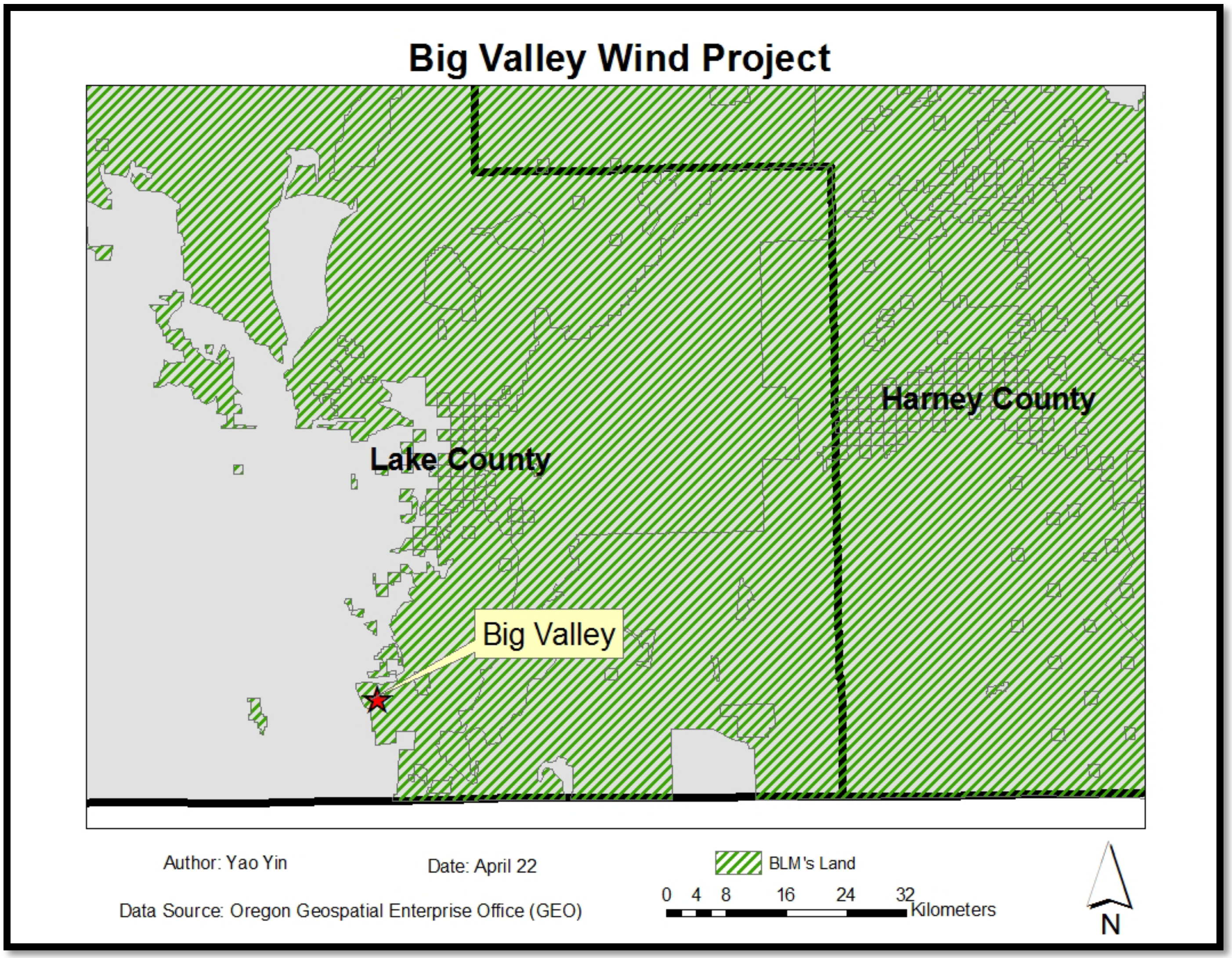

Figure 4.4.13. Big Valley Wind Project

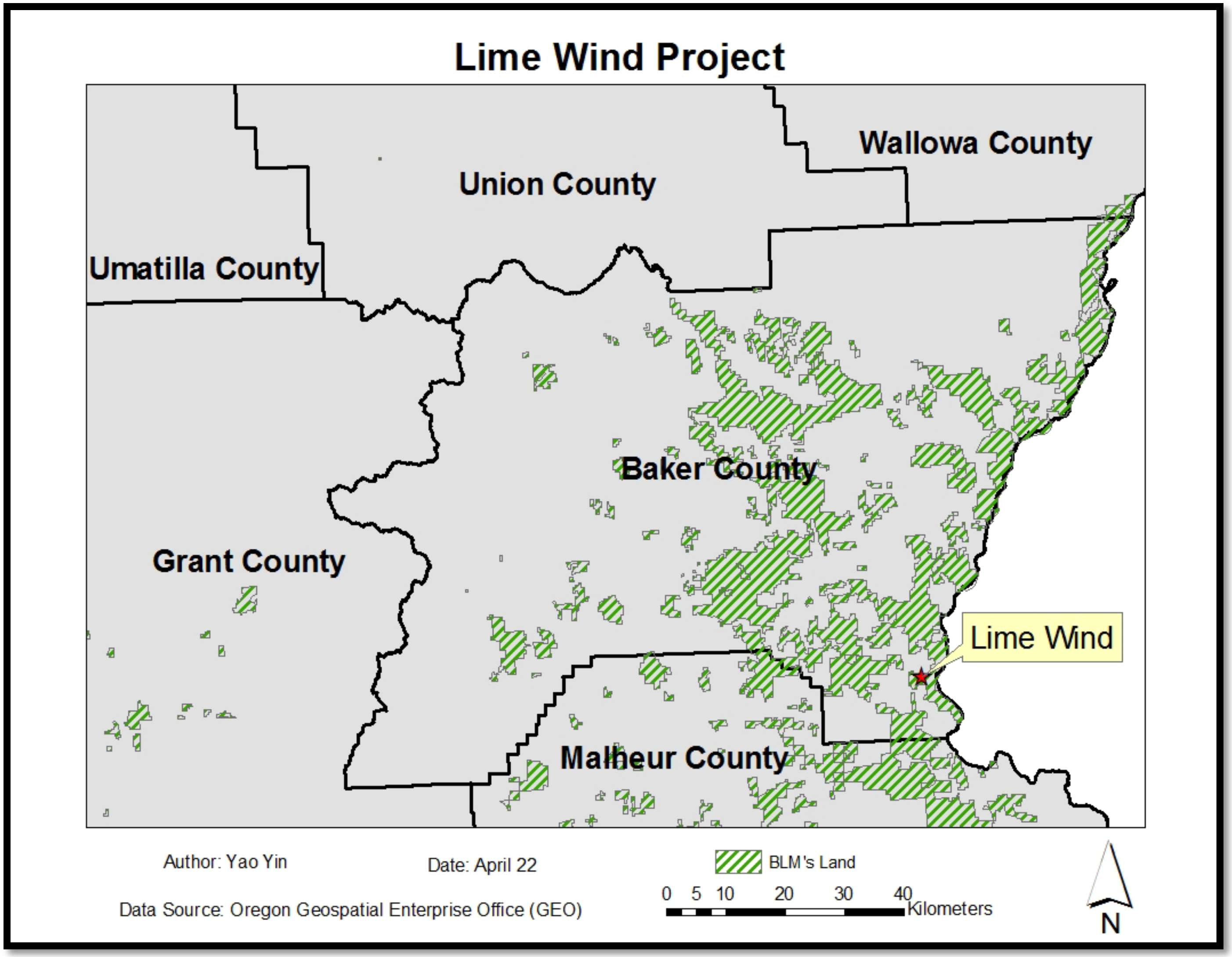

Figure 4.4.14. Lime Wind Project

Table 4.5.2 Important Attributes and Major Barriers and Opportunities

Project Names	Project Size	Land Ownership	Major Barriers	Major Opportunities	Results
PáTu	6×1.5MW =9MW	Private Farmland in Sherman County	Collapse of Financial Sector	Availability of ITC Grant; Construction Loan from CoBank; Investment from Two Families; Surrounded by Other Large Wind Projects	Successful, Operational since December 2010
Sayrs	5×2MW =10MW	Private Farmland in Sherman County	Did not Receive BETC	Having PáTu as an Example; Local Government Securing Transmission Capacity for Community Wind Projects	Not Likely to Succeed as of Early 2011
Middle Mountain	6×1.5MW =9MW	County's Land in Hood River County	Presence of Scenic Landscape; Strong Public Opposition	County Government's Support	Failed in 2010
MCCOG's Project	To Be Decided but Should Be <10MW	BLM Land in Gilliam County	Presence of Endangered Species on BLM's Land	Member Governments' Support	Early-Stage of Development, Future Unknown as of Early 2011
Big Valley	5×2MW =10MW	BLM Land in Lake County	Presence of Endangered Species on BLM's Land; Presence of Military Training Routes; Proximity to Traditional Cultural Property	Local Support; Energy Trust of Oregon's Anemometer Loan; CREFF Fund	Mid-Stage of Development, Very Likely to Succeed as of Early 2011
Lime	6×500kW =3MW	BLM Land in Baker County	Securing Mid-Sized Refurnished Turbines; Securing Construction Financing	BLM's Guidance; BETC; SELP; ITC Grant; REAP Grant; REAP Loan Guarantees; Manufacturers' Contributions	Successful, Construction Starts in July 2011
Butter Creek Power	3×1.65MW =4.95MW	Private Farmland in Umatilla County	Changes of BETC; Local Opposition for Original Transmission Route	Having Professional Developers; Investment from John Deere	Successful, Operational since October 2009

5. CONCLUSION

Summary

