NREL National Renewable Energy Laboratory
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Economic Development Impacts of Community Wind Projects: A Review and Empirical Evaluation

Preprint

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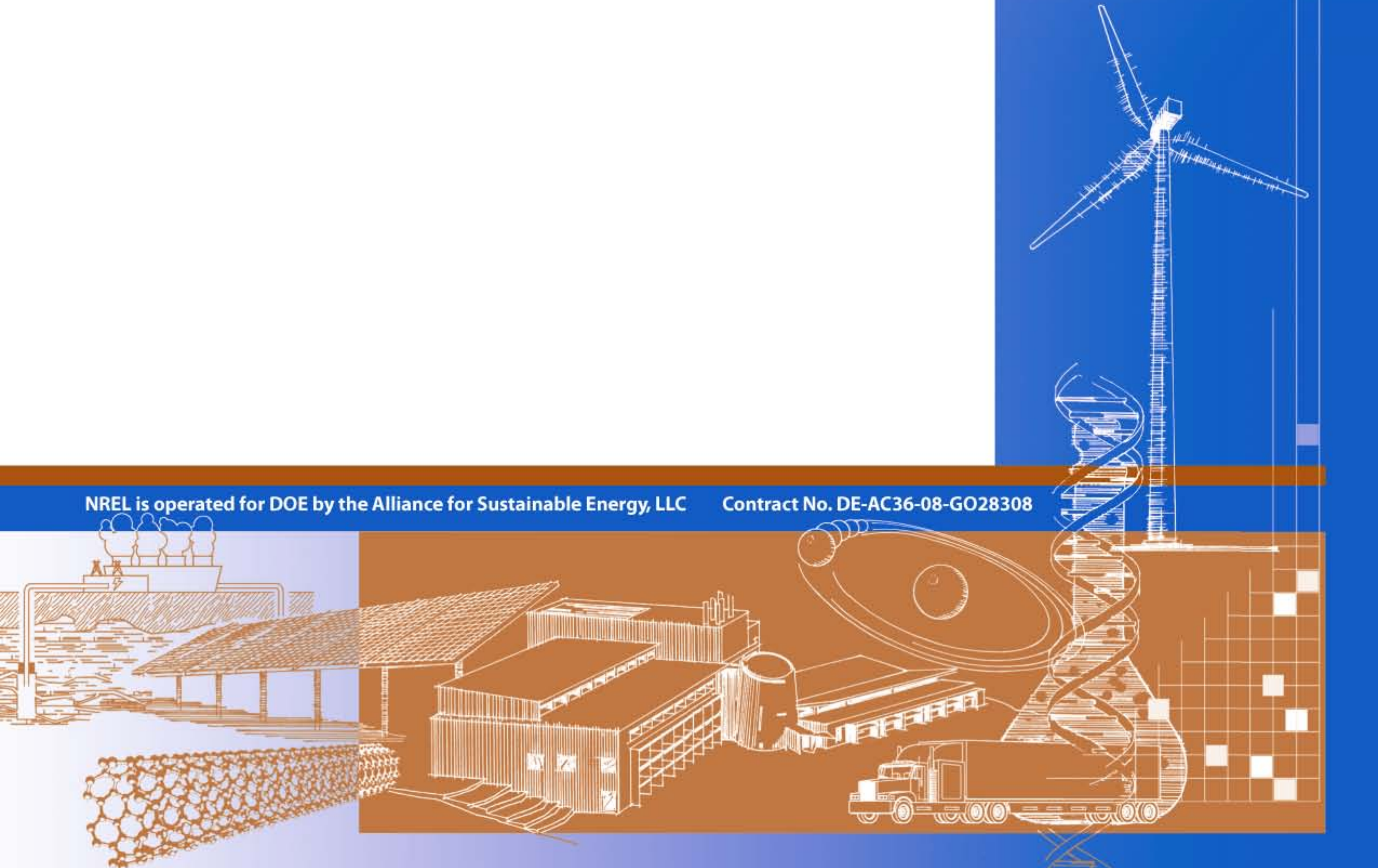
To be presented at WINDPOWER 2009 Conference and Exhibition
Chicago, Illinois
May 4–7, 2009

Conference Paper
NREL/CP-500-45555
April 2009



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Acknowledgements

The authors of this report are indebted to Mark Willers, Dan Juhl, Michael Andreasen, Andrew Stern, Richard Miller, and John McCloud who all graciously shared their knowledge of project development, operations, and finance for community wind projects they have worked on. As well, the authors would like to thank Larry Flowers (NREL) and Marshall Goldberg (MRG & Associates) for reviewing earlier drafts of this report and Ruth Baranowski (NREL) for her technical editing assistance. This work was funded by the Wind Powering America Program within the U.S. Department of Energy. Of course any remaining errors or inaccuracies are the sole responsibility of the authors.

Executive Summary

Community wind projects have long been touted (both anecdotally and in the literature) to increase the economic development impacts of wind projects, but most analyses of community wind have been based on expected results from hypothetical projects. This report provides a review of previous economic development analyses of community wind projects and compares these projected results with empirical impacts from projects currently in operation.

A review of existing literature reveals two primary conclusions. First, construction-period impacts are often thought to be comparable for both community- and absentee-owned facilities.[1] Second, operations-period economic impacts are observed to be greater for community-owned projects. The majority of studies indicate that the range of increased operations-period impact is on the order of 1.5 to 3.4 times.[2]

New retrospective analysis of operating community wind projects finds that total employment impacts from completed community wind projects are estimated to be on the order of four to six 1-year jobs per-MW during construction and 0.3 to 0.6 long-term jobs per-MW during operations. In addition, when comparing retrospective results of community wind to hypothetical average absentee projects, construction-period employment impacts are 1.1 to 1.3 times higher and operations-period impacts are 1.1 to 2.8 times higher for community wind. Comparing the average of the completed community wind projects studied here with retrospective analysis of the first 1,000 MW of wind in Colorado and Iowa indicates that construction-period impacts are as much as 3.1 times higher for community wind, and operations-period impacts are as much as 1.8 times higher.

Ultimately, wind projects are a source of jobs and economic development, and community wind projects are shown to have increased impact both during the construction and operations-period of a wind power plant. The extent of increased impact is primarily a function of local ownership and return on investment.[3] As such, policies that prioritize higher levels of local ownership are likely to result in increased economic development impacts. Furthermore, the increased economic development impact of community wind shown here should not be undervalued. As the wind industry grows and approaches penetrations in the U.S. electricity market of 20%, social opposition to new wind power projects may increase. Community wind could provide a valuable strategy for building community support of wind power - especially in communities that are new to wind power.

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[1] The thought process here is that it is the size and skill set of the local labor pool that is the limiting factor in determining whether local labor and materials support a specific wind project. While this is true in theory, it appears that the on the ground reality does support this.

[2] One study (DanMar & Associates 1996) noted that operations period impacts could be more than six times that of a similar absentee project.

[3] Use of local labor and materials during operations is also important but less so than local ownership.

1 Introduction

"Community wind" refers to a class of wind energy ownership structures. Projects are considered "community" projects when they are at least partially owned by individuals or businesses in the state and local area surrounding the wind power project. The community element of these projects can be defined narrowly so that ownership is concentrated in the county or region where the project is built, or it may be defined broadly so that project investors are simply from the state where the project has been sited. Furthermore, the extent of local ownership may range from a small minority share to full ownership by persons in the immediate area surrounding the wind project site. Potential project owners include local farmers, businesses, Native American tribes, universities, cooperatives, or any other local entity seeking to invest in wind energy. Community wind projects may be a single turbine or multi-megawatt installations.

