

# **Quantifying the Economic Development Impacts of Wind Power in Six Rural Montana Counties Using NREL's JEDI Model**

**Period of Performance:  
December 1, 2003 – May 31, 2004**

M. Costanti  
*Bozeman, Montana*



**NREL**

**National Renewable Energy Laboratory**  
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NREL Technical Monitor: K. Sinclair

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## **Introduction**

The economic development potential that wind power offers is often an overlooked aspect of today's wind power projects. Much has been written about how wind can spur economic development, but few have attempted to quantify these impacts. Using the National Renewable Energy Laboratory's (NREL's) Jobs, Economic Development, and Impacts Model, hereafter referred to as JEDI or the Model, the author examined six counties in Montana to quantify these impacts.

## **Project Goals**

The overriding project goal was to illuminate economic development opportunities from wind project development for six Montana counties using an objective economic modeling tool. Interested stakeholders include the agriculture community, wind developers, renewable energy advocates, government officials, and other decision-makers.

## **Model Background**

The JEDI Model was developed under contract for NREL by Marshall Goldberg (Goldberg 2003). The Model was developed to enable spreadsheet users with limited or no economic modeling background to easily identify the statewide economic impacts associated with constructing and operating wind power plants. The Model's *User Add-In* feature allows users to conduct county-specific analyses using county IMPLAN (Impact Analysis for PLANning) multipliers, while state-level multipliers are contained within the Model as default values for all 50 states.

## **Report Funding**

NREL sponsored the analyses for Blaine, Cascade, Glacier, and Park Counties, while Great Northern Power Development sponsored the McCone and Prairie County analyses.

## **Intended Audience**

The intended audiences for this study are:

- Members of the agricultural community seeking new opportunities for supplementing existing farming activities
- Local and state members of government, including city and county commissioners and state legislators
- Members of Wind Powering America's Wind Working Groups
- Policy makers
- Wind developers
- Economic development firms
- Investor-owned, private, and co-operative utilities
- Wind advocates.

The readers of this report need not have extensive economic modeling, spreadsheet, or wind power experience. The intent was to create an introductory report to inform and educate readers about the economic development aspects of wind power projects in rural areas.

## **Overview of JEDI**

Following is a breakdown of the JEDI Model, including information on history and background, expenditure effects, required JEDI inputs, JEDI outputs, and JEDI assumptions.

## ***History and Background***

The JEDI Model seeks to quantify the economic impacts associated with a given wind project. The JEDI Model is an input-output (I-O) modeling tool incorporating multipliers derived from IMPLAN.

IMPLAN, a model originally developed by the U.S. Forest Service to trace supply linkages in a given economy, is a system of software and data used to perform economic impact analysis. Currently, the IMPLAN software and data are being managed and updated by the Minnesota IMPLAN Group, Inc., (MIG) using data collected at federal, state, and local levels (Minnesota IMPLAN 2003).

## ***Expenditure Effects***

To quantify economic impacts per an associated expenditure, I-O analysis aggregates three economic effects (Goldberg 2003):

- **Direct Effects:** Onsite or immediate effects created by a given project expenditure, which are affected on a first-tier basis with the project
- **Indirect Effects:** Increase in economic activity that occurs when a directly affected entity receives payment for goods or services and is, in turn, able to pay others for goods and services that support the directly affected entity. These entities participate on a second-tier basis with the project.
- **Induced Effects:** Refers to the change in wealth and/or income that occurs, or is induced, by the spending of entities directly and indirectly (first and second tiers) affected by a given project. These entities participate on a third tier, or lower, basis with the project.

To illustrate how these three effects are related, consider the following examples:

- Entities from the **Direct Effects** category receive payment for their goods and services DIRECTLY from project funds. Examples include turbine manufacturers, project developers, project construction crews, or transmission interconnection crews (1<sup>st</sup> Tier).
- Accordingly, entities in the **Indirect Effects** category are compensated INDIRECTLY from project funds. Examples include steel manufacturers that supply turbine tower manufacturers, legal firms employed by the project developer, construction material firms that supply building materials to project construction crews, or electric-utility suppliers that procure goods, such as high-voltage transmission lines and sub-stations for utility crews carrying out interconnection activities (2<sup>nd</sup> Tier).
- An **Induced Effect** refers to the aggregated benefits to 3<sup>rd</sup> Tier support entities that benefit from directly and indirectly affected entities. Examples include suppliers of raw good materials for steel, gravel companies supplying gravel for tower pads, or food and lodging entities that feed and house 1<sup>st</sup> and 2<sup>nd</sup> Tier members.

The sum of the *Direct*, *Indirect*, and *Induced Effects* yields the *Total Effect* from a given expenditure.

## ***Required JEDI Inputs***

To run the JEDI Model for a specific project, the following inputs are required:

- Project location
- Year of construction
- Project size
- Turbine size
- Project construction cost (\$/kW)
- Annual operation and maintenance cost (\$/kW)
- Current dollar year.



In addition to the above items, for a general analysis JEDI provides the user with the ability to use default data that the Model developer researched while constructing the Model. However, in cases in which project-specific data are readily available (bill of goods, actual construction and operation costs, loan terms, percent local ownership, payroll parameters, easement payments, local taxation information, etc.), the user can include these items for a more localized, project-specific analysis.

### **JEDI Outputs**

The JEDI Model generates the following outputs per a given set of inputs:

- **Jobs:** Refers to full-time equivalent employment for a year
- **Output:** The economic activity, or project value, in the state, regional, or local economy
- **Earnings:** Refers to annual wage and/or salary compensations paid to 1<sup>st</sup>, 2<sup>nd</sup>, and 3<sup>rd</sup> Tier workers
- **Local Spending:** Refers to the actual annual dollars spent on goods and services in the area being analyzed (state, regional, or local economy where the plant is being built)
- **Annual Lease Payments:** Provides an annual total of lease/easement payments to landowners
- **Property Taxes:** Represents the annual property taxes that the project will generate, exclusive of any property tax exemptions that may be available.

Model outputs will be discussed in more detail in the Model Output section.

### **JEDI Assumptions**

As with all economic forecasting tools, JEDI has a number of assumptions (Goldberg 2003) that enable a conclusive analysis.

First, the Model is not intended to be a precise forecasting tool; rather, it provides a reasonable profile of how a wind investment will affect a given economy. Second, the Model provides a *gross analysis*, rather than a *net analysis*; i.e., the Model does not reflect net impacts associated with alternate spending of project funds or replacement of existing power generation facilities. Third, the Model assumes that adequate revenue exists to cover all debt and/or equity payments and annual operations and maintenance costs associated with a given project. Therefore, although the Model can provide the user with reasonable benefits associated with a given project, it is up to the user to ensure that a given project is an acceptable investment.

### **Methodology**

As mentioned previously, the author selected six Montana counties, per recommendations made by the *Montana Wind Working Group* (Wind Powering America 2004), to quantify the associated benefits of siting wind power projects in rural economies. The author chose the following counties for analysis:

- Blaine County
- Cascade County
- Glacier County
- McCone County
- Park County
- Prairie County.

NREL sponsored the studies in Blaine, Cascade, Glacier, and Park Counties. Great Northern Power Development L.P. (GNPD) sponsored the studies in McCone and Prairie Counties. GNPD elected to sponsor the studies for McCone and Prairie counties because it is attempting to gain a more comprehensive assessment of the positive economic impacts that wind power can have on rural counties. Furthermore, although GNPD has not been involved in wind power in the past, it believes that a complementary synergy

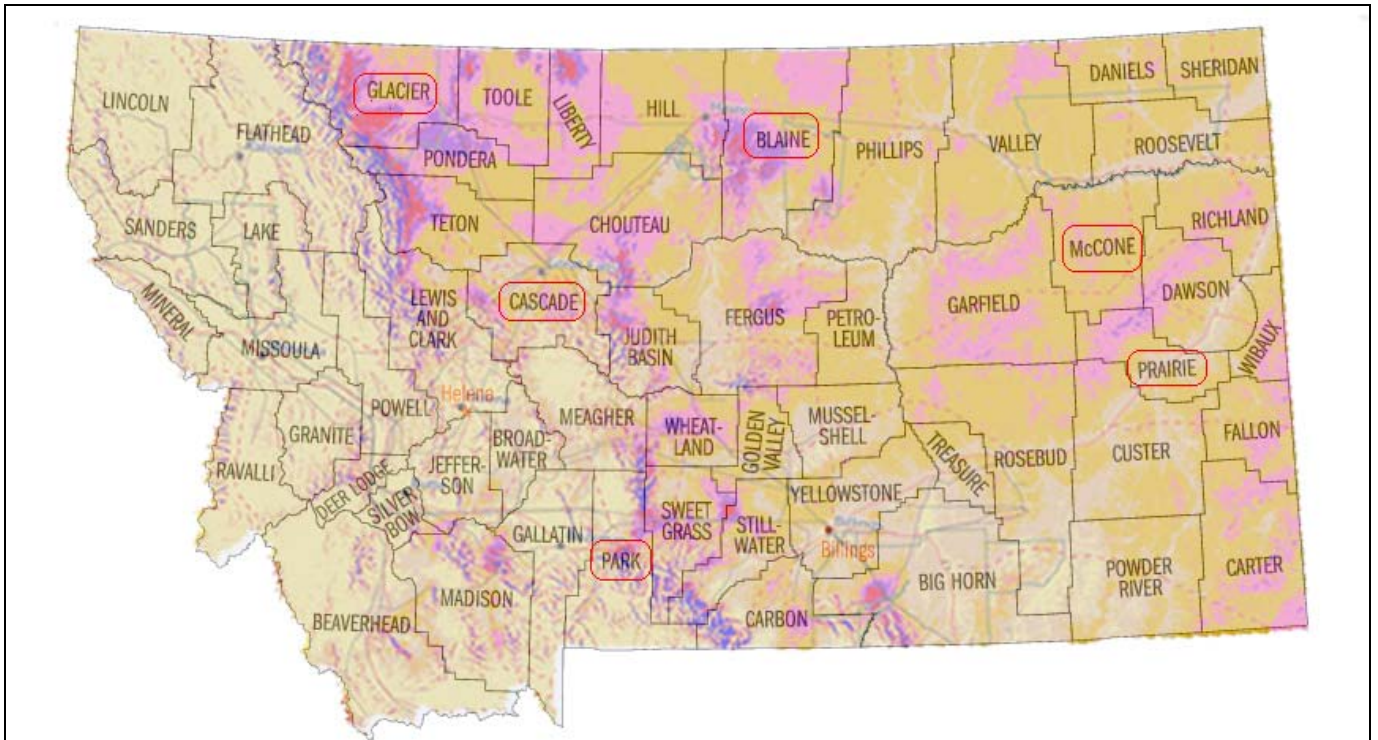
between coal- and wind-generated energy can be realized. For this reason, GNPD is actively pursuing such a project in the region of McCone and Prairie counties.

The county selection criteria were aided by the wind power county map (Fig. 1), which details Montana's wind resource and county boundaries (NWSeed 2004). Fig. 1 also graphically illustrates why Montana ranks fifth in the nation in terms of wind resource (AWEA 2003) and the criteria for which the counties were selected, namely:

- County wind resource
- Geographically diverse locations
- Population diversity
- Native America affiliation
- History of wind development
- Desire to site wind projects.

### ***Project Sizes***

To gain a comprehensive view of how wind power can affect the above counties, the author created six project sizes for each county: 5, 10, 20, 50, 100, and 300 MW. This wide range of project sizes was selected to examine the resultant economic impacts from small, medium, and large wind projects.



**Figure 1: Montana Wind Speed-County Map**



**Figure 2: Wind Speed Map Legend**

## **Model Inputs**

One of the major goals of this analysis was that the project analyses be replicable for future users. To this end, specific descriptions of the inputs listed in the *Required JEDI Inputs* section follows<sup>1</sup>.

