COMMUNITY VS. CORPORATE WIND: DOES IT MATTER WHO DEVELOPS THE WIND IN BIG STONE COUNTY, MN?

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Outline

Part 1: Introduction

Big Stone County on the western extreme of west-central Minnesota is in many ways emblematic of the challenges facing rural America in general, and the Great Plains in particular. Aging, declining population and stagnant agricultural incomes in many cases directly threaten the sustainability of communities. Often it is the high fixed-cost rural schools and other government and community institutions that feel the pinch first.

One of the few promising opportunities in the region is the possibility of commercial development of the wind resource—and in fact, in Big Stone County, there are presently several projects in various stages of development. Wind power is currently the fastest developing segment of the electricity generation market in the United States,[1] and the Upper Great Plains, in particular, are poised to see some dramatic changes in the next few years.

Recently, a number of researchers have focused on *how* the development of wind takes place, and what consequences this has for local incomes and economic development. Wind developments can be categorized as either *corporate*- or *community-owned*. Corporate wind ownership structures generally include large-scale wind projects, often 50 megawatts (MW) in capacity or larger, that are developed, installed, and operated by non-local owners or commercial utility companies. Local participation is often limited to a minor role in construction (e.g. cement contracting) and a continuing stream of land-lease payments. Alternatively, while *community wind* structures tend to vary greatly, they are generally defined as locally-owned and operated small-scale projects of 20 MW capacities or less.[2] Compared to corporate projects, development costs in community projects generally might be spent more locally (e.g. attorney fees). The largest difference, of course, is the accrual of residuals in the form of local income.

An increasing body of empirical research indicates that *corporate* and *community* wind development structures are not equal in terms of their local economic impacts, not limited to the owners themselves. In particular, mounting evidence points to the idea that *community* wind has greater economic impacts on local economies during the operational

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[1] American Wind Energy Association (www.awea.org). The remarkable 2005 growth rate is partly a result of pent-up demand resulting from an intermittently available federal production tax credit (PTC). After lapsing in 2004, the PTC was restored in 2005, with expiration now scheduled for December 31st, 2007.

[2] Bolinger et al. (2004).

phase of the project, due to local spending multiplier effects associated with the higher income streams.

This study undertakes to: i) review the different formal structures for community wind development; ii) review the empirical studies conducted elsewhere on the economic impact of wind development in general, and (where available) on the relative economic impact of community vs. corporate wind; iii) measure the differential impact of community vs. corporate wind for the specific case of a multi-turbine development in Big Stone County.

Part 2: Review of Ownership Structures

According to the data in Bolinger et al. (2004), by the turn of the millennium community-owned wind-power development comprised 88% (5400 MW) of German and 84% (1900 MW) of Danish wind-power capacity. As the Germans and Danes together accounted for just under 50% of the *world's* installed wind power capacity at that time, the role of community wind has evidently been critical to the global development of the resource. Even today, as the wind industry matures and attracts the attention of big business, community wind continues to thrive in Germany, which is by far the world's leader in installed wind power capacity.

Thus, despite its quaint-sounding name, community wind has been responsible globally for large amounts of installed wind power capacity. In the U.S. this is true to a far more limited extent, largely due to public policy.[3] Nevertheless, there are several domestic examples of highly successful community projects, developed under a variety of business structures. Below we review some of the common ownership structures which have been employed in this development, and a give a brief overview of some of the challenges each form faces. The advantages and disadvantages turn in many cases on how well a given ownership structure exploits federal and state incentives as well as on its access to low-cost financing.

Community Wind Structure #1: Municipal Wind

Under this model, a wind project is developed and installed on public property by a municipal entity, such as a municipal utility, school district, county, or other small jurisdiction. These structures generally utilize low-cost public financing through the sale of tax-exempt municipal bonds. Power may be sold to the local utility, or it may displace other generation or import in the case of a municipal utility. In the former case, it may be possible to negotiate a higher price, inclusive of "green tags."