The opposite of community wind is an "absentee" project. In an absentee project, ownership is completely removed from the state and local community surrounding the facility. Thus, there is little or no ongoing direct financial benefit to state and local populations aside from salaries for local repair technicians, local property tax payments[4], and land lease payments. Absentee-owned wind farms may be held by a variety of entities, including utilities and private investors.

At the end of 2007, it was estimated that there were 308 megawatts (MW) of community wind representing roughly 2% of U.S. wind power capacity (Wiser & Bolinger, 2008).[5] These projects are concentrated in a handful of states, including Minnesota, Iowa, and Texas with Minnesota maintaining the dominant position in capacity installed and the total number of projects.

In recent years, growth in the community wind sector has been hampered by the tight market for wind turbines (Wiser & Bolinger, 2008). Nevertheless, moving forward, state policies specifically supporting community wind may become a more influential factor in the market as turbines are now more readily available.

1.1 Potential Attributes of Community Wind

All wind energy projects constitute an economic development opportunity for the states and communities that surround a wind project. However, local communities may only see a small portion of the economic development impacts that can result from investments in wind energy. In fact, it is not uncommon for less than 15% of project-related construction expenditures to remain in the state where a project is built (Lantz, 2008). However, many community wind advocates argue that community wind projects can increase the proportion of economic development impacts that remain in the communities where wind farms are sited. As such, the primary potential attribute of community wind projects is an increase in local economic development impacts.

The increased economic impact of community wind projects is generally thought to result from three primary avenues. First, there is the possibility for increased utilization of local labor and materials during project development and operations. This potential attribute is more feasible in

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[4] Local property tax payments may take the form of Payments in Lieu of Tax (PILOT).

[5] Authors using broader definitions of community wind claim that as much as 736 MW of community wind exist (Mazza, 2008).

some regions than others, depending on the local labor pool, and it often depends on developer preferences.[6] Second, profitable projects with local ownership provide dividends to local shareholders. Finally, community wind projects may also support increased economic development impacts by relying on local banks for construction financing and operating loans, if needed.

However, economic development impacts may not be the only potential benefit of community wind projects. Increased participation and engagement with a local project has often been cited as a means of increasing local acceptance of wind (Nielsen, 2002 and Hoppe-Kilpper & Steinhauser, 2002). One potential avenue of engaging local communities is to offer local ownership shares to individuals and businesses in the community or state where a project is under consideration. In this regard, community wind projects may facilitate a better relationship between wind energy project developers and advocates and the local landowners and communities who are directly impacted by the development and operations of wind power plants. Furthermore, reduced local opposition may generate cost savings by streamlining the development process and facilitating the permitting and approval process.

1.2 Why Does Community Wind Matter?

Throughout the emergence of the U.S. wind industry, community wind has largely been a peripheral development model with a few individual champions. However, the value of community wind may become critical as the wind industry pursues the 20% by 2030 scenario laid out in the U.S. Department of Energy (DOE) Report *20% Wind Energy by 2030*.[7]

At penetration levels approaching 20%, it is increasingly likely that the broader population as well as specific local communities with good wind resources will more frequently encounter wind energy projects and infrastructure. For some, this increased exposure may be viewed as a welcome change. However, there is also the risk that individuals and communities living in the footprint of wind projects may become more resistant to projects if they perceive that “outsiders” or “corporate interests” are benefiting disproportionately at their expense. In addition, social opposition on the grounds of aesthetic, health, wildlife, or similar concerns may become a more significant barrier to wind industry growth.

Community wind projects provide an opportunity to counteract these potential barriers to expanding wind energy development. By increasing the level of economic development impacts that remain in a state or local area, community wind projects can reduce the perception that it is primarily “outsiders” who benefit from wind energy projects. Furthermore, engaging local stakeholders at a highly personal level (e.g., as equity owners with ongoing financial interests) may create increased support for wind power projects in specific communities. As such, community wind projects provide a mechanism to reduce broader social barriers to wind energy.

1.3 Report Purpose

In spite of the potential added value associated with community wind projects, few studies document the impacts of these ownership structures. In addition, analyses showing the economic development attributes of community wind projects have often been projections rather than

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[6] Developer preferences may vary for both community-owned projects and absentee-owned projects.

[7] To view this report and see additional documentation, visit http://20percentwind.org/.

actual estimates from facilities currently in operation. Furthermore, the impacts noted in this body of work often vary, sometimes widely. This inconsistency can send a mixed message to policymakers regarding the value of community wind.

The purpose of this report is to clarify the economic development value of community wind projects. In doing so, the report seeks to explain why there is a range of impacts reported and to assess the actual economic development impacts of projects that have been built. The intention is to provide policymakers with a more complete understanding of the actual economic development attributes of community wind projects.

To carry out this task, the report reviews previous economic development analyses of community wind and estimates the economic development impacts from four completed community wind energy projects. Analysis results are used to show how economic development impacts vary among community wind projects and to discuss the value of community wind relative to absentee projects. The report closes by discussing variables that effect economic development analyses and how they affect community wind projects specifically.

2 Understanding Economic Development Impacts

In the effort to assess and explain the economic development impacts of community wind projects, the following briefly discusses the common methodology of measuring economic development impacts.

2.1 Measuring Economic Development Impacts

Economic development impacts are often measured using input-output (I/O) models. I/O models use the relationship between changes in demand and the resulting economic activity to estimate how new expenditures will impact economic development metrics including jobs, earnings, and "output" or economic activity. I/O models are often static — they measure inter-industry relationships for a given time period — and linear — they assume that any change in demand, regardless of magnitude, has the same proportional result. However, because large-scale economic changes occur gradually, I/O modeling, as it is generally practiced, is a robust methodology for measuring economic development impacts.

Economic impacts in these models are generally assessed at three levels: direct, indirect, and induced.[8] Results shown here include the total (i.e., sum of direct, indirect, and induced impacts)

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[8] For investments in wind power plants, NREL classifies direct impacts as those impacts that go to companies engaged in development and onsite construction and operation of wind farms. These impacts are labeled by NREL as On-site Labor and Professional Services. Direct beneficiaries from wind energy projects include project developers, road builders, concrete-pouring companies, construction companies, turbine erection crews, crane operators, and operations and maintenance personnel, as well as legal and engineering personnel who work on the project. Indirect impacts accrue in supporting industries and are defined by NREL as Turbine Production and Supply Chain Impacts. These impacts are driven by the increase in demand for goods and services from direct beneficiaries. Indirect beneficiaries include construction material and component suppliers, accountants and legal personnel who assess project feasibility and negotiate the contract agreements, banks financing the projects, wind turbine manufacturers, and manufacturers of maintenance equipment and repair parts. Finally, induced impacts result from reinvestment and spending of earnings by direct and indirect beneficiaries. These induced impacts are often associated with increased business at local restaurants and retail establishments but also include child-care providers

economic development impacts as well as the direct or on-site labor and professional services impacts. In addition, results in this analysis are divided between construction- and operations-period impacts. Construction-period impacts are short-term, and construction-period jobs are defined as full-time equivalents or 2,080-hour units of labor (one construction period job equates to one full-time job for 1 year). In contrast, operations-period impacts are annual impacts that accumulate over the life of the project. The only case in which operations-period impacts do not accumulate over multiple years is operations-period jobs, which are reported as long-term jobs that persist for the operating life of the facility.

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and any other entity that is impacted by increased economic activity and spending from direct and indirect beneficiaries.