### ***Project Location***

JEDI provides the user with the ability to use either state-level IMPLAN data, which are embedded in the Model, or to incorporate regional- or county-level IMPLAN (or other) multiplier data. For purposes of general interest, the state-level analyses can provide users with a rough estimate of how a given project may affect the state economy. However, to increase the sensitivity to the local economy where the project will be located, JEDI's *User Add-In Location* feature, which provides a means of generating county or regional analyses, can be utilized to assess the economic impacts associated with wind development on a more localized level. This will be discussed in more depth later.

In all circumstances, *MY COUNTY* (denoting use of county-level data) was selected in the *Project Location* drop-down menu for the specific analyses described in this report.

### ***Year of Construction***

The current year was chosen for the analysis: *2004*.

### ***Project Size***

As mentioned previously, six project sizes were incorporated for each of the six counties. The project sizes were *5, 10, 20, 50, 100, and 300 MW*.

### ***Turbine Size***

Over the past 5 years, the wind industry has seen wind turbines jump from a nominal rating of 300-750 kW to multi-megawatt machines that are more efficient than past turbine technology. In many cases, the size of turbines that are employed on a specific project is highly contingent on a number of factors, including but not limited to site features and financing terms.

For computational purposes, the author elected to employ a *1.5-MW turbine* because it is a representative size for many of today's wind turbine projects.

### ***Project Construction Costs***

Generally, costs associated with large industrial facilities are highly proprietary, and wind power project construction costs are no different. To this end, the author chose to utilize a figure that was easy for users to remember, as well as one that was based upon actual figures.

From research conducted by the author through interviews with three project managers (who will remain anonymous), the author elected to use *\$1,000/kW* as a figure for *Project Construction Costs*. Coincidentally, this is the same as the default value in JEDI that was developed based on aggregate average actual project costs.

The author found that many of today's wind power project managers treat the *Project Construction Cost* figure differently. To some, for instance, this figure includes all costs associated with transporting, erecting, and commissioning, whereas others feel that the cost should only cover the actual costs associated with the turbines. In the end, the author felt that continuity was more important than specificity.

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<sup>1</sup> Figures 3 - 6 in the APPENDIX demonstrate how the *Model Inputs* were entered in JEDI.

Furthermore, by quoting figures that are, in reality, lower than many of today's wind project construction costs, the economic impacts are underestimated. Therefore, if a "low" construction cost yields a satisfactory economic effect, increasing this figure will only serve to increase the associated economic impacts—thus making for even more desirable results.

Conversely, if a high construction cost was utilized, an overestimation of the associated economic benefits could occur. Therefore, being conservative will have the added benefit of increasing the likelihood of meeting JEDI's economic predictions.

### ***Annual Operations and Maintenance Costs***

Similar to *Project Construction Costs*, the *Annual Operations and Maintenance (O&M) Costs* are also proprietary, as well as wide-ranging. The debate over the actual O&M costs is based on which cost components are included in the *O&M* figure. For instance, many developers report an all-inclusive figure (insurance, repair reserves, maintenance contracts, monitoring, etc.), while others report a figure with fewer items.

Through the above-stated meetings with project developers, O&M costs ranged from \$9.50/kW to \$25/kW. The author elected to use a figure based on actual costs (confidential interviews), as well as one that is easy to remember. To this end, \$12.50/kW was chosen as the *Annual Operations and Maintenance Cost*.

Similar to the *Project Construction Cost* parameter, \$12.50/kW is the default O&M cost parameter in JEDI.

### ***Current Dollar Year***

The author chose the current year for this parameter: 2004.

### ***Altering Default Values***

In addition to the above input parameters, JEDI also allows users to input *Local Taxation Parameters*, *Local Ownership Percentages*, *Landowner Easement Payments*, and *County Multipliers*, among a long list of possible inputs. Following is a summary of these parameters, as well as which values were employed.

#### ***Local Taxation Parameters***

Taxes are an item that many people do not understand and are reluctant to deal with. Applying a common local property tax figure would be inappropriate for a county-to-county analysis. The issue is further compounded because many counties in Montana are larger than many East Coast states. Therefore, questions arose on how property taxes are assessed, as well as how to accurately employ each county's tax district mill levies.

In Montana, local property taxes carry a much larger burden than many other states because of the lack of a state sales tax. Property taxes are broken down into five steps (Montana Department of Revenue 2004):

- Valuation
- Taxation
- Billing
- Collection
- Reconciliation.

Of these steps, *Valuation* and *Taxation* are functions of the state government, while *Billing*, *Collection*, and *Reconciliation* are functions of the county governments. Basically, Montana state government sets the tax amount, and the county governments collect the said tax amounts.

The amount of property tax is not determined solely by a property's value, although the property's value is crucial. In Montana, the following formula is used to determine the amount of property tax due.

### Equation 1: The Montana Property Tax Equation

$$\text{Tax Payable} = (\text{Total Construction Costs})(\text{Assessed Value})(\text{Taxable Value})(\text{Local Mill Levy})$$

Following are definitions of these taxation terms:

- **Tax Payable:** The amount of tax due for a given project.
- **Total Construction Cost:** Figured by multiplying the construction cost (\$/kW) by the size of the project (kW).
- **Assessed Value:** A constant for all counties in Montana set by the state legislation, currently at 87.0% for new projects; this represents the percent of construction costs that are taxable.
- **Taxable Value:** Set by the state legislation, currently at 3.30% for new projects; this represents the percent of Assessed Value that is taxable.
- **Local Mill Levy:** The Local Mill Levy is the tax rate that the local taxing district levies on a project and/or piece of land.

By multiplying the above figures together, one readily comes to a tax-payable amount for a given project. To illustrate, consider the following example:

#### EXAMPLE 1: Calculating Montana Property Taxes: A Simplified Path

Project Size = 10 MW = 10,000 kW

Construction Cost = \$1,000/kW

Assessed Value = 87.0%

Taxable Value = 3.30%

Local Mill Levy = 0.42958

TOTAL TAX PAYABLE = (10,000 kW)(\$1,000/kW)(87.0%)(3.30%)(0.42958)  
= \$12,333

The tax payable figure for 2004 would, therefore, be \$12,333.

An important feature of this example is the following: JEDI can calculate the annual tax payment due per the given inputs, but this figure may change from year to year. Accordingly, users should attempt to use *Assessed Values*, *Taxable Values*, and *Local Mill Levies* that best represent what may occur in terms of tax increases or decreases in the future. This gets right at the nature of economic forecasting, though, in that it is a forecasting tool that is able to gauge reasonable outputs per a given set of inputs or expenditures. For most users, however, the above calculation will be adequate for their needs.

#### Assessing Local Mill Levies

Visiting six remote counties in Montana to assess where wind projects would be sited was not practical. Therefore, the departments of revenue in each of the six counties were contacted to gain a better understanding of where wind projects might be located. The reasoning was that a local government official would be much more familiar with his or her county than the author and, furthermore, much more inclined to provide mill rates for rural, windy areas. To minimize confounding the mill levy samples, a sampling of rural taxing districts was used to eliminate urban tax districts. The following mill rates were reported for each of the counties in question:

**Table 1: County Mill Rates**

County					
<i>Blaine</i>	<i>Cascade</i>	<i>Glacier</i>	<i>McCone</i>	<i>Park</i>	<i>Prairie</i>
473.00	475.00	631.18	491.76	460.93	482.93
418.74	489.00	556.02	410.01	460.97	485.87
516.01	466.81		462.32	448.90	484.48
352.71	440.73			478.44	
387.46	505.44				
<b>Average</b>	<b>429.58</b>	<b>475.40</b>	<b>593.60</b>	<b>454.70</b>	<b>462.31</b>
	<b>484.43</b>				

Table 1 reflects the information that a department of revenue official might provide. However, to input these figures into the JEDI Model, the mill rates must be converted. The above figures are coded in the thousands. Accordingly, *Blaine County's Mill Rate* is actually 0.42958. JEDI requires a percent conversion, though, for input into the Model. Therefore, the figure that would be input would be 42.958%<sup>2</sup>. The subsequent discussion will document exactly how these figures were implemented.

The number of mill rates reported was a direct reflection of the fact that many counties in Montana have a limited number of rural taxing districts. Furthermore, so that “urban”<sup>3</sup> mill rates were not included (wind projects are usually not sited in urban areas), only rural tax rates were considered.

**Local Taxation Parameter Inputs**

Table 2 summarizes how the *Local Taxation Parameters* were input into JEDI.

**Table 2: Local Taxation Input Parameters**

County	<i>Local Property/Other Tax Rate (percent of taxable value)</i>	<i>Assessed value (percent of construction cost)</i>	<i>Taxable Value (percent of assessed value)</i>
<b>Blaine</b>	42.958%	87.00%	3.30%
<b>Cascade</b>	47.540%	87.00%	3.30%
<b>Glacier</b>	59.360%	87.00%	3.30%
<b>McCone</b>	45.470%	87.00%	3.30%
<b>Park</b>	46.231%	87.00%	3.30%
<b>Prairie</b>	48.443%	87.00%	3.30%

**Property Tax Assumptions**

To simplify the taxation procedure for the Model’s sake, it was assumed that none of the given projects would be *Centrally Assessed*; i.e., it was assumed that all of the projects would be entirely located within each respective county. If this were not the case, the project would have to be *Centrally Assessed* to reach an acceptable tax payment for both of the counties in question.

It was also assumed that any new projects would be eligible for a 13% exemption.

**Local Ownership Percentages**

The ownership structure of today’s wind farms has traditionally been non-local, developer-owned. This ownership structure has enabled many of today’s farms to be built, but with heavy economic consequence in that many of the project dollars are leaving the project area. Accordingly, local ownership is being

<sup>2</sup> Alternately, the user can bypass the inputs necessary for the model to calculate the appropriate tax payment (dollar value) and simply enter an annual tax payment (Goldberg 2003).

<sup>3</sup>“Urban” is a relative term in Montana. The 2001 U.S. Census reported the state population to be ~904,000, which translates to an average of only 6.2 people per square mile.

explored for many of today's wind farms to maximize the project dollars that remain in the local economy. As will be shown in the *Sensitivity* section, these locally owned projects are able to retain a proportionally higher amount of local spending.

JEDI allows the user to alter the *Local Ownership Percentage*. However, the user will immediately realize that the local share can be altered in a number of areas. Upon further investigation, many of these local share parameters are, by default, set at 0%, 100%, or somewhere in between, and will usually remain constant.

For this analysis, the individual *Local Ownership Percentages* were altered<sup>4</sup> based on the likely level of local resources available for project use. These values were identical for *Blaine, Glacier, McCone, Park,* and *Prairie* counties because they are all rural economies with little or no capability to meet project needs. The economy of *Cascade County* is different from the other five counties in terms of its ability to provide local resources (labor, construction firms/supplies, housing, etc.) to meet project needs<sup>5</sup>.

The *Debt Financing* parameter represents the amount of debt financing that a given project will finance through a local bank. In many cases, this would represent a local bank or possibly municipal-bond financing in some circumstances. Furthermore, if project funds are being loaned from local institutions, oftentimes this would imply that local investors would be financing the project through these local institutions. Accordingly, in order to alter the *Local Ownership Percentage*, the *Debt Financing Local Share Percentage* was modified<sup>6</sup>.

Specifically, three ownership structures were examined to identify how altering the *Local Ownership Percentage* would affect the various Model outputs. These three *Local Ownership Percentages* were 0%, 50%, and 100%.