This research intends to provide insights into community wind energy development in Oregon using an integrated analysis approach, which incorporates GIS Suitability Analysis, Socio-Political Analysis, and Empirical Case Studies. In the GIS analysis, we developed a model through a series of steps (including data acquisition, preprocessing, data management, manipulation and analysis, and output generation) to measure how suitable locations are for developing wind energy in Oregon. The socio-political analysis adopts the Socio-Political Evaluation of Energy Deployment (SPEED) framework and categorized policies and incentives that are applicable to community wind projects into three classes: strategic, tactical, and operational. The empirical case studies, focused on seven projects in Oregon, are analyzed using the actor-network theoretical framework, and their opportunities and barriers are explored as well.

GIS Results

The GIS results suggest some northern counties along the Columbia Gorge, such as Sherman, Gilliam, Morrow, and Umatilla, have high suitability for wind energy development. Southeastern counties like Lake, Harney, and Malheur also reveal great potential for future wind projects. However, users still need to pay attention to the underlying assumptions upon which the model is built. For example, I assume that the factor of wind speed is more important than other factors; farmland or barren land is a desired land type for development; less steep areas are preferred; urban areas, lakes, parks, and wilderness areas should be avoided. I anticipate the suitability map to be a useful starting point for those who are interested in wind energy, especially policy makers, land use planners, and wind developers. For policy makers and land use planners, this map suggests where wind activities are likely to take place in the future. If there is high suitability in their jurisdictions, it may be better to plan ahead and take the possibility into consideration when setting agenda locally. For wind developers, this map serves a good starting point for planning projects by allowing them to concentrate on more suitable areas so that their projects are more likely to succeed. If Oregon would like to see more wind energy development, this map will be helpful for the state to make wise decisions.

Policy Prescriptions