3 Review of Existing Literature

Economic development impacts from community wind projects have been analyzed in the past; however, the results of this work have a wide range and are often difficult to compare with the impacts from other community and absentee wind projects. This portion of the analysis reviews existing literature, some of which has been cited as a basis for policy and public support of community wind projects.

3.1 Economic Impact Analysis of Windpower Development in Southwest Minnesota (DanMar & Associates, 1996)

This report represents one of the first efforts in measuring the economic development impacts of wind energy. Published in 1996, the report focuses on the economic impacts resulting from "large-scale wind power developments and disbursed generation" over a six-county area in southwestern Minnesota. The dispersed-generation model discussed here is comparable to full (100%) community ownership. The study evaluates the total economic impacts resulting from wind energy development.

The published impacts detail the results of two potential 100-MW projects as well as the 100-MW dispersed generation model, which assumes individual 600-kW turbines adding up to 100 MW. Results from the two 100-MW absentee facilities as well as the locally owned dispersed-generation model are shown in Table 1.

Table 1. Results Summary of DanMar & Associates (1996)

	Construction Period (Thousands of 2008$)			Operations-period (Annual) (Thousands of 2008$)		
	Jobs/MW	Earnings	Output	Jobs/MW	Earnings	Output
Absentee Project I[9]	0.9	$29.7	$54.2	0.2	$5.7	$12.3
Absentee Project II	1.3	$40.7	$79.8	0.5	$7.1	$13.8
Locally Owned	0.8	$27.0	$50.8	1.3	$41.7	$80.4
Ratio to Project I[10]	0.9	0.9	0.9	6.8	7.3	6.5
Ratio to Project II	0.6	0.7	0.6	2.4	5.9	5.8

3.2 Wind Power's Contribution to Electric Power Generation and Impact on Farms and Rural Communities (GAO, 2004)

This 2004 report also represents a relatively early attempt to assess economic development impacts from wind power. It remains one of the more widely cited reports on the value of community wind relative to absentee ownership.

The analysis was performed for eleven U.S. counties. Because the results are at the county level, the order of magnitude of the impacts noted here is lower than in a typical state impacts analysis.

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[9] Individual project analysis was labeled as phases in the original work. Our labeling of each phase as a distinct project is for the purpose of clarity in understanding that these individual analyses are actually different scenarios based on pro formas for specific projects.

[10] The term "ratio" used in these tables refers to the ratio of community- to absentee-project impacts. It should be interpreted as the listed value to 1 (e.g., 6.8:1).

In addition, this work is retrospective in the sense that the projections are grounded in data gathered from site-specific visits and interviews in the counties for which the projections are conducted.

The report's authors observe that landholders who own the turbines on their land as opposed to merely leasing the land to an absentee owner have the potential to double or triple revenues per turbine. However, the authors also point out that financing constraints may limit the number of turbines that can be installed on an individual's land and as a result, the gross value of owning fewer turbines may actually be less than leasing land for multiple turbines. Furthermore, the authors assume that there is no variability in construction-period impacts between absentee- and community-owned projects. The operations-period results for this analysis, which details the impacts of a 40-MW absentee facility and twenty 2-MW community-owned projects, are below (see Table 2).

Table 2. Results Summary of GAO (2004)

			Operations-period (Annual) Out of Area		Operations-period (Annual) Locally Owned	
	2003 Population (Thousands)	2003 Personal Income (Millions 2008$)	Jobs/MW	Earnings/MW (Thousands 2008$)	Jobs/MW	Earnings/MW (Thousands 2008$)
Pipestone, MN	10	$313	0.3	$18.18	0.9	$92.04
Rock, MN	10	$280	0.3	$20.98	1.0	$103.79
Upton, TX	3	$67	0.3	$20.42	0.8	$82.81
Crockett, TX	4	$78	0.4	$54.27	0.9	$97.08
Alameda, CA	1,501	$67,726	0.4	$40.57	1.0	$130.93
Solano, CA	420	$13,104	0.4	$36.09	0.9	$118.34
Pecos, TX	16	$269	0.5	$30.77	1.0	$101.56
Weld, CO	211	$5,237	0.5	$42.24	1.2	$135.13
Dickinson, IA	17	$593	0.6	$37.49	1.2	$115.26
Buena Vista, IA	20	$582	0.6	$50.36	1.2	$136.53
Cherokee, IA	13	$369	0.6	$50.08	1.3	$135.69

3.3 Community Versus Corporate Wind: Does it Matter Who Develops the Wind in Big Stone County, MN? (Kildegaard & Myers-Kuykindall, 2006)

Completed in 2006, this report by the Initiative for Renewable Energy and the Environment at the University of Minnesota considers the economic impacts to Big Stone County, MN from development of wind power under three different scenarios. Unlike other reports reviewed here, this report reduces the impacts of local cash flows based on the opportunity cost of capital. In this sense, the cash flow impacts are "net" cash flow impacts rather than "gross" impacts, as is the case in all the other studies reviewed here.

The three scenarios studied in this report are based on a 10.5-MW facility. Two of the scenarios assume 100% local equity financing with variable levels of net cash flow based on the opportunity cost of capital, while the third analysis assumes that a corporate developer simply leases the land for the facility and invests all project profits outside of the county of interest. The variable level of net cash flow that differentiates the first two scenarios implicates employment and other economic development metrics by changing the amount of project level revenues that are available for reinvestment in the local community. All three studies assume the same project cost and expenditure pattern in terms of local contractor activity on the project. Results are only reported for the operations-period of the analysis as there is effectively no difference in construction-period impacts due to the authors simplifying assumption that all scenarios have the same construction cost and local construction expenditure pattern. The results of this study are summarized in Table 3.

Table 3. Results Summary of Kildegaard & Myers-Kuykindall (2006)

Ownership Structure	Annual County-Wide Employment Impact/MW	Ratio of Impacts to Absentee-Owned Scenario
100% Locally Owned (5% Opportunity Cost of Capital)	1.38	3.4
100% Locally Owned (8% Opportunity Cost of Capital)	0.78	1.9
Absentee Owned	0.41	-

3.4 Umatilla County's Economic Structure and the Economic Impacts of Wind Energy Development (Torgerson, Sorte, & Nam, 2006)

This report, conducted in 2006 for Umatilla County, OR, details the variable impact that county resources can have on a county's ability to capture the economic development impacts from a wind project. The report also considers the value of community ownership for a 5-MW wind facility.

The authors estimate that five turbines can generate approximately $13,335 in land lease payments while ownership can result in $72,000 per year in equity payments over the life of the project.[11] The results from this report's analysis of community wind impacts are summarized in Table 4.

Table 4. Results Summary of Torgerson, Sorte, & Nam (2006)

	Jobs/MW	Earnings (Annual) (Thousands of 2008$)	Output (Annual) (Thousands of 2008$)
Absentee Ownership	0.2	$8.8	$25.5
Local Ownership	0.5	$31.1	$133.4
Ratio of Impacts	2.1	3.5	5.2

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[11] Assuming a 20% equity share, a 16% interest rate return, and a 10-year payback period.

3.5 Prior NREL Work

The final reviews in this report are of two NREL studies conducted in 2008 on local ownership of future projects. Unlike the studies reviewed above, the NREL studies focused on state-level impacts rather than the county or regional impacts. In addition, both analyses assume a moderate increase in use of local contractors for construction of community wind projects.