### ***Landowner Easement Payments***

The compensation that a landowner receives from a would-be developer for the use of his or her land is a crucial figure. On many of today's wind farms, landowner easement payments are the most direct way in which an entity or individual can benefit from a project. The question arises: "*How much are you going to pay me?*"

To determine landowner compensation, a number of questions regarding features of the proposed project must be answered. These include the following:

- How good is the wind resource at the location in question?
- What size turbines will be employed?
- What is the project's proximity to transmission lines?
- Does the project developer have a Power Purchase Agreement (PPA)?
- What does the developer's past dealing with other landowners reveal?
- How will the proposed project affect current insurance rates/premiums?
- Who will assume the property tax bills: the developer or the landowner?
- What type of land is being removed from production (prime, fallow, etc.)?

Many of today's wind projects compensate landowners three ways: *Single Up-Front Payment, Fixed Annual Payment,* or *Percentage of Revenues* (Wind Powering America 2003). Many of today's lease agreements are based on some combination of the above.

The two most crucial items in determining the easement payment are the wind resource at the site and the size of the turbine being employed. In the case of the wind resource, JEDI does not have the ability to

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<sup>4</sup> Figures 3 - 6 in the APPENDIX demonstrate input of *Local Ownership* percentages.

<sup>5</sup> Conservative figures were used for *Local Ownership Percentages* to avoid overestimating the expected economic impacts.

<sup>6</sup> Table 15 in the APPENDIX demonstrates *Debt Financing* annual payments.



differentiate easement payments based on wind resource. However, in the case of turbine size, the JEDI Model automatically adjusts and estimates the easement payment. A 1.5-MW turbine was considered for all projects, so a *\$4,000/Turbine Easement Payment* was utilized throughout the analysis.

### **County Multipliers**

To gain the sensitivity that the study required, IMPLAN multipliers were aggregated from IMPLAN data per the process outlined in Goldberg's *Wind Impact Model* (2003). Each set of multipliers for the chosen counties was then input into JEDI's *User Add-in Location* to ensure that county-level data were utilized for all six counties.

(It is important to note that the Model requires the user to select *MY COUNTY* in the *Project Location* input parameter to utilize the county-level data.)

### **Use of Default Values**

To meet the goal of being able to replicate these analyses, no other input parameters were changed or altered beyond the ones mentioned above. However, the Model prompts the user: "*Utilize Model Default Values Below (Y/N)?*" For these analyses, *N* was selected.

### **Model Output**

To quantify the associated economic impacts produced from a wind power project, the total expenditure effects must be analyzed. The process requires breaking down the outputs, in certain cases, to their respective phase and Tier effects.

Wind power projects, as with nearly any industrial facility, are comprised of two main phases: Construction and Annual Operations phases. Accordingly, job creation, Project Output Value, worker pay, and local spending Model Outputs are broken down into Construction Phase Effects and Annual Operations Effects. Annual easement and property tax payments are separate from the Construction Phase and, therefore, represent Annual Phase Effects.

In addition to the expenditure phase, outputs are broken down into *Tier* effects, namely *Direct*, *Indirect*, and *Induced Effects*. To accurately represent the quantitative expenditure effects, only *Total Effects* were included in the analysis. Therefore, for example, only *Total Construction Phase Jobs (Direct + Indirect + Induced Effects)* were included in the analysis.

Upon running the JEDI Model with the inputs detailed in the *Model Inputs* section, forecasts were produced to quantify the economic benefits that can be realized from a wind project.

Model Outputs in terms of Job Creation, Worker Pay, Project Output Value, Local Spending, Annual Easement Payments, and Annual Property Taxes are represented in the Appendix.

## ***Discussion of Results***

When predicting associated economic impacts per a given expenditure using an Input-Output Model, the importance of multipliers is crucial. IMPLAN divides these aggregated multipliers into four main categories:

- Personal Consumption Expenditures
- Output per \$1 Million Change in Final Demand
- Earnings per \$1 Million Change in Final Demand
- Jobs per \$1 Million Change in Final Demand.

The relative linkage among these multipliers constitutes the resulting economic impact. Accordingly, the higher the multiplier, the larger the economic benefit. Furthermore, the degree to which the individual industry multipliers are linked (Goldberg 2003) determines the amount of money that remains at the local level.

In the economic world, local entities that are able to procure goods and services from other local entities retain a higher amount of value locally. Accordingly, this would represent a well-linked economy. Conversely, when local entities must procure goods and services from outside the local economy to meet their needs, these local entities are said to be importing the required goods and services. This would represent a “poorly” linked economy. From this simple framework, the concept of the *Ripple Effect* is readily apparent.

The *Ripple Effect* is a conceptual picture that depicts the size of the ripples that develop from a given expenditure—say, a wind power project. If the “pebble” is dropped in a well-linked economy, the resulting “ripples” will be locally significant (large). However, if the “pebble” is dropped into a poorly linked economy, the resulting ripples will not be locally significant (small) because the majority of the expenditure will be used for importing goods and services from outside the local economy. A well-linked economy contains a greater number of local businesses to support one another throughout the life of the expenditure, while this support network of local businesses is somewhat inferior in a poorly linked economy.

This conceptual framework can be used to discuss the resulting impacts that wind power projects yield.

### ***Job Creation***

JEDI breaks *Job Creation* down into *Construction and Annual Phase* jobs (annual full-time equivalent). The number of jobs created during the *Construction Phase* was not dependent on the amount of local ownership, whereas the local ownership percentage affected the number of jobs created during the *Annual Phase*.

Table 3 summarizes the *Construction Phase Job Creation*, whereas Table 4 shows the number of jobs created during *Annual Phase* operations.

A proportionately higher amount of labor is required during the *Construction Phase* than during the *Annual Phase*. However, what is the catalyst that results in higher employment figures between counties? What separates one county from another?

The answer lies in how the local economies are set up. Specifically, this translates to how the labor requirements can be filled—either with local or imported labor. Often, how the labor requirements

**Table 3: Construction Phase Job Creation per Project Size, County**

County	Project Size (MW)					
	5.0	10.0	20.0	50.0	100.0	300.0
<b>Blaine</b>	0.6	1.3	2.6	6.5	12.9	38.8
<b>Cascade</b>	7.9	15.7	31.4	78.6	157.1	471.3
<b>Glacier</b>	0.8	1.5	3.1	7.7	15.5	46.5
<b>McCone</b>	0.7	1.4	2.8	7.0	14.0	41.9
<b>Park</b>	0.8	1.6	3.1	7.9	15.7	47.2
<b>Prairie</b>	0.8	1.5	3.1	7.6	15.3	45.8

**Table 4: Annual Phase Jobs per Project Size, County, and Local Ownership Percentage**

County, Local Ownership %	Project Size (MW)					
	5.0	10.0	20.0	50.0	100.0	300.0
<b>Blaine</b>						
0%	1.6	3.1	6.3	15.6	31.2	93.5
50%	2.3	4.5	8.9	22.3	44.4	133.2
100%	2.9	5.8	11.6	28.9	57.7	172.9
<b>Cascade</b>						
0%	2.8	5.4	10.9	27.1	54.2	162.4
50%	4.0	7.9	15.7	39.2	78.2	234.6
100%	5.2	10.3	20.5	51.2	102.3	306.8
<b>Glacier</b>						
0%	2.1	4.1	8.1	20.3	40.4	121.1
50%	2.8	5.5	11.1	27.6	55.2	165.4
100%	3.6	7.0	14.0	35.0	69.9	209.7
<b>McCone</b>						
0%	1.3	2.5	5.0	12.5	24.8	74.4
50%	2.1	4.1	8.2	20.3	40.6	121.7
100%	2.9	5.7	11.3	28.2	56.4	169.0
<b>Park</b>						
0%	1.9	3.7	7.4	18.4	36.7	110.2
50%	2.9	5.8	11.6	28.9	57.7	173.1
100%	4.0	7.9	15.8	39.4	78.7	236.1
<b>Prairie</b>						
0%	1.3	2.5	4.9	12.2	24.3	72.8
50%	2.6	5.1	10.3	25.6	51.1	153.3
100%	4.0	7.8	15.6	39.0	77.9	233.7

are filled is directly correlated to the amount of skilled labor that is present and/or whether the economy can support the given activity. This point can be illustrated with the following example.

**EXAMPLE 2: Importance of a Linked Economy**

*Typical wind project construction costs can be associated with the equipment/installation costs (wind turbine components, transmission interconnection, remote monitoring setup, etc.) or the balance of plant expenditures (site preparation, foundations, monitoring facilities, etc.). In terms of construction cost percentages, the equipment/installation costs usually account for roughly 80%, while the balance of plant costs account for the remaining 20%.*

*In most cases, the equipment/installation expenditures require highly specialized labor, while most of the balance of plant costs do not. To maximize the amount of local economic impact, the local economy must be able to supply the required labor.*

*A county with a highly skilled workforce can maximize their role, whereas an economy with fewer businesses and/or necessary skilled workers must seek outside inputs to accomplish the given task. In the case of the county with fewer local business or labor resources, these imports represent leakage to an outside economy, thereby reducing the amount of local jobs that are supported.*

*Accordingly, how the respective county meets the labor requirements will directly influence the number of local jobs that a given project will support or create.*

In terms of *Annual Phase Job Creation*, the amount of local ownership (0%, 50%, 100%) affected the total number of jobs (Table 3).

*Annual Phase* jobs are very similar to *Construction Phase* jobs in that the presence of skilled labor could suggest that a higher number of labor requirements will be met with local labor. As mentioned in the *Local Ownership Section* above, the most direct way to show local ownership is through how much of the project is financed locally, as well as the percentage of project needs that can be met at the local level. Utilizing local financial institutions to provide project financing employs local labor to manage these transactions. Accordingly, the “pebble” in the pond creates a ripple effect resulting in local jobs that are a function of project size and location.

To gauge the magnitude of the predicted total job creation<sup>7</sup>, Table 5 represents the number of workers reported in each county by the U.S. Census Bureau (2004),<sup>8</sup> and Table 6 represents the percent increase in each county by project size and local ownership level.

**Table 5: Total Number of Employees per County**

	County					
	Blaine	Cascade	Glacier	McCone	Park	Prairie
<b>TOTAL</b>	2,789	34,792	4,750	1,011	7,857	577

<sup>7</sup> For *Total Job Creation*, see Table 10 in the APPENDIX, which combines the *Job Creation* in the *Annual* and *Construction Phases*.

<sup>8</sup> Table 21 in the APPENDIX provides a segmented employment breakdown.

**Table 6: Total Job Creation as a Percent of Existing Employees per County**

County, Local Ownership %	Project Size (MW)					
	5.0	10.0	20.0	50.0	100.0	300.0
<b>Blaine</b>						
0%	0.08%	0.16%	0.32%	0.79%	1.58%	4.74%
50%	0.10%	0.21%	0.41%	1.03%	2.06%	6.17%
100%	0.13%	0.25%	0.51%	1.27%	2.53%	7.59%
<b>Cascade</b>						
0%	0.03%	0.06%	0.12%	0.30%	0.61%	1.82%
50%	0.03%	0.07%	0.14%	0.34%	0.68%	2.03%
100%	0.04%	0.07%	0.15%	0.37%	0.75%	2.24%
<b>Glacier</b>						
0%	0.06%	0.12%	0.24%	0.59%	1.18%	3.53%
50%	0.08%	0.15%	0.30%	0.74%	1.49%	4.46%
100%	0.09%	0.18%	0.36%	0.90%	1.80%	5.39%
<b>McCone</b>						
0%	0.20%	0.39%	0.77%	1.93%	3.84%	11.51%
50%	0.28%	0.54%	1.09%	2.70%	5.40%	16.18%
100%	0.35%	0.70%	1.40%	3.48%	6.96%	20.86%
<b>Park</b>						
0%	0.03%	0.07%	0.13%	0.34%	0.67%	2.00%
50%	0.05%	0.09%	0.19%	0.47%	0.93%	2.80%
100%	0.06%	0.12%	0.24%	0.60%	1.20%	3.61%
<b>Prairie</b>						
0%	0.36%	0.69%	1.39%	3.43%	6.86%	20.56%
50%	0.59%	1.15%	2.32%	5.75%	11.51%	34.50%
100%	0.82%	1.61%	3.25%	8.08%	16.16%	48.44%

### **Worker Pay**

The creation of new jobs brings with it the associated economic benefit of increasing *Worker Pay*<sup>9</sup>.