A major drawback of this structure is that non-profit municipal entities are unable to harvest the federal Production Tax Credit (PTC), which is the major feature of the

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[3] Kildegaard and Finzel (2006).

incentive landscape for wind power in the U.S.[4] On the other hand, the minimum required internal rate of return for a municipal project is lower than most other private equity-driven ownership structures.

Some authors have questioned whether the tax authorities will permit municipalities to engage in such entrepreneurial activities using tax-free financing.[5] However, an increasing number of jurisdictions have established Economic Development Authorities (EDAs), which have allowed access to the same sources of financing, and that have engaged in a wide variety of development efforts far removed from traditional municipal functions. Finally, at least in Minnesota, legislation in the spring of 2005 expressly authorized community based energy development (C-BED) projects undertaken by municipalities (**Minn**. Stat. § 216B.1612).

Like all models which depend upon sales to a third party, this one would benefit from tradability of PTCs, from a lucrative standard-offer utility power purchase agreement (PPA), and from clear, fair, and standard terms for interconnection.

Community Wind Structure #2: On-Site, Behind-the-Meter

In this model, a wind project is developed and installed on a large-end electricity consumer's side of the meter, in order to provide on-site power to offset energy purchased from a utility. Power that is generated on-site offsets retail kWh purchases at a 1:1 ratio, which is almost always superior to the price received in a negotiated PPA. This category includes both taxable and tax-exempt entities.

Historically, these projects have been largely the purview of tax-exempt entities, in part because the savings are effectively taxable.[6] In addition, the power consumed on-site behind the meter is not an arm's length transaction eligible for the federal PTC, nor is sale of "green tags" possible for on-site consumed power. The great advantage of

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[4] Historically, some municipal structures qualified for the Renewable Energy Production Incentive (REPI), which was a federal cash incentive program. It has not been renewed for several years.

[5] Bolinger et al. (2004).

[6] Since the reduction in the electricity bill effectively reduces a firm's cost of inputs, profits (and profit taxes) rise.

offsetting retail power purchases, rather than being paid a wholesale rate by the utility, may be diminished somewhat by utility fees for stand-by power and severance charges.

Community Wind Structure #3: Cooperatives (Co-ops)

Cooperative members invest their pooled resources into a wind project that produces energy for the purpose of personal consumption at cost, via direct purchase or through Green Tags or Tradable Renewable Certificates (TRCs). Co-ops take many forms, whether it is a consumer or producer entity, but they generally adhere to principles such as *user ownership*. Energy is either delivered to members through the cooperative as the energy service provider or via an agreement with a local utility. They usually follow *democratic rule*, such that each member has one vote, most are non-profit organizations, and most offer *patronage dividends*, members receive proportional annual dividends according to personal consumption during the year.[7]

In the U.S. electricity industry, co-ops are a common form of organization for rural electricity distribution (rural electrical co-ops, or RECs), and to a lesser extent, generation and transmission (G&Ts). For a variety of reasons these co-ops have not developed significant production for own-use, and are an unlikely candidate to do so in the future.[8]

Community Wind Structure #4: Multiple Local Investors

In this model local farmers/landowners/investors register as a limited liability corporation (LLC). Typically, such a project raises a certain amount of equity capital through sale of shares, and augments it with debt from a local bank. The power is sold on

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[7] So-called *new generation co-ops* (NGCs) reduce but don't eliminate the emphasis on democratic control and patronage, in an attempt to adapt cooperative business structures to the investment arena. See O'Brien (2005), and Stefanson et al. (2001).

[8] Kildegaard and Finzel (2006). RECs commonly sign *all-requirement contracts* with generation and transmission companies. Consistent with their conservative organizational culture and their legal requirement to supply power to their members at the lowest possible cost, RECs typically enter long-term commitments with a supplier to meet all of the co-op's power needs, in exchange for a lower cost of power and a commitment on the part of the RECs to meet minimum contractual peak demand and energy flow. Often these contracts expressly limit the RECs ability to purchase from other sources or to generate its own power. Most RECs are thus unlikely to be in a position to develop wind within the bubble of their service areas.

to the local utility via a long-term PPA, and partners receive proportional dividends according to their investment.