The two studies include Lantz and Tegen (2008) and Lantz (2008). In the first report, the results of two potential community ownership models were projected for Colorado and compared with the impacts to the state of a single absentee-owned project. These results are detailed in Table 5.[12]

Table 5. Results Summary of Lantz & Tegen (2008)

	Economic Development Impacts (Per-MW)			
	Construction Period		**Operations-period (Annual)**	
Ownership Structure	**Jobs**	**Output (Thousands of 2008$)**	**Jobs**	**Output (Thousands of 2008$)**
Absentee Owned	2.8	$348	0.37	$38
100% Locally Owned	3.0	$372	0.92	$101
Locally Owned Flip	3.0	$372	0.63	$68

Additional work by Lantz (2008) indicates that projects that qualify as Nebraska C-BED projects[13] in Nebraska are likely to result in slightly higher impacts during construction and approximately 1.5 times greater impacts during the operations-period when compared with absentee-owned projects also in Nebraska (Table 6). The increased impact observed during construction is based on the assumption that community projects will secure a moderately higher level of local contractors and material suppliers during construction,[14] while the increase in operations-period impacts are primarily driven by the return on investment for Nebraska-based shareholders.

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[12] In the 100% Locally Owned model, the projects were 100% owned by local entities for the full life of the project. In the Locally Owned Flip model, projects are 100% owned locally for 50% of the project life.

[13] C-BED is one form of locally or community-owned wind energy projects. To qualify for C-BED status in Nebraska, 33% of gross project revenues must flow back to qualified Nebraska individuals or businesses. In effect, this policy supports local, Nebraska ownership of wind power projects. Results are modeled assuming a 33% local equity share and an effective interest rate of 9% on equity investments.

[14] Although it is not yet clear if this increased impact will materialize since only one C-BED project has been completed to date, impacts modeling was conducted with this provision in place as a result of input from interviews with various utility and wind energy stakeholders in Nebraska.

Table 6. Results Summary of Lantz (2008)

	Economic Development Impacts (Per-MW)					
	Construction Period			Operations-period (Annual)		
Ownership Structure	Jobs	Earnings (Thousands of 2008$)	Output (Thousands of 2008$)	Jobs	Earnings (Thousands of 2008$)	Output (Thousands of 2008$)
Nebraska CBED High	4.2	$165	$514	0.52	$18	$56
Nebraska CBED Low	2.8	$108	$319	0.45	$16	$50
Absentee High	3.9	$150	$475	0.35	$13	$39
Absentee Low	2.3	$86	$260	0.26	$10	$30

3.6 Conclusions from Existing Literature

Table 7 provides a comparative summary of each of the studies reviewed.[15] It compares the total employment impacts from these studies on a per-megawatt basis for both the construction-period and operations-period impacts. In addition, it provides the ratio of operations-period employment impacts for community-owned projects relative to absentee-owned projects.

Table 7. Summary of Results from Literature Review

	Analysis Details			Employment Impacts (Jobs per-MW)		
Study	Publication Year	Area Covered by Analysis	Analysis Perspective	Construction Period (Short-Term Jobs)	Operations-period (Annual)	Ratio of Operations-Period Impacts (Community to Absentee; e.g., 2.4-6.8:1)
DanMar & Associates	1996	six-county area	projection	0.8	1.3	2.4 - 6.8
GAO	2004	county	projection	0.15 - 2.58	0.8 - 1.3	2.0 - 3.0
Kildegaard & Myers-Kuykindall	2006	county	projection	n/a	0.8 - 1.4	1.9 - 3.4
Torgerson, Sorte, & Nam	2006	county	projection	n/a	0.5	2.1
Lantz & Tegen	2008	state	projection	3	0.63 - 0.92	1.7 - 2.5
Lantz	2008	state	projection	2.8 - 4.2	0.45 - 0.52	1.5 - 1.7

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[15] One additional study (Costanti , 2004) is often cited by reports seeking to argue the merits of community wind. However, because the author does not break out construction-period and operations-period labor results, this report was not reviewed here.

This review demonstrates two primary conclusions. First, construction-period impacts are often thought to be comparable for both community- and absentee-owned facilities. The basis for this conclusion is that, in theory, the size and skill set of the local labor pool are the limiting factors in determining whether local labor and materials support a specific wind project. The assumption in past work is that both absentee- and community-wind projects will typically rely on as much local labor and materials as is reasonable.

The second primary conclusion is that operations-period economic impacts are observed to be greater for community-owned projects. Table 8 demonstrates that the projected jobs impacts for hypothetical community wind projects are estimated to range from 1.5 times to 6.8 times more for community-owned than absentee-owned facilities. However, the majority of studies indicate that the range is likely more narrow, on the order of 1.5 to 3.4 times.[16] Variability among operations-period impacts is observed to be a function of the extent of local equity in a given project (Lantz & Tegen, 2008) and the local economic structure (GAO, 2004).

In addition to these primary conclusions, two additional trends are revealed. First, estimated economic impacts for specific projects vary, and as a result, the ratio of impacts for community wind to absentee-owned projects also varies. Second, analysis details (i.e., county- or state-level analysis) have an impact on the economic development results due to significant discrepancies in the size, structure, and diversity of a state versus a county labor force. Therefore it is important not to directly compare the results of analyses that have widely differing assumptions and analytical details.[17,18]

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[16] Because a large portion of the added benefit of community wind is due to returns on local equity, these projections assume the projects described here are profitable and capable of maintaining a specific, set return on investment.

[17] Generally comparisons are only insightful when an analytical methodology is similar and when one has a complete understanding of the assumptions used and how each analysis has been carried out. That said, it is not entirely unreasonable to compare the ratio of results between community and absentee projects so long as the analysis upon which each individual ratio is based is comparable.

[18] Analytical methodology can also result in variability. However, results should be generally comparable.

4 Economic Impacts Resulting from Completed Community Wind Projects

This portion of the analysis quantifies the economic impacts from completed community wind projects. The projects considered in this portion of the analysis include three types of community wind ownership structures:

- A project owned by a local municipal utility
- A project owned by local investors
- A set of community wind flip projects.

Ex post analysis of this sort is important because modeler assumptions and projections and actual on-the-ground impacts do not always concur. Nevada's Solar One project provides a classic example in this regard. The project developer testified that the project would result in 700 jobs and used economic development impacts as a justification for pursuing the project. However, because the developer contracted primarily with out-of-state contractors, only a fraction of the forecasted economic development impacts accrued to Nevada (Sterzinger, 2008). This type of discrepancy can result for a variety of reasons and underscores the importance of retrospective project analysis.

While this analysis is empirical in that it details the results of completed projects, it relies on the National Renewable Energy Laboratory's (NREL) Jobs and Economic Development Impacts (JEDI) Wind Model to measure the full range of impacts from these projects (direct, indirect, and induced impacts).[19]

To determine the correct model inputs, the authors interviewed individuals involved with the development and operations of these wind power facilities and determined project-level details, including costs and ownership structure as well as the use of in-state labor and materials for these projects. The impacts highlighted here represent the state-level impacts from these projects.

4.1 Hull Wind I and II

Hull Wind I and Hull Wind II are turbines built near the town of Hull, Massachusetts. The town is located on the east side of Boston Harbor within 8 miles of Boston's City Hall. These turbines are owned and operated by the local municipal utility, the Hull Municipal Light Plant (HMLP).