In terms of applicable policies and incentives, the findings suggest that at the strategic level the Oregon Renewable Portfolio Standard needs more enforcement to reach its eight percent goal for small-scale renewable energy projects by 2025. Some ways to strengthen enforcement could include the Governor and Legislature checking with the executive agencies to ensure they have adopted policies and procedures to encourage community renewable energy projects, and the Legislature establishing requirements of utilities that a certain percent of renewable electricity must be from small-scale renewable energy projects. Another strategic goal set by the Energy Policy Act of 2005 demands public lands to have a 10,000 MW of non-hydropower renewable energy by 2015, but local offices of federal agencies, such as the BLM, vary in attitudes towards renewable energy. Federal agencies may need to resolve the issue of inconsistency among district offices internally and send out clear signals to developers and general public as to whether or not they want to pursue renewable energy on federal lands.

At the tactical level, the Production Tax Credit has played a vital role in promoting renewable energy including wind energy, but community-scale projects find it difficult to utilize the PTC because it is based on how much power is produced and requires outside tax equity investors who typically are not very attracted by small-scale projects. However, the ITC (or 1603 Grant) works much better because it does not depend on project performance; instead, it depends only on how much investment has been made. The Rural Energy for America Program (REAP) from the USDA is also a great incentive, but lack of funding is a challenge that faces the agency. The federal government should keep funding the ITC program and provide sufficient financial support for REAP if they hope to see more community wind projects emerging in the U.S. In Oregon, the Oregon Business Energy Tax Credits has substantially changed over the past few years from being a "given" to a "lottery system" where community wind has little, if any, chance of receiving the credits. If Oregon still wants to meet the goal of having eight percent of electricity come from small-scale renewable energy projects, the State should reconsider prioritizing small-scale projects, such as community wind energy, for BETC.