A multiple local owner LLC might capture the full PTC, but it would probably require a specific kind of investor. The larger the group, the more likely an investor will be considered "passive" for tax purposes, and the PTC will thus only be allocable against any passive tax liability that investors may have--for example from rental of property. Most non-farmer investors will not have passive income to offset.

This particular ownership model has been successfully employed in the cases of the *Minwind* projects in southern Minnesota, precisely by uniting local farmers as shareholders.

Community Wind Structure #5: Joint Limited Liability Company (LLC) "Flip" Structures

At least two categories of "flip" structures have been proposed, both with the purpose of exploiting the PTC incentive in ways that might not otherwise be possible. Both the "Minnesota flip" and the "Wisconsin flip" unite local investors who wouldn't on their own have tax appetite sufficient to consume the PTC, with a corporate partner that does. The ownership "flips" from the latter to the former, once the 10-year PTC period expires.

Typically, under the "Minnesota Flip" structure, local investors form an LLC and conduct pre-development work (wind monitoring, negotiating wind rights, negotiating a PPA, and local zoning and permitting). Upon completion of the pre-development work, the local investors form a partnership with a corporation with a sufficiently large tax liability to absorb the entire PTC. The local investors may contribute anywhere from 1% to 25% of the investment into the project via equity or financing, and the corporate partner contributes the remaining portion of the needed investment required to develop the project. For the first ten years of the project (after which the PTC expires), the corporate partner retains most of the ownership of the project. At the pre-established moment the ownership ratio "flips," and local investor obtains majority or complete ownership for the remainder of the life of the project.

Alternatively, as with the "Wisconsin Flip" structure, instead of local farmers/landowners/investors providing a portion of the equity, local investors pool their resources to provide a loan to the corporate investors to cover the costs and development of the project. Because of the tax treatment of debt, this loan lowers the corporate partner's minimum required internal rate of return on the capital it does invest. For the first ten years the corporate partner retains 100% of the ownership of the project and realizes 100% of the profits or losses as well as the tax benefits, and the local investors earn only the interest on the provided loan. At the end of the ten year period or after the corporate partner has exhausted all of the eligible tax-benefits, the entire structure is sold back to the local investors for a price equal to the original principal of the loan, which is in turn forgiven.

A potential stumbling block for this structure lies in the unwieldiness of a large, multiple-equity-partner LLC. There are some non-trivial diseconomies of scale to contend with, relating to legal fees and securities registration, as well as to formal communication costs within a large, registered partnership. Such administrative expenses should not be overlooked.[9]

The Minnesota flip has in practice allowed individual local investors to launch a community wind project. Typically the corporate partner plays a passive role, consuming the PTC (and in Minnesota, when applicable, the state cash production incentive as well) and as much of the revenue flow as necessary to meet its minimum required internal rate of return, but leaving the development, permitting, and operational costs to the local partner. The Wisconsin flip has not yet been implemented in practice, and may yet face some legal hurdles.[10]

Research on Viability of Different Ownership Structures

Bolinger, et al. (2004) prepared a report for the Energy Trusts of Oregon that analyzed potential options for the various types of community wind power development

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[9] Bolinger et al. estimate them at an extra $5, 000 annually in operating expenses, in addition to $10,000 in up-front additional legal fees, compared to a simpler *Minnesota flip* model, described above.

[10] The repurchase agreement may face IRS hurdles, as per Kubert (2005), and Bolinger et al. (2004). Nevertheless, this arrangement holds out intriguing possibilities, particularly in terms of exploitable depreciation allowances for the local investors.

in Oregon. The authors attributed the slow growth of community wind to the barriers that potential community wind developers in the US face, such as the inability of most individual investors to efficiently utilize tax credits, select a viable ownership structure to match their individual needs, finance projects, reap economies of scale, escape contractual constraints that limited on-site opportunities, and connect to the distribution grid. Nevertheless, the authors concluded that with the right mix of policy and the correct ownership structures there still remains a viable opportunity for domestic community wind development.