In terms of *Construction Phase* activities, counties with a sufficient supply of highly specialized workers to supply a substantial portion of the project needs retained an economic edge over other counties.

*Annual Phase Worker Pay* is also highly dependent on the amount of local labor that can meet the project needs. However, similar to *Job Creation*, the amount of local ownership in a given project will affect wages. Through local ownership in a given project, more local services will be required to manage this ownership and will accordingly positively impact the local pay scale.

Furthermore, although JEDI cannot quantify the return on investment to local owners, this return can also have a significant impact on the local economy (NWCC 2003). If a higher portion of project returns can be retained locally, the local economy will duly benefit from higher wages and these returns.

<sup>9</sup> Table 11 and Table 12 in the APPENDIX summarize resultant *Worker Pay* figures.

## **Local Spending**

The amount of *Local Spending*<sup>10</sup> per a given expenditure is contingent on the project's size, phase, ownership structure, and multiplier linkages among affected industries.

The amount of *Local Spending* is highly dependent on the size of the project or expenditure. This is akin to the size of the “pebble” being dropped in the local economy. A larger expenditure (pebble) will have a proportionally greater *Ripple Effect* than a smaller expenditure.

In addition to the size of the project, the amount of *Local Spending* is also relative to the phase of the project.

For example, the *Construction Phase* economic impacts are different from those of the *Annual Phase Local Spending* phases. A disproportionate level of expenditures occurs during the *Construction Phase* when compared to the *Annual Operations*.

The magnitude of the multipliers also influences the amount of *Local Spending* per a given project. Economically, this implies that economies that are highly linked will require fewer instances of importing outside goods and services, whereas poorly linked economies require a greater amount of importing. Therefore, as the amount of importing activities increases, the subsequent level of *Local Spending* decreases.

## **Project Output Value**

As mentioned previously, the *Project Output Value* represents the actual dollars spent on goods and services in the state, regional, or local economy where the plant is being built. In essence, the *Project Output Value* puts a quantitative figure<sup>11</sup> on what value a given project (expenditure) will have to the respective economy. In terms of wind power projects, it states that a wind project's value is “X” to the economy in question.

Quantitatively, the *Project Output Value* is affected by the project's phase, where it is located, as well as the level of local ownership. Additionally, the *Project Output Value* is affected by how well the economy is linked (strength of multipliers) and the current status of the economy (contracting or expanding).

In addition to the above items, the *Project Output Value*, similar to *Local Spending* and *Worker Pay*, is highly dependent on the linkages within the local economy, as well as the economic status of the economy in question (contracting or detracting). As mentioned previously, a well-linked economy retains a higher share of the project expenditures, and a contracting economy tends to place a higher value on the impact that is generated from a new project.

## **Annual Easement Payments**

The *Annual Easement Payments* that a given project creates does not vary according to how much of the project is locally owned or in which county the project is sited. Accordingly, Table 7 depicts the relationship between project size and *Annual Easement Payments*. (Note: Easement payments were input as \$4,000/1.5-MW turbine per the *Model Inputs* section.)

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<sup>10</sup> Table 13 and Table 14 in the APPENDIX provide the resultant *Local Spending* figures.

<sup>11</sup> Table 16, Table 17, and Table 18 in the APPENDIX provide the resultant *Project Output Value* figures.

**Table 7: Annual Easement Payments per Project Size**

Project Size (MW)	Easement Payment
5.0	\$ 16,000
10.0	\$ 28,000
20.0	\$ 56,000
50.0	\$ 136,000
100.0	\$ 268,000
300.0	\$ 800,000

**Annual Property Taxes**

Per the given *Model Inputs*, JEDI estimates the following *Annual Property Taxes* (Table 8). These are based on the mill levies previously summarized in Table 1.

**Table 8: Annual Property Taxes per Project Size, County**

County	Project Size (MW)					
	5.0	10.0	20.0	50.0	100.0	300.0
Blaine	\$61,666	\$123,332	\$246,665	\$616,662	\$1,233,324	\$3,699,973
Cascade	\$68,244	\$136,487	\$272,975	\$682,437	\$1,364,873	\$4,094,620
Glacier	\$85,211	\$170,423	\$340,845	\$852,113	\$1,704,226	\$5,112,677
McCone	\$65,272	\$130,544	\$261,089	\$652,722	\$1,305,444	\$3,916,331
Park	\$66,365	\$132,729	\$265,458	\$663,646	\$1,327,292	\$3,981,876
Prairie	\$69,540	\$139,080	\$278,160	\$695,399	\$1,390,799	\$4,172,396

To illustrate the impact that a wind project can have on the local tax base, Table 9 shows the figures in Table 8<sup>12</sup> as a percentage of the estimated general property tax figures for 2003<sup>13</sup>.

**Table 9: Project Tax Generation as a Percent of County Tax Base**

County	Project Size (MW)					
	5.0	10.0	20.0	50.0	100.0	300.0
Blaine	1.19%	2.37%	4.74%	11.86%	23.72%	71.16%
Cascade	0.13%	0.27%	0.53%	1.33%	2.66%	7.99%
Glacier	0.86%	1.72%	3.44%	8.60%	17.20%	51.60%
McCone	2.46%	4.91%	9.82%	24.56%	49.12%	147.37%
Park	0.48%	0.96%	1.92%	4.80%	9.59%	28.78%
Prairie	4.34%	8.69%	17.37%	43.43%	86.86%	260.58%

<sup>12</sup> General Property Tax was calculated by multiplying each individual county's Taxable Value by the Average Mill Levies in Table 1. (MT Department of Revenue 2004)

<sup>13</sup> Table 19 in the APPENDIX provides an in-depth analysis of the project tax contribution.

## **Qualitative Differences Between Counties**

The above analyses have quantitatively shown the economic impacts that wind power can yield, as well as how multiplier strength affects these impacts. Although the multiplier strength's impact on the results is crucial, other qualitative factors can duly influence the economic outcomes.

County demographics<sup>14</sup>, including population levels, education levels, per capita income, as well as the amount of economic diversity, help to further solidify the economic impacts that wind power projects can have on the economies in question by identifying how the counties are similar and/or different. Furthermore, demographics enable counties to readily identify steps that can be taken to increase the benefits brought by wind power development.

### ***Blaine County***

*Blaine County* lies in north-central Montana. Known for its extremely windy climate, 6,870 residents currently live in this largely rural area. Although the population has increased over the past decade by 4.2%, it lags behind the state average population growth during the same period.

In *Blaine County*, farming and ranching are a way of life, with nearly 22.4% of the residents employed in the agricultural industry. Other industries include retail trade (9.2%), construction (7.0%), professional services (2.0%), and manufacturing (0.8%)—certainly not a very diverse economy.

In terms of education, 78.7% of the county's adults have received a high school diploma, while only 17.4% have earned a bachelor's degree. The median household income is \$25,247, with an extremely high poverty rate of 28.1%.

### ***Cascade County***

*Cascade County* is the third-largest county in Montana in terms of population, with 79,298 residents. The area has seen a short-term population decline, with a below-average growth in the past decade.

Its largest city, Great Falls, is the heart of its economic engine. This is evidenced by its extremely diverse economic environment. Only 3.0% of its residents are employed in agricultural-related enterprises, while education/social services (23.8%), retail (14.2%), construction (7.6%), and manufacturing (3.5%) comprise the bulk of the remaining economic activity.

*Cascade County* is the second-highest educated county in the study, with 87.1% of its residents receiving high school diplomas and 21.5% receiving bachelor degrees.

It has the highest ranked median household income at \$32,971 per household, while 13.5% of the people are classified below the poverty line.

### ***Glacier County***

*Glacier County*, the home of Glacier National Park in northwestern Montana, is largely composed of the *Blackfeet Indian Reservation*. Its Rocky Mountain Front Range geography endows it with an incredible wind resource—easily one of the best in the country. Past developers have attempted to implement wind projects in the area, but transmission and utility concerns have arrested these attempts. However, these problems have not dissuaded the residents. Many are still actively seeking large-scale wind projects to take advantage of the excellent resource.

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<sup>14</sup> Table 20 in the APPENDIX provides a concise breakdown of county demographics (U.S. Census 2004).



*Glacier County's* population is 13,125, which has seen fairly moderate growth over the past decade. It is below average in terms of education, with only 78.6% and 16.5% receiving high school diplomas and bachelor's degrees, respectively. Households have a median income of \$27,921, with an extremely high poverty rate of 27.3%.

The economy of *Glacier County* is fairly diverse. Many residents are employed in the educational, health, and social services (31.3%) sectors, while another 15.2% are employed in the public sector. Agricultural-related businesses are relatively low at 9.3% of county employment, while retail (9.7%), construction (5.8%), and transportation (5.5%) comprise the remainder of the county's employment. The manufacturing industry is basically non-existent in terms of county employment (1.4%), while professional service-related jobs fare no better (4.4%).

*Glacier County* is as rural as they come, with no urban center to hold and/or attract new opportunities.

### ***McCone County***

If there were a typical eastern Montana county, it would be *McCone County*. Home to only 1,900 people, it has seen an extreme population drop of 13.1% over the past decade. It has above-average poverty (16.8%) and boasts only 0.7 persons per square mile—rural indeed.

In terms of education, *McCone* has an average high school graduation rate of 86.1%, with a below-average number of residents receiving a bachelor's degree (16.4%). Its median household income is only \$29,718, largely as a result of its heavy dependence on agriculture.

In *McCone County*, 35.7% of its population is employed in agriculture in some manner. Low commodity prices, extreme drought, and the decline of the family farm makes matters worse. It has a non-existent manufacturing element (0.4% of county employment), with the professional service sector accounting for only 2.6% of county employment.

### ***Park County***

*Park County* lies 80 miles north of *Yellowstone National Park* along the I-90 corridor. Its 15,686 residents have created a fairly robust, diversified economy that ranks first in the study counties in terms of education (87.6% high school diploma and 23.1% bachelor's degree). It has seen moderate growth over the past decade, with a slow shift away from its agricultural roots.

*Park County* was slated to be the next Altamont Pass in the mid-1980s before poor turbine designs and extremely high wind speeds destroyed the numerous experimental turbines that were erected throughout the County. Consequently, as the turbines disintegrated, so too did the public enthusiasm for wind power development in the area.

The one mainstay to the exodus of wind power from Montana has been Dr. Gordon Brittan, a history and philosophy professor at Montana State University in Bozeman, Montana. The three 65-kW *Windmatic* turbines that he co-owns with Dr. Dave Healow in Billings, Montana, supplement the single 65-kW turbine that powers his ranch. Although others are slowly following suit, for many years Dr. Brittan and his turbines remained all that was left of the 1980s attempt at Montana wind power.

*Park County* households earn a median annual income of \$31,739, while the county has a below-average poverty rate of 11.4%. Being a gateway to *Yellowstone National Park* translates to a higher percentage of its employment in the tourism, food service, and accommodations industries (19.1%). Agriculture now accounts for only 7.3% of the county's employment, with social services (15.2%),

retail (12.0%), construction (9.9%), and professional services (5.9%) comprising the remainder of the employment breakdown.

### ***Prairie County***

*Prairie County* and *McCone County* share more than just a border; they also share each other's economic heartache. *Prairie County's* population is low (1,216) and falling at a rate of 13.3% over the past decade. Education rates are below average, with only 78.8% and 14.8% of residents earning a high school diploma and college degree, respectively. Poverty rates are high (17.2%), and typical households only earn a \$25,451 annual income.