At the operational level, the Public Utility Regulatory Policy Act with the Oregon Order 05-584 requires the three Investor-Owned Utilities (IOUs)-PacifiCorp, Portland General Electric (PGE), and Idaho Power-to provide standard rates and a Commission-approved 20-year standard contract for facilities up to 10 MW. Because of this 10 MW cap, almost all the community wind energy projects are 10 MW or less in size. But its pricing mechanism for wind is based on the forecasted price of natural gas. To make the price fair, policy makers may want to consider adopting a different pricing mechanism:

feed-in tariff. The feed-in tariff bases prices on the cost of renewable energy generation plus a reasonable profit. In terms of permitting, community wind projects would prefer applying for a Conditional Use Permit from local governments to pursuing a Site Certificate from Energy Facility Siting Council at the state government because of lower costs. If the project is on the BLM's land, a National Environmental Policy Act review process will be required. I found normally a community wind project is likely to go through the Environmental Assessment (EA) pathway rather than the Environmental Impact Statements (EIS) because of its small scale and the limited impacts on human environment. Therefore, developers should focus more on the EA, unless there are some unique characteristics associated with the project that may trigger the EIS.

Also, in order to stimulate community wind energy from a financing perspective, Oregon could have had an investment plan which allows the general public to invest in such projects and receive different rates of return depending on their zip codes (i.e. the closer a person resides to the wind project, the higher return he will receive). This way, the projects are likely to expand local ownership and increase acceptance for wind projects by local communities.

Empirical Case Studies

Lastly, this research intends to approach community wind energy from multiple perspectives, such as the material aspects of wind technology, the geographic characteristics of the location, community attitudes towards facilities, as well as the political climate in which the project is embedded, using the actor-network theoretical framework. Seven case studies include PáTu Wind Farm and Sayrs Wind Farm in

Sherman County, Middle Mountain project in Hood River County, MCCOG's project in Gilliam County, Big Valley project in Lake County, Lime Wind in Baker County, and Butter Creek Power project in Umatilla County. There are similarities and differences among these projects with regard to project size, land ownership, opportunities and barriers. A developer needs to pay attention to the temporal and the spatial factors associated in planning a community wind energy project.

Integrating Three Analyses

The GIS Analysis, the Socio-Political Analysis, and the Empirical Case Studies complement one another very well in depicting community wind energy development in Oregon. The inter-linkages between them are identified as follows.

The GIS Analysis-The Empirical Case Studies: Several developers in the empirical case studies began their development journeys by touring around the state to find potential sites, and also some county government employees mentioned that they were asked to point out where suitable locations are for building wind energy. Therefore, a need for a GIS analysis has been confirmed by my interviewees in the empirical cast studies. In addition, the locations of the seven projects verify the credibility of the GIS results (See Figure 5.1. at the end of this section). A developer should use the GIS map as a starting point and next find out if there is a case project near the site he or she is interested in. The GIS analysis will help filter areas that are unsuitable, and the empirical experiences will bring in more temporal and spatial factors for the developer to consider.

The GIS Analysis-The Socio-Political Analysis: The GIS can inform policy-making and how resources should be used. For example, the map shows southeast Oregon has many suitable areas for wind development, and most of the land there is the BLM land. Therefore, it may be more pressing to make consistent the BLM district offices in the southeast towards renewable energy development than to homogenize those in other areas. Another example can be the investment plan discussed earlier. If policy makers think it is a good idea to invest based on zip codes, they may want to experiment with some small areas first and see if the plan is feasible. A location with adequate wind resources would be a good place to start, because that is where wind farms are most likely to be built.

The Empirical Case Studies-The Socio-Political Analysis: The major opportunities and barriers identified in the seven empirical cases indicated that incentives at the operational level are key factors that substantially determine the eventual outcome. For example, PáTu Wind Farm could not have been successful without the ITC program; and Sayrs Wind Farm would have been successful if it had received the BETC. However, the seven projects also revealed that the goals at the strategic levels were not as effective as expected due to lack of enforcement and variations in implementation. At the operational level, PáTu and Butter Creek Power serve as examples of permitting locally with the county governments for private lands. On the BLM land, Lime Wind and Big Valley wind project are two examples that only require a partial NEPA process.