In 2001, the first of the two wind machines, a Vestas 660-kW turbine, was installed. Due to the high level of success observed from Hull I, an additional 1.8-MW Vestas wind turbine, Hull II, was installed in 2006. Both of the turbines installed in Hull were purchased off the HMLP balance sheet on a turnkey basis from Vestas Wind Systems. Local contractors and HMLP carried out a great deal of the site preparation and installation work, including the pouring of the turbine foundations, crane operations, and interconnecting the wind turbines to the local grid. Operations and maintenance of the turbines is managed by HMLP but routine maintenance is

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[19] The JEDI Wind Model is a publicly available Input/Output model specifically tailored to the wind industry. The model was developed by Marshall Goldberg of MRG & Associates for NREL. It is a free tool and available for download at http://www.nrel.gov/analysis/jedi/about_jedi_wind.html.

covered through the warranty agreement with Vestas (McCloud, 2009). Table 9 details the economic development impacts of constructing and operating these two turbines as well as their impacts on a per-MW basis.

Table 8. Economic Development Impacts to Massachusetts Resulting from Hull I and Hull II (2.46 MW)

	Construction-Period Impacts			Operations-Period Impacts (Annual)[20]		
Level of Impacts	**Jobs**	**Earnings (Thousands of 2008$)**	**Output (Thousands of 2008$)**	**Jobs**	**Earnings (Thousands of 2008$)**	**Output (Thousands of 2008$)**
Onsite Labor and Professional Services	2.2	$170	$185	-	-	-
Total Impact	12.9	$664	$1,631	1.5	$72	$253
Total Impact per-MW	5.2	$270	$663	0.6	$29	$103

4.2 Minwind Energy

The second set of community wind projects considered here are the Minwind projects I – IX, constructed by Minwind Energy.[21] Minwind Energy is one of the pioneers of community wind. This company, based in southwest Minnesota, relied solely on local debt and equity to build 15.4 MW of wind power. The Minwind projects are primarily farmer-owned projects consisting of one or two turbines. They rely on a local investor pool and completed their financing with debt from a local bank. As such, all project returns, after debt service, flow to local entities (Willers, 2009).[22] The total economic development impacts from the Minwind projects as well as the per-MW impact are shown in Table 10.

Table 9. Economic Development Impacts to Minnesota Resulting from MinWind I-IX (15.4 MW)

	Construction-Period Impacts			Operations-Period Impacts (Annual)		
Level of Impacts	**Jobs**	**Earnings (Thousands of 2008$)**	**Output (Thousands of 2008$)**	**Jobs**	**Earnings (Thousands of 2008$)**	**Output (Thousands of 2008$)**
Onsite Labor and Professional Services	13	$1,000	$1,190	1.2	$76	$76
Total Impact	62	$2,854	$6,905	9	$387	$1,221
Total Impact per-MW	4.0	$185	$448	0.6	$25	$79

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[20] While HMLP oversees management and monitoring of the Hull Wind turbines, the amount of time required to carry out this task is such that it is not included in the actual onsite labor and professional services category of impacts. Despite this, there are indirect jobs, and $253,000 in economic activity is generated annually. Potential contributors to economic output during operations include the purchase of local supplies and the use of local services when workers perform maintenance, as well as the value of renewable energy credit (REC) sales, renewable energy production incentive (REPI) payments, and savings from reduced conventional power consumption. All provide a boost to the local economy.

[21] For the purpose of this analysis, this collection of projects is essentially treated as one unit and is referred to as the "Minwind Project" throughout the rest of this paper.

[22] It is also assumed that 50% of debt interest payments are reinvested in the Minnesota economy.

4.3 Community Wind in Texas

The third type of community wind project reviewed here is representative of a series of 10-MW facilities financed by a combination of tax equity and local equity. This review profiles one 10-MW facility with a flip-style ownership structure in Texas. This project structure is unique because it relies on corporate equity to capture the full value of the production tax credit (PTC) and also seeks to funnel project revenues back to local investors over the life of the project (Andreasen, 2009). The expected results from this type of project are detailed in Table 11.

Table 10. Economic Development Impacts to Texas Resulting from a 10-MW Facility with a Flip Ownership Structure

	Construction-Period Impacts			Operations-Period Impacts (Annual)		
Level of Impacts	**Jobs**	**Earnings (Thousands of 2008$)**	**Output (Thousands of 2008$)**	**Jobs**	**Earnings (Thousands of 2008$)**	**Output (Thousands of 2008$)**
Onsite Labor and Professional Services	8.6	$578	$743	1.4	$98	$98
Total Impact	61.0	$2,491	$7,348	4	$196	$562
Total Impact per-MW	6.1	$249	$735	0.4	$20	$56

4.4 A Minnesota Flip Project

The final retrospective project analysis performed here is for a 15-MW flip project in Minnesota.[23] Community wind pioneer Dan Juhl, of Juhl Wind Inc., completed this project in 2007. The project relied almost completely on Minnesota labor, and all project materials were noted as purchased in Minnesota. Similar to the Hull Wind projects, individual turbine owners manage and monitor their turbines, but all maintenance is performed by a crew of technicians affiliated with the turbine manufacturer. However, unlike the Hull Wind project, these technicians are based in Minnesota, so this project also supports in-state wind turbine technicians. The estimated economic impacts from this project are summarized in Table 12.

Table 11. Economic Development Impacts to Minnesota from a 15-MW Wind Facility with a Flip Ownership Structure

	Construction-Period Impacts			Operations-Period Impacts (Annual)		
Level of Impacts	**Jobs**	**Earnings (Thousands of 2008$)**	**Output (Thousands of 2008$)**	**Jobs**	**Earnings (Thousands of 2008$)**	**Output (Thousands of 2008$)**
Onsite Labor and Professional Services	13.3	$1,011	$1,222	1.4	$99	$99
Total Impact	85.6	$3,759	$9,662	4	$209	$480
Total Impact per-MW	5.7	$251	$644	0.3	$14	$32

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[23] Although this is analyzed and referred to as a single project in this report, in reality each individual turbine is legally its own Limited Liability Corporation (LLC).

5 Comparing Results

A review of the results shown above indicates that the impacts from community wind projects vary based on the facility size (Figure 1) as well as other factors (Figure 2). However, a few key caveats should be taken into account before drawing firm conclusions about how different community wind projects compare to one another.

First, economic development impacts are driven by the size of expenditures into the economy being analyzed. In this regard, economic development impacts analyses do not take into account the cost of electricity produced by a given facility. However, the result is that a larger local investment results in greater economic development impacts. Generally the local investment can be increased either by using a greater percentage of local labor and materials on a project, or simply by paying more for a good or service that is purchased locally. As such, on a per-MW basis, when all else is equal, lower-cost projects will have reduced economic development impacts when compared with projects that have higher construction costs. It is rare that all factors except project cost are equal between two projects, but the fact that higher costs boost economic development impacts may cause higher-cost projects to overshadow lower-cost projects that actually rely on higher levels of local goods and services. This is especially critical when evaluating projects that are built at different times because in recent years the cost of developing wind projects has increased at rates higher than the nominal rate of inflation. As a result, projects completed more recently are more expensive than older projects and thus the economic development impacts of these projects may be increased.[24]

Second, while the rate of return on local equity is important, an equally or perhaps more important factor is the extent of local ownership. Thus, individual investor returns may be very high when comparing local ownership with a traditional landowner leases. However, if these investors make up only a small fraction of project equity, then the value of these returns becomes more moderate when analyzed as one piece in a broad-based economic development impacts analysis. Of course this does not diminish the benefit to the individual investor, it merely places these returns with the context of the impacts experienced by the broader community.

Finally, the Minnesota projects profiled here do not pay traditional property tax payments. Instead they make production-based payments to local government. However, these payments are structured to incentivize small-scale, dispersed wind projects. As a result, effective property tax payments for these Minnesota projects are much lower than the other projects reviewed here, and operations-period impacts are diminished. Likewise any property tax incentive for community wind projects will have a negative impact on operations-period economic development impacts.