Agriculture provides 36.0% of *Prairie County's* employment, while social services (22.2%), retail trade (5.5%), construction (4.7%), and manufacturing (1.2%) make up bulk of the remainder.

### ***Significant County Differences***

From the preceding information, one can develop a picture of how differences between the counties can influence the effect of a proposed wind power project on respective local economies. Can JEDI account for these demographic differences and, if so, what effect do they have on the Model outputs?

The economic multipliers that IMPLAN derives are comprehensive, taking into account a multitude of federal, state, local, and city demographic data. Furthermore, because JEDI is based on multiplier inputs, JEDI is able to account for much of the demographic data that IMPLAN produces.

As mentioned earlier, a higher degree of economic diversity provides for a more stable economy. In terms of a wind power project, this diversity allows for more project needs being met at the local level, while minimizing the amount of leakage to outside imports. Therefore, minimizing the amount of project funds spent on imported goods and services will, in turn, maximize the benefits to the local economy—more jobs, higher wages, increased local spending, etc.

The amount of economic diversity also contributes to the current state of the economy. Highly diverse economies tend to expand, while lower diversity is often attributed to contracting economies. In terms of *Model Outputs*, this often translates to a greater economic benefit in contracting economies, while expanding economies tend to see a lower economic effect. For this reason, *McCone* and *Prairie* counties reap greater economic benefits than, for example, *Park* or *Cascade* counties in certain situations, as is the case with job creation, annual *Project Output Value*, and percent increase in tax base.

The importance of a skilled labor pool is also critical to meeting project needs. If local specialized labor can complete a given set of project tasks, more of the subsequent project expenditures can be retained locally. In terms of a wind project, this will translate to maximizing available labor to complete *Construction Phase* (site preparation, interconnection, erection, etc.) and *Annual Operations Phase* (monitoring, maintenance, accounting, project management, etc.) activities. Therefore, a skilled local labor pool will ensure that higher local wages will be earned and spent at the local level than by importing outside labor to accomplish these needs.

### ***How to Improve Local Economic Impacts?***

To improve the wind power project economic impacts on the local level, a number of issues can be examined:

- Educating the local community about specific required activities, such that qualified local individuals and/or businesses can take steps to maximize their roles during the planning, site preparation, construction, and operations phases of the project
- Educating landowners about easement payment options, as well as salient legal aspects
- Evaluating local property taxation codes to optimize long-term return to the county, while ensuring a solid relationship with the project owner(s)
- Urging project developers to offer local ownership shares. Furthermore, encourage local business and agricultural leaders to examine the feasibility of developing 100% locally owned wind projects
- Financing a portion of the project through local financial institutions
- Taking steps to get the local community behind wind power, such that the likelihood of additional future projects is increased. Multiple projects bring more local opportunities, making it much easier to justify educating a local workforce to meet project needs
- Involving the community—short-term involvement will breed long-term project acceptance, thus creating an increasing likelihood of siting future projects in the area (more projects = more local benefits).

Although a local community cannot directly alter its economic make-up overnight, the above steps represent some suggestions to realize more economic activity in the area. By actively seeking wind projects, educating the businesses and citizens about the local role, and then taking steps to maximize the local role during the various stages of the project, significant economic benefits can be realized.

### **Recommendations and Conclusions**

The economic development impact that wind power brings to local economies is apparent. NREL has developed the JEDI Model, thus creating a readily accessible tool for a multitude of users who wish to evaluate these impacts. Furthermore, local communities can take steps to maximize these benefits to their local economies through education, planning, and action.

The importance of local project ownership cannot be overlooked. Local project ownership can serve a key role in maximizing the local economic impacts of wind power in rural America by increasing the retention of project expenditures on the local level. These increased benefits can be seen in higher job creation, worker pay, local project value, local spending, as well as project returns.

The six Montana counties included in this study now have quantitative impact figures to encourage the implementation of wind projects in their communities. The hope is that other states, counties, and cities will see the benefits that wind power can bring to their communities and utilize JEDI to quantify these benefits.

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## Appendix

### Model Inputs

To assist meeting the goal of enabling replication of this study, the following is a breakdown of what *Model Inputs* were used for *Blaine, Glacier, McCone, Park, and Prairie* counties. (The example shown here is for a 100% *Locally Owned* project.)

Project Descriptive Data				
Project Location	MYCOUNTY			
Year of Construction	2004			
Project Size - Nameplate Capacity (MW)	5			
Turbine Size (KW)	1,500			
Number of Turbines	4			
Construction Cost (\$/KW)	\$1,000			
Annual Direct Operations and Maintenance Cost (\$/kW)	\$12.50			
Money Value - Current or Constant (Dollar Year)	2004			
Utilize Model Default Values (below)? (Y or N)	n		Review/Enter Data below	
<a href="#">Go To Summary Impacts</a>				
Project Cost Data				
Construction Costs	Cost	Cost	Percent of	Local Share
		Per KW	Total Cost	
<b>Materials</b>				
Construction (concrete, rebar, equip, roads and site prep)	\$262,682	\$53	5.3%	10%
Transformer	\$66,357	\$13	1.3%	0%
Electrical (drop cable, wire, )	\$31,119	\$6	0.6%	0%
HV line extension	\$57,204	\$11	1.1%	0%
Materials Subtotal	\$417,363	\$83	8.3%	
<b>Labor</b>				
Foundation	\$22,882	\$5	0.5%	25%
Erection	\$22,882	\$5	0.5%	0%
Electrical	\$25,170	\$5	0.5%	0%
Management/supervision	\$13,729	\$3	0.3%	0%
Labor Subtotal	\$84,662	\$17	1.7%	
Construction Subtotal	\$502,025	\$100	10.0%	
<b>Equipment Costs</b>				
Turbines (excluding blades and towers)	\$2,746,500	\$549	54.9%	0%
Blades	\$915,500	\$183	18.3%	0%
Towers	\$575,000	\$115	11.5%	0%
Equipment Subtotal	\$4,237,000	\$847	84.7%	
<b>Other Costs</b>				
HV Sub/Interconnection	\$183,054	\$37	3.7%	0%
Engineering	\$60,000	\$12	1.2%	0%
Legal Services	\$4,650	\$1	0.1%	0%
Land Easements	\$0	na	0.0%	100%
Site Certificate/Permitting	\$13,271	\$3	0.3%	100%
Other Subtotal	\$260,975	\$52	5.2%	
<b>Total</b>	<b>\$5,000,000</b>	<b>\$1,000</b>	<b>100.0%</b>	

Figure 3: Input Values for Blaine, Glacier, McCone, Park, and Prairie counties

## Wind Plant Annual Operating and Maintenance Costs

	Cost	Cost Per KW	Percent of Total Cost	Local Share
<b>Personnel</b>				
Field Salaries	\$24,235	\$4.85	38.8%	50%
Administrative	\$6,378	\$1.28	10.2%	50%
Management	\$19,133	\$3.83	30.6%	50%
Personnel Subtotal	\$49,745	\$9.95	79.6%	
<b>Materials and Services</b>				
Vehicles	\$893	\$0.18	1.4%	0%
Misc. Services	\$2,551	\$0.51	4.1%	0%
Fees, Permits, Licenses	\$893	\$0.18	1.4%	100%
Utilities	\$2,551	\$0.51	4.1%	100%
Insurance	\$3,827	\$0.77	6.1%	0%
Fuel (motor vehicle gasoline)	\$638	\$0.13	1.0%	100%
Tools and Misc. Supplies	\$1,020	\$0.20	1.6%	50%
Spare Parts Inventory	\$383	\$0.08	0.6%	2%
Materials and Services Subtotal	\$12,755	\$2.55	20.4%	
<b>Total</b>	<b>\$62,500</b>	<b>\$12.50</b>	<b>100.0%</b>	

## Other Parameters

### Financial Parameters

### Local Share

#### Debt Financing

Percentage financed	80%
Years financed (term)	10
Interest rate	10%

100%

#### Equity Financing/Repayment

Percentage equity	20%
Individual Investors (percent of total equity)	0%
Corporate Investors (percent of total equity)	100%
Return on equity (annual interest rate)	16%
Repayment term (years)	10

100%  
0%

### Tax Parameters

Local Property/Other Tax Rate (percent of taxable value)	43.0%
Assessed value (percent of construction cost)	87%
Taxable Value (percent of assessed value)	3%
Taxable Value	\$143,550
Local Taxes	\$61,666

100%

### Land Lease Parameters

Land Lease Cost (per turbine)	\$4,000
Number of Turbines	4
Land Lease (total cost)	\$16,000
Lease Payment recipient (F = farmer/household, O = Other)	F

100%

### Payroll Parameters

	Base Wage per Hour	Annual Wage
Field Salaries (technicians, other)	\$15.50	\$32,240
Administrative	\$11.04	\$22,968
Management	\$26.00	\$54,080

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Figure 4: Input Values for Blaine, Glacier, McCone, Park, and Prairie counties

The following is a breakdown of the *Model Inputs* used for *Cascade County*. The main difference between *Cascade County* and the other five counties is the amount of local contribution that was possible. This difference is shown in the level of *Local Share* below. (The example shown here is for a 100% *Locally Owned* project.)

Project Descriptive Data	
Project Location	MYCOUNTY
Year of Construction	2004
Project Size - Nameplate Capacity (MW)	5
Turbine Size (KW)	1,500
Number of Turbines	4
Construction Cost (\$/KW)	\$1,000
Annual Direct Operations and Maintenance Cost (\$/kW)	\$12.50
Money Value - Current or Constant (Dollar Year)	2004
Utilize Model Default Values (below)? (Y or N)	n

**Review/Enter Data below**

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Project Cost Data	Cost	Cost	Percent of	Local Share
Construction Costs		Per KW	Total Cost	
<b>Materials</b>				
Construction (concrete, rebar, equip, roads and site prep)	\$262,682	\$53	5.3%	75%
Transformer	\$66,357	\$13	1.3%	0%
Electrical (drop cable, wire, )	\$31,119	\$6	0.6%	40%
HV line extension	\$57,204	\$11	1.1%	0%
<b>Materials Subtotal</b>	<b>\$417,363</b>	<b>\$83</b>	<b>8.3%</b>	
<b>Labor</b>				
Foundation	\$22,882	\$5	0.5%	100%
Erection	\$22,882	\$5	0.5%	25%
Electrical	\$25,170	\$5	0.5%	75%
Management/supervision	\$13,729	\$3	0.3%	50%
<b>Labor Subtotal</b>	<b>\$84,662</b>	<b>\$17</b>	<b>1.7%</b>	
<b>Construction Subtotal</b>	<b>\$502,025</b>	<b>\$100</b>	<b>10.0%</b>	
<b>Equipment Costs</b>				
Turbines (excluding blades and towers)	\$2,746,500	\$549	54.9%	0%
Blades	\$915,500	\$183	18.3%	0%
Towers	\$575,000	\$115	11.5%	0%
<b>Equipment Subtotal</b>	<b>\$4,237,000</b>	<b>\$847</b>	<b>84.7%</b>	
<b>Other Costs</b>				
HV Sub/Interconnection	\$183,054	\$37	3.7%	50%
Engineering	\$60,000	\$12	1.2%	0%
Legal Services	\$4,650	\$1	0.1%	80%
Land Easements	\$0	na	0.0%	100%
Site Certificate/Permitting	\$13,271	\$3	0.3%	100%
<b>Other Subtotal</b>	<b>\$260,975</b>	<b>\$52</b>	<b>5.2%</b>	
<b>Total</b>	<b>\$5,000,000</b>	<b>\$1,000</b>	<b>100.0%</b>	