The authors develop a 20-year cash flow model in order to determine the minimum amount of $/MWh returns necessary to meet the after-tax financial requirements of both lenders and equity investors, under the various ownership structures discussed above.

The study found a wide disparity in the viability of different ownership structures, only some of which they deemed economically feasible. In particular, the structures that efficiently capture the PTC and/or qualify for capital grants were deemed most viable by this study.

Part 3: Review of Research on Economic Impact Analysis of Wind Projects

Impact Analysis

How can we measure the economic impact of a proposed wind project on the region in question? Despite grossly inflated popular estimates of, for example, how many times a given dollar of spending re-circulates in the local economy, the respectable methodology for arriving at an honest answer has been relatively un-controversial among economists for over half a century.

A dollar of new spending "injected" into a local economy does indeed have ripple effects. Spent at a local restaurant, it might generate $.15 in tip income for the waitress, and $.20 in profit for the restaurant owner. These are the clear impacts on income. The remaining $.65 will no doubt fall in some measure on "imported" inputs (e.g. on vegetables from California, or on natural gas from Canada or Louisiana), thus "leaking" out of the local spending stream. Another part of it may go to a local baker who provides the rolls—but of course this is part of his gross and not his net income. The increased demand for bread will generate some income at the bakery, as well as some increased demand for the bakery's inputs (some of which will be local and some not). Finally, the net income that is generated locally will certainly be re-circulated in the form of an increment to spending, some on local goods, and some on imports to the region.

The tool of choice for measuring the cumulative effects of these kinds of impacts is called *input-output modeling,* and it is discussed in more detail in Section 5 of this report. It consists of dividing the local economy into various industries, and tracking the pattern of their spending on inputs across other industries. For example, a $20,000 car produced by the auto industry might require $500 in purchases from the auto-glass industry, $850 from the electronics industry, $4000 in value added ("labor" and "capital" inputs), etc. Some of these industries will be "local" and some will not. The increased output required from local suppliers will in turn generate demand on their part for other inputs, some of which will be produced locally. In this way, an initial "injection" of spending "multiplies" its way through the local economy, until it has fully "leaked" onto goods produced elsewhere.

In recent years, input-output modeling has been greatly advanced by the availability of county-level data, compiled and distributed by the Minnesota IMPLAN Group. In what follows, we review some of the findings of other input-output analyses (many of which employ IMPLAN data), and we conduct our own analysis of the Big Stone County data, as provided us by Minnesota IMPLAN.

Review of Existing Studies

Grover (2002) utilized input/output analysis to estimate the local economic impact of two potential projects (comprising a combined 260 turbines and 390 MW) in Kittitas County, Washington. Like most such analyses, this one considered the economic impacts of the construction and operations phases separately.

Grover's final analysis estimated that the construction phase of the projects would stimulate 185 full and part time jobs, $10,202,000 in wages, an increase in business income of $1,391,000, and an additional $864,000 in income from "other sources."

As Table 3.1 shows, this study estimated that the operations phase would create a total of 53 additional jobs, and increase annual wages, business income, and income from other sources by $4,267,000 annually.

Table 3.1: Various Estimates of Economic Impact, per MW of Capacity Installed: Operations Phase

	Grover (2002)	Northwest Economic Associates (2003)		
	Kittitas County, WA (390MW)	Lincoln County, MN (107 MW)	Morrow &Umatilla Counties, OR (25 MW)	Culberson County, TX (30 MW)
Jobs	.14	.29	.24	.36
Wages, Business Income, and Income from Other Sources	$10,940	$14,207	$6,704	$13,253
State and Local Taxes	N/A	$4682	$9,680	$12,900

Table 3.1 also reports the results from Northwest Economic Associates (2003). This study, prepared for the National Wind Coordinating Committee, provides an input/output analysis of three existing commercial/corporate wind projects ranging from 30 MW to 107 MW structures: Lake Benton I, located in Lincoln County, Minnesota; Vansycle Ridge, located in Morrow and Umatilla counties, Oregon; and Delaware Mountain, located in Culberson County, Texas. Northwest Wind Association used Minnesota IMPLAN data and software to demonstrate the actual economic impacts that wind projects can have on their respective local economies throughout the construction and operations phases.[11]

The study found that during the construction phase of the 107 MW Lake Benton I project that began development in 1998, the wind project produced 8 jobs, and created $98,400 in personal income. Table 3.1 presents the data for the operational phase.