Future Research

First, due to the time constraints, I did not have an opportunity to include as many information layers as I expect in building the GIS model, and many layers are missing such as habitats for endangered species, proximity to power grid, distance to ridge, forest density, land ownership, and public perceptions. For future research, I hope to improve the accurateness of the model by including more data. Second, as private land suitable for wind energy diminishes, there may be more and more projects emerging on the federal lands. Are federal agencies ready for this? If not, what problems will result from the interaction between private energy companies and federal agencies? Third, as high-voltage transmission lines are getting fuller, how will community wind projects deal with the power delivery? I would like to seek answers for these questions in my future research.

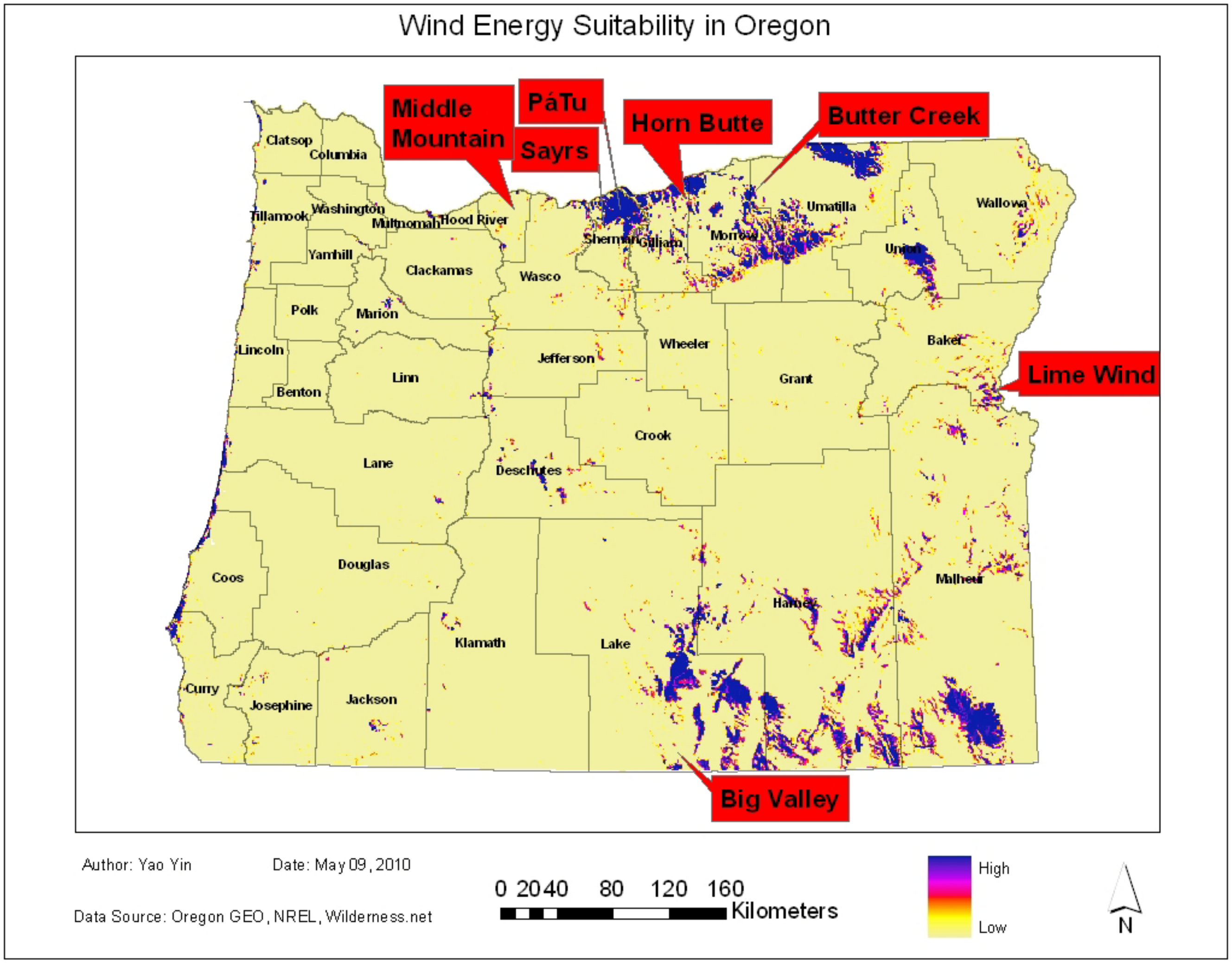

Figure 5.1. Locations of Seven Cases

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