**Figure 5: Input Values for Cascade County**

### Wind Plant Annual Operating and Maintenance Costs

	Cost	Cost Per KW	Percent of Total Cost	Local Share
<b>Personnel</b>				
Field Salaries	\$24,235	\$4.85	38.8%	100%
Administrative	\$6,378	\$1.28	10.2%	100%
Management	\$19,133	\$3.83	30.6%	100%
Personnel Subtotal	\$49,745	\$9.95	79.6%	
<b>Materials and Services</b>				
Vehicles	\$893	\$0.18	1.4%	100%
Misc. Services	\$2,551	\$0.51	4.1%	80%
Fees, Permits, Licenses	\$893	\$0.18	1.4%	100%
Utilities	\$2,551	\$0.51	4.1%	100%
Insurance	\$3,827	\$0.77	6.1%	0%
Fuel (motor vehicle gasoline)	\$638	\$0.13	1.0%	100%
Tools and Misc. Supplies	\$1,020	\$0.20	1.6%	100%
Spare Parts Inventory	\$383	\$0.08	0.6%	2%
Materials and Services Subtotal	\$12,755	\$2.55	20.4%	
<b>Total</b>	<b>\$62,500</b>	<b>\$12.50</b>	<b>100.0%</b>	

### Other Parameters

#### Financial Parameters

##### Debt Financing

		Local Share
Percentage financed	80%	100%
Years financed (term)	10	
Interest rate	10%	

##### Equity Financing/Repayment

Percentage equity	20%	
Individual Investors (percent of total equity)	0%	100%
Corporate Investors (percent of total equity)	100%	0%
Return on equity (annual interest rate)	16%	
Repayment term (years)	10	

#### Tax Parameters

Local Property/Other Tax Rate (percent of taxable value)	43.0%	
Assessed value (percent of construction cost)	87%	
Taxable Value (percent of assessed value)	3%	
Taxable Value	\$143,550	
Local Taxes	\$61,666	100%

#### Land Lease Parameters

Land Lease Cost (per turbine)	\$4,000	
Number of Turbines	4	
Land Lease (total cost)	\$16,000	
Lease Payment recipient (F = farmer/household, O = Other)	F	100%

#### Payroll Parameters

	Base Wage per Hour	Annual Wage
Field Salaries (technicians, other)	\$15.50	\$32,240
Administrative	\$11.04	\$22,968
Management	\$26.00	\$54,080

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Figure 6: Input Values for Cascade County



**Total Job Creation**

**Table 10: Total Job Creation in Annual and Construction Phases**

County, Local Ownership %	Project Size (MW)					
	5.0	10.0	20.0	50.0	100.0	300.0
<b>Blaine</b>						
0%	2.2	4.4	8.9	22.1	44.1	132.3
50%	2.9	5.8	11.5	28.8	57.3	172.0
100%	3.5	7.1	14.2	35.4	70.6	211.7
<b>Cascade</b>						
0%	10.7	21.1	42.3	105.7	211.3	633.7
50%	11.9	23.6	47.1	117.8	235.3	705.9
100%	13.1	26.0	51.9	129.8	259.4	778.1
<b>Glacier</b>						
0%	2.9	5.6	11.2	28.0	55.9	167.6
50%	3.6	7.0	14.2	35.3	70.7	211.9
100%	4.4	8.5	17.1	42.7	85.4	256.2
<b>McCone</b>						
0%	2.0	3.9	7.8	19.5	38.8	116.3
50%	2.8	5.5	11.0	27.3	54.6	163.6
100%	3.6	7.1	14.1	35.2	70.4	210.9
<b>Park</b>						
0%	2.7	5.3	10.5	26.3	52.4	157.4
50%	3.7	7.4	14.7	36.8	73.4	220.3
100%	4.8	9.5	18.9	47.3	94.4	283.3
<b>Prairie</b>						
0%	2.1	4.0	8.0	19.8	39.6	118.6
50%	3.4	6.6	13.4	33.2	66.4	199.1
100%	4.8	9.3	18.7	46.6	93.2	279.5

**Worker Pay**

**Table 11: Construction Phase Worker Pay per Project Size, County**

County	Project Size (MW)					
	5.0	10.0	20.0	50.0	100.0	300.0
<b>Blaine</b>	\$ 9,710	\$ 19,421	\$ 38,842	\$ 97,104	\$ 194,209	\$ 582,626
<b>Cascade</b>	\$ 195,898	\$ 391,796	\$ 783,591	\$ 1,958,978	\$ 3,917,957	\$ 11,753,871
<b>Glacier</b>	\$ 12,590	\$ 25,181	\$ 50,362	\$ 125,905	\$ 251,810	\$ 755,430
<b>McCone</b>	\$ 8,474	\$ 16,948	\$ 33,896	\$ 84,741	\$ 169,482	\$ 508,446
<b>Park</b>	\$ 13,454	\$ 26,909	\$ 53,817	\$ 134,543	\$ 269,085	\$ 807,256
<b>Prairie</b>	\$ 5,315	\$ 10,630	\$ 21,260	\$ 53,150	\$ 106,300	\$ 318,901

**Table 12: Annual Worker Pay per Project Size, Location, and Local Ownership Percentage**

County, Local Ownership %	Project Size (MW)					
	5.0	10.0	20.0	50.0	100.0	300.0
<b>Blaine</b>						
0%	\$ 31,205	\$ 98,518	\$ 197,037	\$ 491,291	\$ 981,280	\$ 2,942,538
50%	\$ 60,742	\$ 120,181	\$ 240,363	\$ 599,606	\$ 1,197,910	\$ 3,592,429
100%	\$ 71,573	\$ 141,845	\$ 283,689	\$ 707,921	\$ 1,414,541	\$ 4,242,321
<b>Average Increase</b>	<b>\$ 10,832</b>	<b>\$ 21,663</b>	<b>\$ 43,326</b>	<b>\$ 108,315</b>	<b>\$ 216,630</b>	<b>\$ 649,891</b>
<b>Cascade</b>						
0%	\$ 71,026	\$ 140,056	\$ 280,112	\$ 698,282	\$ 1,394,568	\$ 4,181,707
50%	\$ 99,186	\$ 196,376	\$ 392,753	\$ 979,885	\$ 1,957,773	\$ 5,871,321
100%	\$ 127,347	\$ 252,697	\$ 505,393	\$ 1,261,487	\$ 2,520,977	\$ 7,560,935
<b>Average Increase</b>	<b>\$ 28,160</b>	<b>\$ 56,320</b>	<b>\$ 112,641</b>	<b>\$ 281,602</b>	<b>\$ 563,205</b>	<b>\$ 1,689,614</b>
<b>Glacier</b>						
0%	\$ 43,686	\$ 126,034	\$ 252,068	\$ 628,497	\$ 1,255,322	\$ 3,764,293
50%	\$ 74,710	\$ 147,747	\$ 295,494	\$ 737,063	\$ 1,472,454	\$ 4,415,688
100%	\$ 85,567	\$ 169,460	\$ 338,921	\$ 845,629	\$ 1,689,586	\$ 5,067,084
<b>Average Increase</b>	<b>\$ 10,857</b>	<b>\$ 21,713</b>	<b>\$ 43,426</b>	<b>\$ 108,566</b>	<b>\$ 217,132</b>	<b>\$ 651,396</b>
<b>McCone</b>						
0%	\$ 58,380	\$ 114,722	\$ 229,445	\$ 571,574	\$ 1,141,111	\$ 3,421,296
50%	\$ 82,455	\$ 162,872	\$ 325,745	\$ 588,354	\$ 1,622,611	\$ 4,865,797
100%	\$ 106,530	\$ 211,022	\$ 422,045	\$ 829,104	\$ 2,104,112	\$ 6,310,297
<b>Average Increase</b>	<b>\$ 24,075</b>	<b>\$ 48,150</b>	<b>\$ 96,300</b>	<b>\$ 240,750</b>	<b>\$ 481,500</b>	<b>\$ 1,444,500</b>
<b>Park</b>						
0%	\$ 61,011	\$ 120,348	\$ 240,695	\$ 600,063	\$ 1,198,452	\$ 3,593,680
50%	\$ 78,275	\$ 154,876	\$ 309,751	\$ 772,703	\$ 1,543,730	\$ 4,629,516
100%	\$ 95,539	\$ 189,403	\$ 378,807	\$ 945,342	\$ 1,889,009	\$ 5,665,353
<b>Average Increase</b>	<b>\$ 17,264</b>	<b>\$ 34,528</b>	<b>\$ 69,056</b>	<b>\$ 172,639</b>	<b>\$ 345,279</b>	<b>\$ 1,035,837</b>
<b>Prairie</b>						
0%	\$ 53,438	\$ 105,282	\$ 210,564	\$ 524,818	\$ 1,048,043	\$ 3,142,535
50%	\$ 80,275	\$ 158,958	\$ 317,915	\$ 793,195	\$ 1,584,798	\$ 4,752,800
100%	\$ 107,113	\$ 212,633	\$ 425,266	\$ 1,061,573	\$ 2,121,552	\$ 6,363,064
<b>Average Increase</b>	<b>\$ 26,838</b>	<b>\$ 53,675</b>	<b>\$ 107,351</b>	<b>\$ 268,377</b>	<b>\$ 536,755</b>	<b>\$ 1,610,264</b>

## Local Spending

**Table 13: Annual Phase Local Spending per Project Size, Location, and Local Ownership Percentage**

County, Local Ownership %	Project Size (MW)					
	5.0	10.0	20.0	50.0	100.0	300.0
<b>Blaine</b>						
0%	\$ 97,785	\$ 229,495	\$ 458,989	\$ 1,143,474	\$ 2,282,947	\$ 6,844,841
50%	\$ 387,785	\$ 771,569	\$ 1,618,989	\$ 4,043,474	\$ 8,082,947	\$ 24,244,841
100%	\$ 696,747	\$ 1,389,495	\$ 2,778,989	\$ 6,943,474	\$ 13,882,947	\$ 41,644,841
<b>Average Increase</b>	<b>\$ 308,963</b>	<b>\$ 617,926</b>	<b>\$ 1,160,000</b>	<b>\$ 2,900,000</b>	<b>\$ 5,800,000</b>	<b>\$ 17,400,000</b>
<b>Cascade</b>						
0%	\$ 123,325	\$ 242,650	\$ 485,299	\$ 1,209,248	\$ 2,414,496	\$ 7,239,489
50%	\$ 413,325	\$ 822,650	\$ 1,645,299	\$ 4,109,248	\$ 8,214,496	\$ 24,639,489
100%	\$ 703,325	\$ 1,402,650	\$ 2,805,299	\$ 7,009,248	\$ 14,014,496	\$ 42,039,489
<b>Average Increase</b>	<b>\$ 290,000</b>	<b>\$ 580,000</b>	<b>\$ 1,160,000</b>	<b>\$ 2,900,000</b>	<b>\$ 5,800,000</b>	<b>\$ 17,400,000</b>
<b>Glacier</b>						
0%	\$ 140,292	\$ 276,585	\$ 553,170	\$ 1,378,924	\$ 2,753,848	\$ 8,257,545
50%	\$ 430,292	\$ 856,585	\$ 1,713,170	\$ 4,278,924	\$ 8,553,848	\$ 25,657,545
100%	\$ 720,292	\$ 1,436,585	\$ 2,873,170	\$ 7,178,924	\$ 14,353,848	\$ 43,057,545
<b>Average Increase</b>	<b>\$ 290,000</b>	<b>\$ 580,000</b>	<b>\$ 1,160,000</b>	<b>\$ 2,900,000</b>	<b>\$ 5,800,000</b>	<b>\$ 17,400,000</b>
<b>McCone</b>						
0%	\$ 120,353	\$ 236,707	\$ 473,413	\$ 1,179,533	\$ 2,355,067	\$ 7,061,200
50%	\$ 410,353	\$ 816,707	\$ 1,633,413	\$ 4,079,533	\$ 8,155,067	\$ 24,461,200
100%	\$ 700,353	\$ 1,396,707	\$ 2,793,413	\$ 6,979,533	\$ 13,955,067	\$ 41,861,200
<b>Average Increase</b>	<b>\$ 290,000</b>	<b>\$ 580,000</b>	<b>\$ 1,160,000</b>	<b>\$ 2,900,000</b>	<b>\$ 5,800,000</b>	<b>\$ 17,400,000</b>
<b>Park</b>						
0%	\$ 121,446	\$ 238,891	\$ 477,783	\$ 1,190,457	\$ 2,376,915	\$ 7,126,745
50%	\$ 411,446	\$ 818,891	\$ 1,637,783	\$ 4,090,457	\$ 8,176,915	\$ 24,526,745
100%	\$ 701,446	\$ 1,398,891	\$ 2,797,783	\$ 6,800,830	\$ 13,976,915	\$ 41,926,745
<b>Average Increase</b>	<b>\$ 290,000</b>	<b>\$ 580,000</b>	<b>\$ 1,160,000</b>	<b>\$ 2,710,372</b>	<b>\$ 5,800,000</b>	<b>\$ 17,400,000</b>
<b>Prairie</b>						
0%	\$ 124,621	\$ 245,242	\$ 490,484	\$ 1,222,211	\$ 2,440,421	\$ 7,317,264
50%	\$ 414,621	\$ 825,242	\$ 1,650,484	\$ 4,122,211	\$ 8,240,421	\$ 24,717,264
100%	\$ 704,621	\$ 1,405,242	\$ 2,810,484	\$ 7,022,211	\$ 14,040,421	\$ 42,117,264
<b>Average Increase</b>	<b>\$ 290,000</b>	<b>\$ 580,000</b>	<b>\$ 1,160,000</b>	<b>\$ 2,900,000</b>	<b>\$ 5,800,000</b>	<b>\$ 17,400,000</b>