During the 1998 construction phase of the 25 MW Vansycle Ridge project, an estimated 4 jobs and $105,400 in personal income was created. During the 1994 construction phase of the 30 MW Delaware Mountain project**,** 26 jobs and $391,300 in personal income was created.

The study concluded that the three case studied projects stimulated only modest to moderate new local economic activity. The Lake Benton I and Culberson projects, located in the two counties in the study with the biggest decline in growth and employment had the biggest impacts. While leasing of land and additional state and local tax revenues played important role in this study, the multiplier effects on the local economy were small, as spending leakages were high. The study speculated that if these projects had been community owned versus commercially/corporately owned the local multiplier effect would have been significantly greater and more of the annually generated income would have remained in the county.

Grover (2005) conducted an input/output analysis of the potential local economic impacts of six small rural wind projects ranging from 0.75 MW to 9 MW structures on rural counties in Washington State. This is a rare example of a recent study that has explicitly attempted to analyze the consequences of community vs. corporate wind, in the operational phase of a wind project.

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[11] This same approach is used in the present study of Big Stone County. It is discussed at length below.

The report was developed as a prototype for rural wind projects in Washington State. Grays Harbor, Okanogan, Grant, Klickitat, and Columbia Counties were selected for analysis because they cover a wide geographic area and each county provided individual demographics that were representative of a standard rural community in Washington State. The study found that *during the construction phase there were no differences in local economic impact between community and commercial/corporate wind projects* with the average increases in output being $243,100 per MW, wages being $78,100 per MW, business income being $20,300 per MW, jobs being 2.7 per MW, and state and local tax revenues being $5000 per MW. *However in the operations phase or phase 2 the study found that the local economic impacts of community wind versus commercial/corporate structures fared significantly different returns*. Table 3.2 reports these estimates.

Table 3.2: Average Operational Phase Local Annual Economic Impacts in Washington State (per MW)

	(A) Corporate	(B) Community	(C) Absolute Difference (B-A)	(D) Percent Difference (C/A)*100
Output	$138,800	$161,200	$22,400	16%
Wages	$34,900	$49,500	$14,600	42%
Jobs	1.2	1.5	.3	25%
Business Income	$3,200	$4,900	$1,700	53%
State & Local Tax Revenues	$15,700	$17,000	$1,300	8%

source: Grover (2005)

Goldberg, Sinclair, and Milligan (2004) reported the results of an input-output analysis using JEDI,[12] conducted by the National Renewable Energy Laboratory (NREL)

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[12] JEDI: *Job and Economic Development Impact* model The authors describe the JEDI model as a user-friendly input-output tool that incorporates IMPLAN multipliers to analyze and provide local economic

of the local economic impacts of various wind projects on 11 counties in California, Colorado, Iowa, Minnesota, and Texas. The study assumes that the 150 MW and 40 MW projects were commercial/corporate structures, while the twenty 2 MW projects were locally financed community structures. The study found a great deal of variation in local spending results, based on state incentives, location, and ownership structures. Community wind structures generally had the greatest local economic impact, by a wide margin. In most cases the job creation estimates for the community wind projects were at least double those of the corporate wind developments. Estimates of the local annual O&M expenses were an order of magnitude larger in the community wind developments, on a per kW basis. The authors conclude:

> *The local ownership and local financing result in more dollars remaining in the local economy (i.e., more local spending and fewer monetary leakages) when compared with a project of similar size not locally owned or financed.*