5.1 Comparing Economic Development Impacts among Community Wind Projects

Given this background, the employment impacts from the projects analyzed here are shown in Figure 1. Clearly the largest project, the Minnesota Flip has the highest total impacts. However,

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[24] Unfortunately this condition is a limitation of the general of input/output methodology used in the JEDI Wind Model. Analysis carried out here does adjust project level costs for inflation but it cannot normalize for supply and demand pressures that increase prices at a rate higher than that of inflation.

both the Minwind and Minnesota Flip project relied on high percentages of local goods and services; hence the on-site labor and professional services impacts are comparable for both of these projects. The primary source discrepancy between these projects in their total impacts is in project costs.[25] In addition, the Hull Wind projects are relatively low when considering total project impacts simply because the scale of the Hull project was much less than that of the other projects considered here.

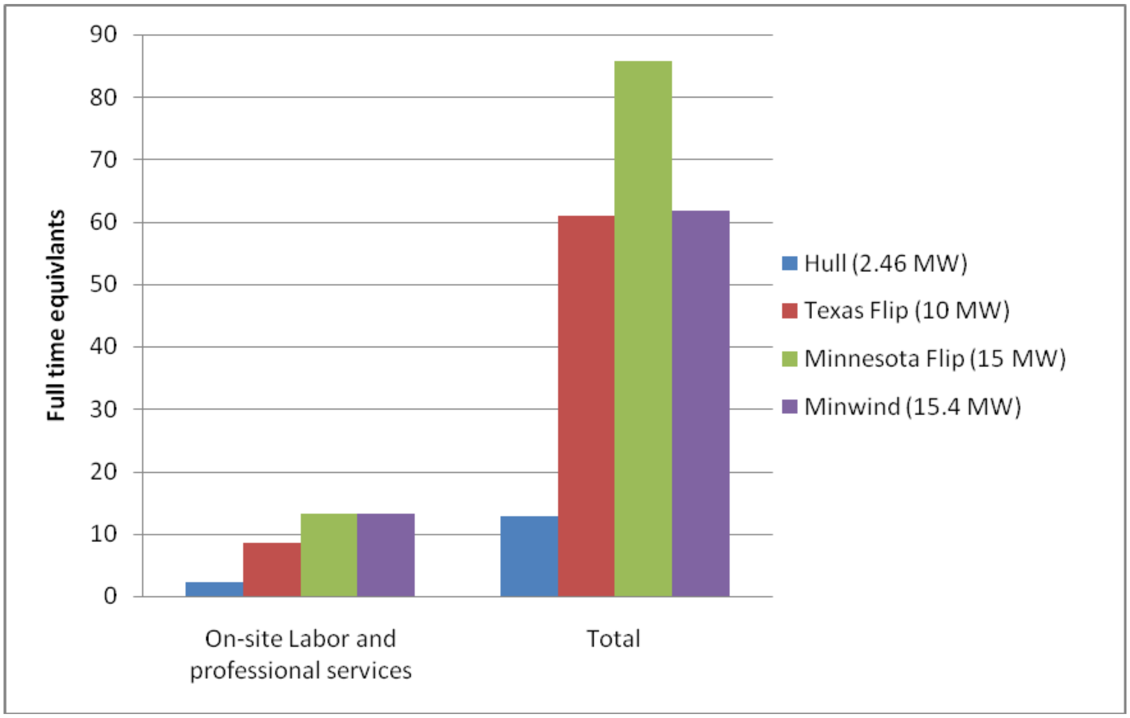

Figure 1. Construction-period employment impacts from community wind projects.

However, when adjusting the results based on project size, it becomes clear that not all community wind projects are equal in terms of their ability to contribute to economic development per unit of installed capacity (Figure 2).

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[25] When adjusted for inflation, the older Minwind Projects are roughly 17% lower in cost, which reduces their relative economic development impacts.

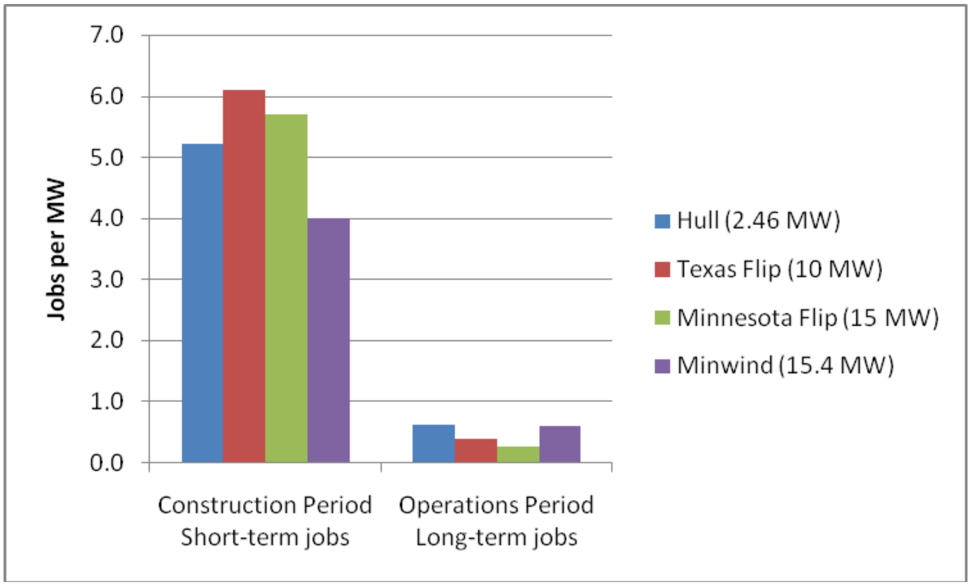

Figure 2. Employment impacts per megawatt from completed community wind projects.

The most recent project, the Texas Flip, was noted to have the highest inflation-adjusted project cost and, despite the fact that it relied on lower levels of local labor and materials than either of the Minnesota projects, its impact per-MW during construction is greater.

Furthermore, the flip-style projects have the lowest operations-period impact, but this is largely a function of the fact that they rely on the lowest levels of local equity. Despite their performance relative to other community wind ownership structures, it is worth noting that many community wind projects rely on this type of general flip structure, and it may offer advantages in terms of facilitating project finance and ultimately deployment of community wind projects. As a result, policymakers seeking to promote community wind for its economic development attributes may want to weigh the value of total economic development with the value of maximizing economic development per-MW of installed capacity.