**Table 14: Local Spending during Construction Phase by Project Size**

Project Size (MW)					
5.0	10.0	20.0	50.0	100.0	300.0
\$ 45,260	\$ 90,520	\$ 181,040	\$ 452,600	\$ 905,201	\$ 2,715,602

**Table 15: Average Annual Debt/Equity Payment per Project Size and Local Ownership Percentage**

Project Size (MW)	Average Annual Debt/Equity Payment		
	0%	50%	100%
5	\$ -	\$ 290,000	\$ 580,000
10	\$ -	\$ 580,000	\$ 1,160,000
20	\$ -	\$ 1,160,000	\$ 2,320,000
50	\$ -	\$ 2,900,000	\$ 5,800,000
100	\$ -	\$ 5,800,000	\$11,600,000
300	\$ -	\$17,400,000	\$34,800,000

**Project Output Value**

**Table 16: Project Output Value during Construction Phase by Project Size and County**

County	Project Size (MW)					
	5.0	10.0	20.0	50.0	100.0	300.0
Blaine	\$ 48,597	\$ 97,194	\$ 194,389	\$ 485,972	\$ 971,944	\$ 2,915,831
Cascade	\$ 780,462	\$1,560,925	\$3,121,849	\$ 7,804,623	\$15,609,246	\$46,827,737
Glacier	\$ 57,653	\$ 115,307	\$ 230,613	\$ 576,533	\$ 1,153,066	\$ 3,459,199
McCone	\$ 46,753	\$ 93,506	\$ 187,012	\$ 467,529	\$ 935,059	\$ 2,805,176
Park	\$ 61,660	\$ 123,320	\$ 246,641	\$ 616,602	\$ 1,233,205	\$ 3,699,614
Prairie	\$ 42,176	\$ 84,353	\$ 168,705	\$ 421,763	\$ 843,526	\$ 2,530,579

**Table 17: Annual Project Output Value per Project Size, County, Local Ownership Percentage**

County, Local Ownership %	Project Size (MW)					
	5.0	10.0	20.0	50.0	100.0	300.0
<b>Blaine</b>						
0%	\$ 76,429	\$ 147,357	\$ 294,714	\$ 731,283	\$ 1,457,066	\$ 4,365,697
50%	\$ 187,565	\$ 369,630	\$ 739,260	\$ 1,842,649	\$ 3,679,798	\$ 11,033,893
100%	\$ 298,702	\$ 591,903	\$ 1,183,806	\$ 2,954,015	\$ 5,902,530	\$ 17,702,088
<b>Average Increase</b>	<b>\$ 111,137</b>	<b>\$ 222,273</b>	<b>\$ 444,546</b>	<b>\$ 1,111,366</b>	<b>\$ 2,222,732</b>	<b>\$ 6,668,195</b>
<b>Cascade</b>						
0%	\$ 186,653	\$ 365,599	\$ 731,198	\$ 1,820,288	\$ 3,632,869	\$ 10,890,901
50%	\$ 333,864	\$ 660,021	\$ 1,320,042	\$ 3,292,398	\$ 6,577,089	\$ 19,723,559
100%	\$ 481,075	\$ 954,443	\$ 1,908,886	\$ 4,764,508	\$ 9,521,309	\$ 28,556,218
<b>Average Increase</b>	<b>\$ 147,211</b>	<b>\$ 294,422</b>	<b>\$ 588,844</b>	<b>\$ 1,472,110</b>	<b>\$ 2,944,220</b>	<b>\$ 8,832,659</b>
<b>Glacier</b>						
0%	\$ 111,960	\$ 217,816	\$ 435,632	\$ 1,082,976	\$ 2,159,850	\$ 6,473,445
50%	\$ 229,903	\$ 453,703	\$ 907,406	\$ 2,262,413	\$ 4,518,722	\$ 13,550,063
100%	\$ 347,847	\$ 689,590	\$ 1,379,181	\$ 3,441,849	\$ 6,877,594	\$ 20,626,680
<b>Average Increase</b>	<b>\$ 117,944</b>	<b>\$ 235,887</b>	<b>\$ 471,774</b>	<b>\$ 1,179,436</b>	<b>\$ 2,358,872</b>	<b>\$ 7,076,617</b>
<b>McCone</b>						
0%	\$ 80,187	\$ 153,661	\$ 307,322	\$ 761,593	\$ 1,516,474	\$ 4,542,709
50%	\$ 191,517	\$ 376,321	\$ 752,642	\$ 1,874,892	\$ 3,743,070	\$ 11,222,499
100%	\$ 302,847	\$ 598,980	\$ 1,197,961	\$ 2,988,190	\$ 5,969,667	\$ 17,902,288
<b>Average Increase</b>	<b>\$ 111,330</b>	<b>\$ 222,660</b>	<b>\$ 445,319</b>	<b>\$ 1,113,298</b>	<b>\$ 2,226,596</b>	<b>\$ 6,679,789</b>
<b>Park</b>						
0%	\$ 109,052	\$ 211,600	\$ 423,200	\$ 1,051,497	\$ 2,096,490	\$ 6,282,967
50%	\$ 239,240	\$ 471,976	\$ 943,952	\$ 2,353,375	\$ 4,700,247	\$ 14,094,238
100%	\$ 369,427	\$ 732,351	\$ 1,464,703	\$ 3,655,254	\$ 7,304,004	\$ 21,905,510
<b>Average Increase</b>	<b>\$ 130,188</b>	<b>\$ 260,376</b>	<b>\$ 520,751</b>	<b>\$ 1,301,879</b>	<b>\$ 2,603,757</b>	<b>\$ 7,811,271</b>
<b>Prairie</b>						
0%	\$ 70,216	\$ 134,289	\$ 268,579	\$ 665,306	\$ 1,324,470	\$ 3,967,267
50%	\$ 178,659	\$ 351,176	\$ 702,353	\$ 1,749,740	\$ 3,493,338	\$ 10,473,873
100%	\$ 287,102	\$ 568,063	\$ 1,136,126	\$ 2,834,174	\$ 5,662,207	\$ 16,980,479
<b>Average Increase</b>	<b>\$ 108,443</b>	<b>\$ 216,887</b>	<b>\$ 433,774</b>	<b>\$ 1,084,434</b>	<b>\$ 2,168,869</b>	<b>\$ 6,506,606</b>

**Table 18: Total Project Value per Project Size, County, and Local Ownership Percentage**

County, Local Ownership %	Project Size (MW)					
	5.0	10.0	20.0	50.0	100.0	300.0
<b>Blaine</b>						
0%	\$ 125,026	\$ 1,729,009	\$ 3,458,018	\$ 8,374,253	\$ 17,273,587	\$ 51,815,261
50%	\$ 236,163	\$ 1,898,224	\$ 3,796,448	\$ 9,485,619	\$ 18,965,738	\$ 56,891,712
100%	\$ 347,299	\$ 2,120,497	\$ 4,240,994	\$ 10,596,985	\$ 21,188,469	\$ 63,559,907
<b>Cascade</b>						
0%	\$ 1,411,518	\$ 2,815,328	\$ 5,630,655	\$ 14,068,931	\$ 28,130,155	\$ 84,382,758
50%	\$ 1,558,729	\$ 3,109,750	\$ 6,219,499	\$ 15,541,041	\$ 31,074,375	\$ 93,215,416
100%	\$ 1,705,940	\$ 3,404,172	\$ 6,808,343	\$ 17,013,151	\$ 34,018,594	\$ 102,048,075
<b>Glacier</b>						
0%	\$ 1,023,166	\$ 2,040,228	\$ 4,080,456	\$ 10,195,037	\$ 20,383,970	\$ 61,145,806
50%	\$ 1,111,328	\$ 2,216,552	\$ 4,433,104	\$ 11,076,657	\$ 22,147,210	\$ 66,435,526
100%	\$ 1,229,271	\$ 2,452,439	\$ 4,904,878	\$ 12,256,093	\$ 24,506,082	\$ 73,512,143
<b>McCone</b>						
0%	\$ 862,354	\$ 1,717,995	\$ 3,435,991	\$ 8,583,264	\$ 17,159,815	\$ 51,472,732
50%	\$ 943,539	\$ 1,880,366	\$ 3,760,733	\$ 9,395,119	\$ 18,783,526	\$ 56,343,865
100%	\$ 1,054,869	\$ 2,103,026	\$ 4,206,052	\$ 10,508,417	\$ 21,010,122	\$ 63,023,655
<b>Park</b>						
0%	\$ 1,073,558	\$ 2,140,613	\$ 4,281,226	\$ 10,696,560	\$ 21,386,617	\$ 64,153,348
50%	\$ 1,172,194	\$ 2,337,885	\$ 4,675,770	\$ 11,682,920	\$ 23,359,337	\$ 70,071,509
100%	\$ 1,302,382	\$ 2,598,261	\$ 5,196,521	\$ 12,984,799	\$ 25,963,095	\$ 77,882,780
<b>Prairie</b>						
0%	\$ 789,234	\$ 1,572,325	\$ 3,144,651	\$ 7,855,486	\$ 15,704,830	\$ 47,108,349
50%	\$ 870,008	\$ 1,733,875	\$ 3,467,749	\$ 8,663,232	\$ 17,320,322	\$ 51,954,825
100%	\$ 978,452	\$ 1,950,762	\$ 3,901,523	\$ 9,747,666	\$ 19,489,191	\$ 58,461,431

**Percent Increase in Local Tax Base Due to Implementation of Wind Project**

**Table 19: Percent Increase in Tax Base Due to Wind Project**

County	Project Size (MW)					
	5.0	10.0	20.0	50.0	100.0	300.0
<b>Blaine</b>						
Estimated Annual Property Tax from Wind Project	\$ 61,666	\$ 123,332	\$ 246,665	\$ 616,662	\$ 1,233,324	\$ 3,699,973
2003 County Taxable Value	\$ 12,102,916	\$ 12,102,916	\$ 12,102,916	\$ 12,102,916	\$ 12,102,916	\$ 12,102,916
Avg County Mill Levy	0.42958	0.42958	0.42958	0.42958	0.42958	0.42958
County General Property Tax	\$ 5,199,171	\$ 5,199,171	\$ 5,199,171	\$ 5,199,171	\$ 5,199,171	\$ 5,199,171
<b>Percent Increase of County GPT</b>	<b>1.19%</b>	<b>2.37%</b>	<b>4.74%</b>	<b>11.86%</b>	<b>23.72%</b>	<b>71.16%</b>
<b>Cascade</b>						
Estimated Annual Property Tax from Wind Project	\$ 68,244	\$ 136,487	\$ 272,975	\$ 682,437	\$ 1,364,873	\$ 4,094,620
2003 County Taxable Value	\$107,742,853	\$107,742,853	\$107,742,853	\$107,742,853	\$107,742,853	\$107,742,853
Avg County Mill Levy	0.47540	0.47540	0.47540	0.47540	0.47540	0.47540
County General Property Tax	\$ 51,220,952	\$ 51,220,952	\$ 51,220,952	\$ 51,220,952	\$ 51,220,952	\$ 51,220,952
<b>Percent Increase of County GPT</b>	<b>0.13%</b>	<b>0.27%</b>	<b>0.53%</b>	<b>1.33%</b>	<b>2.66%</b>	<b>7.99%</b>
<b>Glacier</b>						
Estimated Annual Property Tax from Wind Project	\$ 85,211	\$ 170,423	\$ 340,845	\$ 852,113	\$ 1,704,226	\$ 5,112,677
2003 County Taxable Value	\$ 16,693,150	\$ 16,693,150	\$ 16,693,150	\$ 16,693,150	\$ 16,693,150	\$ 16,693,150
Avg County Mill Levy	0.59360	0.59360	0.59360	0.59360	0.59360	0.59360
County General Property Tax	\$ 9,909,054	\$ 9,909,054	\$ 9,909,054	\$ 9,909,054	\$ 9,909,054	\$ 9,909,054
<b>Percent Increase of County GPT</b>	<b>0.86%</b>	<b>1.72%</b>	<b>3.44%</b>	<b>8.60%</b>	<b>17.20%</b>	<b>51.60%</b>
<b>McCone</b>						
Estimated Annual Property Tax from Wind Project	\$ 65,272	\$ 130,544	\$ 261,089	\$ 652,722	\$ 1,305,444	\$ 3,916,331
2003 County Taxable Value	\$ 5,844,650	\$ 5,844,650	\$ 5,844,650	\$ 5,844,650	\$ 5,844,650	\$ 5,844,650
Avg County Mill Levy	0.45470	0.45470	0.45470	0.45470	0.45470	0.45470
County General Property Tax	\$ 2,657,562	\$ 2,657,562	\$ 2,657,562	\$ 2,657,562	\$ 2,657,562	\$ 2,657,562
<b>Percent Increase of County GPT</b>	<b>2.46%</b>	<b>4.91%</b>	<b>9.82%</b>	<b>24.56%</b>	<b>49.12%</b>	<b>147.37%</b>
<b>Park</b>						
Estimated Annual Property Tax from Wind Project	\$ 66,365	\$ 132,729	\$ 265,458	\$ 663,646	\$ 1,327,292	\$ 3,981,876
2003 County Taxable Value	\$ 29,924,049	\$ 29,924,049	\$ 29,924,049	\$ 29,924,049	\$ 29,924,049	\$ 29,924,049
Avg County Mill Levy	0.46231	0.46231	0.46231	0.46231	0.46231	0.46231
County General Property Tax	\$ 13,834,187	\$ 13,834,187	\$ 13,834,187	\$ 13,834,187	\$ 13,834,187	\$ 13,834,187
<b>Percent Increase of County GPT</b>	<b>0.48%</b>	<b>0.96%</b>	<b>1.92%</b>	<b>4.80%</b>	<b>9.59%</b>	<b>28.78%</b>
<b>Prairie</b>						
Estimated Annual Property Tax from Wind Project	\$ 69,540	\$ 139,080	\$ 278,160	\$ 695,399	\$ 1,390,799	\$ 4,172,396
2003 County Taxable Value	\$ 3,305,304	\$ 3,305,304	\$ 3,305,304	\$ 3,305,304	\$ 3,305,304	\$ 3,305,304
Avg County Mill Levy	0.48443	0.48443	0.48443	0.48443	0.48443	0.48443
County General Property Tax	\$ 1,601,188	\$ 1,601,188	\$ 1,601,188	\$ 1,601,188	\$ 1,601,188	\$ 1,601,188
<b>Percent Increase of County GPT</b>	<b>4.34%</b>	<b>8.69%</b>	<b>17.37%</b>	<b>43.43%</b>	<b>86.86%</b>	<b>260.58%</b>

## County Demographics

The following demographics were taken from the U.S. Census Bureau (2004).

**Table 20: County Demographics**

<i>% Change, 2000 to 2001</i>	0.2%	2.0%	-1.3%	-0.9%	-3.9%	-0.1%	1.4%
<i>% Change, 1990 to 2000</i>	12.9%	4.2%	3.4%	9.3%	-13.1%	8.1%	-13.3%
<b>HS Diploma</b>	87.2%	78.7%	87.1%	78.6%	86.1%	87.6%	78.8%
<b>Bachelors Degree</b>	24.4%	17.4%	21.5%	16.5%	16.4%	23.1%	14.8%
<b>Median Household Income</b>	\$ 33,024	\$ 25,247	\$ 32,971	\$ 27,921	\$ 29,718	\$ 31,739	\$ 25,451
<b>Per Capita Income</b>	\$ 17,151	\$ 12,101	\$ 17,556	\$ 11,597	\$ 15,162	\$ 17,704	\$ 14,422
<b>Below Poverty Line</b>	14.6%	28.1%	13.5%	27.3%	16.8%	11.4%	17.2%
<b>Nonfarm Businesses</b>	31,365	167	2,534	275	46	706	34
<b>Nonfarm Employment</b>	288,358	1,023	27,093	2,046	336	4,379	182
<b>Manufacturing Shipments</b>	\$ 4,866,279,000	NA	\$ 228,464,000	NA	NA	\$ 63,337,000	NA
<b>Retail Sales</b>	\$ 7,779,112,000	\$ 30,534,000	\$ 803,040,000	\$ 71,119,000	\$ 7,967,000	\$ 102,670,000	\$ 5,214,000
<b>Retail Sales per Capial</b>	\$ 8,853	\$ 4,273	\$ 10,168	\$ 5,635	\$ 3,942	\$ 6,384	\$ 3,917
<b>Land Area</b>	145,552	4,226	2,698	2,995	2,643	2,802	1,737
<b>Persons per Sq-mile</b>	6.2	1.7	29.8	4.4	0.7	5.6	0.7
<b>Metropolitan Area(s)</b>	--	None	Great Falls, MT	None	None	None	None
<b>Industry Employment</b>							
<i>Agriculture</i>	N/A	22.4%	3.0%	9.3%	35.7%	7.3%	36.0%
<i>Construction</i>	N/A	7.0%	7.6%	5.8%	6.7%	9.9%	4.7%
<i>Manufacturing</i>	N/A	0.8%	3.5%	1.4%	0.4%	5.9%	1.2%
<i>Retail</i>	N/A	9.2%	14.2%	9.7%	9.8%	12.0%	5.5%
<i>Professional Services</i>	N/A	2.0%	6.5%	4.4%	2.6%	5.9%	2.3%
<i>Education/Social Services</i>	N/A	29.1%	23.8%	31.3%	13.8%	15.2%	22.2%
<i>Arts/Recreation</i>	N/A	4.5%	9.9%	6.5%	5.5%	19.1%	5.7%
<i>Public Administration</i>	N/A	11.0%	7.0%	15.2%	6.0%	4.9%	6.2%
<i>Transportation</i>	N/A	4.1%	5.6%	5.5%	5.0%	4.2%	4.3%



## Segmented County Employment Figures

The following demographics were taken from the U.S. Census Bureau (2004).

**Table 21: Segmented Total County Employment Figures**

<i>Retail trade</i>	257	4,925	461	99	946	32
<i>Transportation and warehousing, utilities</i>	115	1,954	260	51	327	25
<i>Information</i>	35	832	76	35	212	9
<i>Financing, insurance, real estate, and rental and leasing</i>	116	2,579	125	42	349	16
<i>Professional, scientific, management, administrative, and waste management services</i>	55	2,259	207	26	465	13
<i>Educational, health, and social services</i>	811	8,297	1,489	140	1,191	128
<i>Arts, entertainment, recreation, accomodation, and food services</i>	126	3,454	310	56	1,503	33
<i>Other services (except public administration)</i>	102	1,894	269	37	574	31
<i>Public administration</i>	308	2,419	722	61	386	36
<b>TOTAL EMPLOYMENT</b>	<b>2,789</b>	<b>34,792</b>	<b>4,750</b>	<b>1,011</b>	<b>7,857</b>	<b>577</b>

# REPORT DOCUMENTATION PAGE

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<b>1. REPORT DATE (DD-MM-YYYY)</b> September 2004		<b>2. REPORT TYPE</b> Subcontractor Report		<b>3. DATES COVERED (From - To)</b> December 1, 2003 - May 31, 2004	
<b>4. TITLE AND SUBTITLE</b> Quantifying the Economic Development Impacts of Wind Power in Six Rural Montana Counties Using NREL's JEDI Model			<b>5a. CONTRACT NUMBER</b> DE-AC36-99-GO10337		
			<b>5b. GRANT NUMBER</b>		
			<b>5c. PROGRAM ELEMENT NUMBER</b>		
<b>6. AUTHOR(S)</b> M. Costanti			<b>5d. PROJECT NUMBER</b> NREL/SR-500-36414		
			<b>5e. TASK NUMBER</b> WER4 6003		
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<b>7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)</b> Michael Costanti 512 Dell Place Bozeman, MT 59715				<b>8. PERFORMING ORGANIZATION REPORT NUMBER</b> LEE-4-33228-01	
<b>9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)</b> National Renewable Energy Laboratory 1617 Cole Blvd. Golden, CO 80401-3393				<b>10. SPONSOR/MONITOR'S ACRONYM(S)</b> NREL	
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<b>12. DISTRIBUTION AVAILABILITY STATEMENT</b> National Technical Information Service U.S. Department of Commerce 5285 Port Royal Road Springfield, VA 22161					
<b>13. SUPPLEMENTARY NOTES</b> NREL Technical Monitor: K. Sinclair					
<b>14. ABSTRACT (Maximum 200 Words)</b> The economic development potential that wind power offers is often an overlooked aspect of today's wind power projects. Much has been written about how wind can spur economic development, but few have attempted to quantify these impacts. Using the National Renewable Energy Laboratory's (NREL's) Jobs, Economic Development, and Impacts Model (JEDI), the author examined six counties in Montana to quantify these impacts. The overriding project goal was to illuminate economic development opportunities from wind project development for six Montana counties using an objective economic modeling tool. Interested stakeholders include the agriculture community, wind developers, renewable energy advocates, government officials, and other decision-makers. The Model was developed to enable spreadsheet users with limited or no economic modeling background to easily identify the statewide economic impacts associated with constructing and operating wind power plants. The Model's User Add-In feature allows users to conduct county-specific analyses using county IMPLAN (Impact Analysis for PLANning) multipliers, while state-level multipliers are contained within the Model as default values for all 50 states.					
<b>15. SUBJECT TERMS</b> wind energy; wind energy projects; JEDI; model; economic model; jobs and economic development; rural; Montana					
<b>16. SECURITY CLASSIFICATION OF:</b>			<b>17. LIMITATION OF ABSTRACT</b> UL	<b>18. NUMBER OF PAGES</b>	<b>19a. NAME OF RESPONSIBLE PERSON</b>
<b>a. REPORT</b> Unclassified	<b>b. ABSTRACT</b> Unclassified	<b>c. THIS PAGE</b> Unclassified			<b>19b. TELEPHONE NUMBER (Include area code)</b>