5.2 Comparing Economic Development of Completed Community Wind Projects with Absentee-Owned Projects

This analysis shows that all community wind projects are expected to have a higher operations-period impact than absentee-owned projects. In addition, when comparing community wind projects with similar hypothetical "average" absentee projects, community wind has a moderately greater economic development impact, 1.1 to 1.3 times, during the construction period (Figure 3).[26]

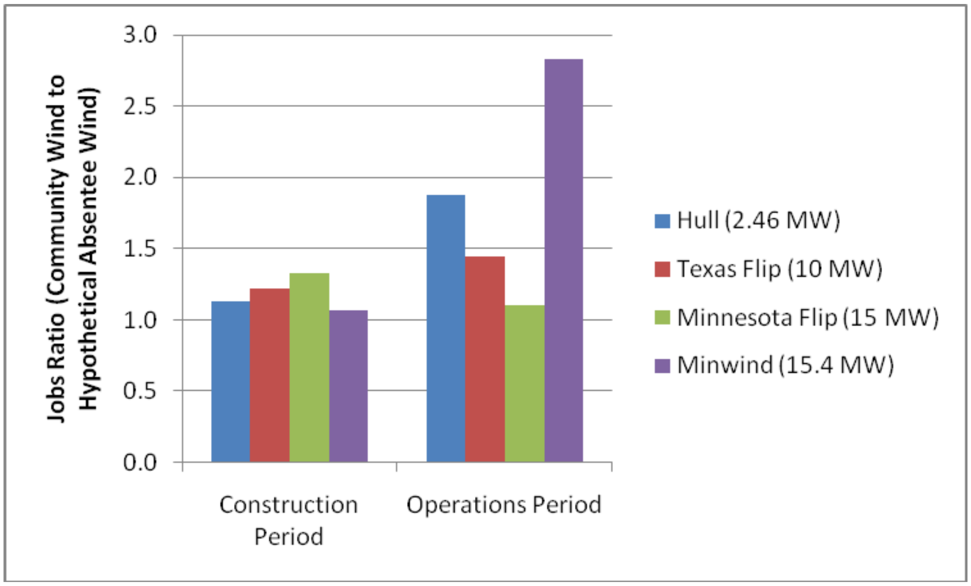

Figure 3. Comparing the ratio of economic development impacts between Community Wind and Hypothetical Absentee Projects.

Note: The ratio of impacts should be interpreted as the value shown to one (e.g., 2.8:1).

However, construction-period impacts often vary widely between projects, and developers may not always rely on what is actually available in the local labor pool. When comparing the average per-MW construction-period impact from community wind projects considered here with the results from two retrospective analyses conducted by Reategui (2008 and forthcoming) for the first 1,000 MW of completed projects in Colorado and Iowa, community wind projects are shown, on a per-MW basis, to have 2.3 to 3.1 times the construction period impact of the first 1,000 MW in Colorado and Iowa. This suggests that while it may be possible and reasonable for absentee wind projects to have economic development impacts comparable to community-owned projects during construction, in some cases community project impacts are actually much higher. Nevertheless, one should exercise caution in generalizing the value of community wind project impacts during the construction period.

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[26] The hypothetical average project is based on what is reasonable in terms of acquisition and use of local labor and materials in today's wind industry. This does not necessarily mean that specific projects will conform to this "average" project but is intended to be representative of the broader wind industry. Model inputs for the hypothetical average project were developed based on years of industry interviews and work modeling the economic development impacts of wind energy. Nevertheless, more recent evidence suggests that individual projects do vary greatly from this average industry characterization.

When comparing the operations-period impacts of community wind projects studied here with the hypothetical average project referenced above, operations-period impacts are observed to be 1.1 to 2.8 times that of absentee-owned projects. As well, when comparing the average operations-period impact of community wind projects reviewed here with the average impact from the first 1,000 MW in Colorado and Iowa, community wind impacts are 1.5 to 1.8 times higher. With the exception of the Southwest Minnesota Study, these results are relatively consistent with what has been documented in the past (Figure 4).

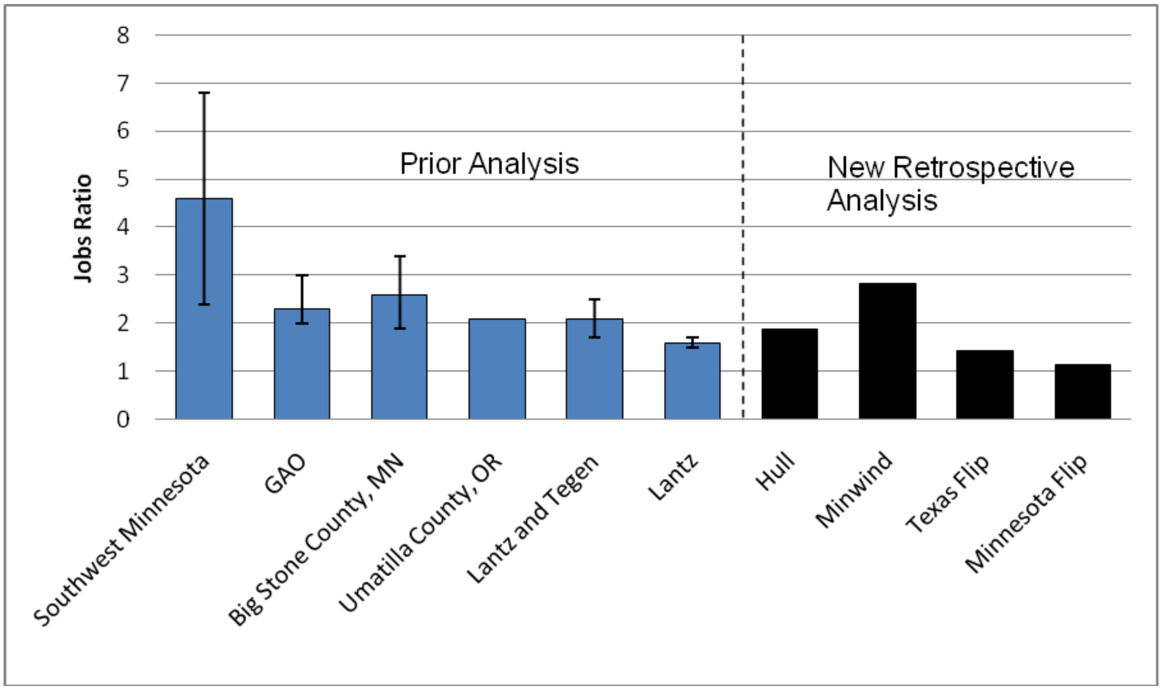

Figure 4. Comparing past analysis, completed projects, and the ratio of impacts relative to absentee projects.

Note: Error bar denotes the range of values reported when available.

For the projects constituting the new retrospective analysis (Figure 4), variability in the ratio of operations-period impacts is largely a function of the actual percentage of local equity as was discussed above. However, the impact of the property tax incentive in Minnesota is revealed by comparing the ratio resulting from the Texas Flip with the ratio resulting for the Minnesota Flip. The impact of rate of return and O&M expenditures is also revealed by comparing the resulting ratios of the Minwind projects with the Hull turbines, which are fully owned by the municipal utility but operate in an area with a less valuable wind resource and send a greater percentage of O&M expenditures out of the local economy.

In spite of variability among individual project results, clearly the average impact of community wind projects relative to absentee-owned projects is greater. Thus, policymakers and individuals seeking to increase local economic development impacts from wind energy are justified in pursuing policies that promote and support community wind projects.

6 Explaining Variability in Economic Development Impacts

This portion of the analysis provides additional detail on why economic impact results vary generally and why economic impacts of community wind projects vary. This is intended to provide additional detail on why one often observes such a range of impacts reported for community wind projects and the ratio of community to absentee wind project impacts.

6.1 Why Variability in Economic Impacts Occurs Generally

Economic impacts vary for many reasons, including the size of the investment, the size of the local labor pool, the availability of local goods and services, the percentage of available labor and materials that are used in the project,[27] and how the revenues from a specific project are allocated to individuals or businesses within the area under consideration.

The first factor, the size of the investment, is directly related to the size and cost of the project in question. In theory, the larger the investment, the greater the impacts; this assumes, however, that a project can be built at a specific cost, a sound assumption for retrospective analysis. Assuming that all projects can be built at the expected costs, one can compare across analyses simply by evaluating the impacts on a per-unit basis. For this reason, the comparisons here are performed on a per-MW basis.

Second, results vary depending on the size and structure of the local economy. This is directly related to the level at which an analysis is conducted as county economies are often very different from state-level economies. Nevertheless, even among analyses that are conducted at the same level (i.e., two county analyses), results may be greatly different because different counties (and states) have different populations, labor skills, and production potential. The reason this drives variability in results is because of the multiplier effect. Investment in an economy will “leak out” at different rates depending on the size and diversity of the economy under consideration. Therefore, the multiplier effect or the number of times a dollar circulates within a given area of analysis will vary based on the size and diversity of the economy. This is especially critical for the indirect and induced impacts. The difference between local economies and their respective multiplier effect can be seen quite clearly in the results reported by the GAO (2004).[28]

The third factor driving variability in results is the percentage of local labor and materials that are used for a given project. This factor cannot be completely separated from the second factor (i.e., the size of the local economy or labor pool) because a larger and more diverse economy has more potential to contribute local labor and materials to a specific project. Still, if a developer hires contractors from out of state to work on a specific project, the economic development impacts are greatly diminished regardless of the size and diversity of the local economy. Individual developers may contract with companies from all parts of the country. However, it is only when they choose to contract with local companies that the local region experiences the greatest benefit.

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[27] From the respective area considered in the analysis.

[28] Even though the actual magnitude of impacts varies based on this parameter, this does not diminish the importance of any specific impact. In reality, the impacts to a rural county from a wind project may be much more valuable to the county even though the gross magnitude of the impacts are much less than what might accrue in another region with a larger economy.

Finally, economic development impacts may vary based on the allocation of project revenues for a specific project and the expected return for a project.[29] Projects that are capitalized outside of the state or area where they are sited are likely to have far less of an impact on the rural areas, where wind resources are often of great value, than projects that reinvest in their local communities or pay dividends to local shareholders. Variability in results traced to this factor assumes that a given project is profitable at a specific rate.

6.2 Why Community Wind Economic Development Impacts Vary

The economic development impacts from community wind vary for all the reasons noted above. However, a few specific highlights deserve additional attention to better understand the range of impacts that result from community wind projects and why the ratio of impacts between community and absentee wind projects may vary.

First, community wind studies are often conducted at different levels. Many individual community projects are considered at the county level. However, others are conducted at the state level. Because state and county economies have different multipliers and different capacities to provide local labor to a project, the results of a state-level analysis will differ from county-level analysis. Limiting comparisons to studies conducted at the same analytical level reduces some of the variability among reports on the impacts of community wind projects and allows one to better understand how the impacts of a specific wind project may vary based on other external factors.

Second, the percentage of local labor used in the construction of projects is highly variable. Community wind advocates often argue that community wind projects utilize much higher levels of local labor and materials than absentee project developers. Evidence suggests that this may in fact be the case, but due to individual project variability it is not possible to draw firm conclusions on this issue. Ultimately, community wind projects have no inherent advantage for construction-period impacts. Nevertheless, the differences in use and application of local labor during construction are sometimes great. Therefore, depending on one's assumptions about use of local labor during construction, one can have a high level of variability in project impacts and especially in the ratio of community- to absentee-project impacts.

Finally, community wind projects employ a wide range of ownership structures and have a wide range of expected returns for local shareholders. The specific ownership structure that is considered for community wind projects is important because it determines how project revenues are allocated. In the case of Minwind-style projects where the local equity share is quite high, economic development impacts are likely greater than in other ownership structures where the percentage of total project revenues that remain local is much less. Yet, because the term "community wind" encompasses such a wide range of potential ownership structures, there may be a wide divergence in how much benefit actually flows back to the local parties invested in any given project.

Furthermore, the expected returns for a project impact the actual magnitude of benefits that can be allocated. Specific assumptions of the expected rate of return for a given project can also

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[29] The economic development impacts of absentee-owned projects are not sensitive to changes in assumed return on investment because none of these impacts are assessed as in-region.

affect economic development impacts for projects that utilize local ownership. This in turn impacts how community wind economic development impacts stack up against absentee-owned projects.

7 Conclusions

This analysis finds that total employment impacts from completed community wind projects are on the order of four to six 1-year jobs per-MW during construction and 0.3 to 0.6 long-term jobs per-MW during operations. Furthermore, when comparing community wind to hypothetical average absentee projects, construction-period employment impacts are 1.1 to 1.3 times higher and operations-period impacts are 1.1 to 2.8 times higher for community wind. Comparing the average of the completed projects studied here with retrospective analysis of the first 1,000 MW of wind in Colorado and Iowa shows construction-period impacts are as much as 3.1 times higher for community wind, and operations-period impacts are as much as 1.8 times higher.

As the wind industry has grown, community wind has largely been a peripheral development model. However, this analysis shows that wind projects are a source of jobs and economic development, and that community wind projects have greater economic development impacts than absentee-owned projects. As such, policies that prioritize higher levels of local ownership are likely to result in increased economic development impacts. While the magnitude of increased benefit is primarily a function of local ownership and project profitability, the increased economic development impact of all community wind projects should not be undervalued. The ability of community wind projects to disperse economic impacts within the states and communities where they are built and to engage local community members in the project could provide a valuable strategy for building community support of wind power - especially in communities that are new to wind power.

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REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

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1. REPORT DATE *(DD-MM-YYYY)*
30-04-2009

2. REPORT TYPE
Conference Paper

3. DATES COVERED *(From - To)*

4. TITLE AND SUBTITLE
Economic Development Impacts of Community Wind Projects:
A Review and Empirical Evaluation; Preprint

5a. CONTRACT NUMBER
DE-AC36-08-GO28308

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)
E. Lantz and S. Tegen

5d. PROJECT NUMBER
NREL/CP-500-45555

5e. TASK NUMBER
WER9 8530

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
National Renewable Energy Laboratory
1617 Cole Blvd.
Golden, CO 80401-3393

8. PERFORMING ORGANIZATION REPORT NUMBER
NREL/CP-500-45555

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

10. SPONSOR/MONITOR'S ACRONYM(S)
NREL

11. SPONSORING/MONITORING AGENCY REPORT NUMBER

12. DISTRIBUTION AVAILABILITY STATEMENT
National Technical Information Service
U.S. Department of Commerce
5285 Port Royal Road
Springfield, VA 22161

13. SUPPLEMENTARY NOTES

14. ABSTRACT *(Maximum 200 Words)*

“Community wind” refers to a class of wind energy ownership structures. The extent of local ownership may range from a small minority share to full ownership by persons in the immediate area surrounding the wind project site. Potential project owners include local farmers, businesses, Native American tribes, universities, cooperatives, or any other local entity seeking to invest in wind energy. The opposite of community wind is an “absentee” project, in which ownership is completely removed from the state and community surrounding the facility. Thus, there is little or no ongoing direct financial benefit to state and local populations aside from salaries for local repair technicians, local property tax payments, and land lease payments.

In recent years, the community wind sector has been inhibited by manufacturers’ preference for larger turbine orders. This often puts smaller community wind developers and projects at a competitive disadvantage. However, state policies specifically supporting community wind may become a more influential market factor as turbines are now more readily available given manufacturer ramp-ups and the slow-down in the industry that has accompanied the recent economic and financial crises. This report examines existing literature to provide an overview of economic impacts resulting from community wind projects, compares results, and explains variability.

15. SUBJECT TERMS
wind energy; wind projects; community wind; economic development; absentee projects; wind energy policy

16. SECURITY CLASSIFICATION OF:

a. REPORT	b. ABSTRACT	c. THIS PAGE	17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES
Unclassified	Unclassified	Unclassified	UL	

19a. NAME OF RESPONSIBLE PERSON

19b. TELEPHONE NUMBER (*Include area code)*