Costanti (2004) conducted an NREL and Great Northern Power Development L.P. (GNPD) sponsored JEDI analysis on the local economic impact of 6 wind project sizes ranging from 5 MW to 300 MW capacities on six Montana counties: Blaine, Cascade, Glacier, McCone, Park, and Prairie. The study found that the amount of local impact depended on the size, phase, ownership structure, and the degree of intra-regional economic linkages. Job creation was found to be significantly higher when projects were locally funded. Spending effects on the local economy were also found to be very significantly higher. Across project sizes and counties, a 100% community-owned project generated approximately $135,000 in additional annual local spending per MW installed during the operational phase, while a corporate-wind project generated approximately $20,000.[13]

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impacts of the construction and operations phases of potential wind projects at varying levels of project specific information, for policy makers, renewable energy advocates, wind developers, and citizens that do not have the necessary resources to develop their own models. JEDI is free and available electronically available through the National Renewable Energy Laboratory (NREL).

[13] There is apparently no subtraction for the opportunity cost of capital in this model, though we make this correction below.

Part 4: Big Stone County

According to the Minnesota IMPLAN data, Big Stone County's 2003 population stood at 5,682. The 3,211 households held a combined total of 3,523 jobs. Average household income, including transfer payments, stood at $44,167.

According to one source, the population of Big Stone County declined from 10,477 in1940 to 6,026 in 1995.[14] According to the 2000 Census Bureau report, the population declined another 3.5 percent between 1995 and 2000. According to the same source, almost 30 percent of the county population is aged 55 or older.

Much of the out-migration is attributable to the decline in employment in the agricultural sector. In 1940 some 50 percent of the population was tied to agriculture, while in 1990 the farm population was reported as 18 percent, and the population outside of the agriculture sector remained almost constant.

The weekly average income in 1996 was reported at 43 percent below the state average of $318. The percentage of the population receiving transfer payments, in the form of welfare or unemployment climbed from 14% in 1970 to 28% (double the statewide average) in 1990.[15]

In addition to the large decline in population and employment between 1970 and 2000, according to a report released in 2003 by the state demographic center, the number of employed Big Stone County residents working outside of Big Stone County increased dramatically from 8.3 percent in 1970 to 24.9 percent in 2000. Thus, of the below average amount of employed workers a significant portion of them had to locate employment outside of their county of residence.

Table 4.1 provides an overview of the size and importance of the various economic sectors and activities. The major productive sectors are: Agriculture, Forestry and Fishing (28% of output, 20% of employment); Government (17% of output, 18% of employment); Other Services (6% of output, 17% of employment); Health and Social Services (9% of output, 11% of employment); and Construction (12% of output, 6% of employment).

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[14] Business Retention & Expansion Strategies Program (1998).

[15] ibid.

Table 4.1

Industries in Big Stone County	Industry Output	Employment	Employee Compensation	Total Value Added
Ag, Forestry, Fish & Hunting	27.98%	20.36%	22.79%	4.86%
Government	16.70%	17.58%	15.62%	53.06%
Other services	6.20%	16.84%	4.10%	11.28%
Health & social services	9.39%	10.62%	5.83%	16.89%
Retail trade	5.25%	8.46%	3.27%	13.92%
Construction	11.63%	6.67%	7.66%	20.91%
Accommodation & food services	2.77%	5.77%	1.03%	3.33%
Transportation & Warehousing	4.4%	3.64%	1.13%	7.2%

Source: IMPLAN Input-Output Table for Big Stone County, Minn. (2003)

Part 5: Economic and Empirical Analysis

The spending on construction and operation of a wind plant affects the local economy through several different channels. Construction and operations expenditures impact the economy *directly*, through the purchases of goods and services locally, and *indirectly*, as those purchases, in turn, generate purchases of intermediate goods and services from other, related sectors of the economy. In addition, the direct and indirect increases in employment and income enhance overall economy purchasing power, thereby *inducing* further spending on goods and services. This cycle continues until the spending eventually leaks out of the local economy as a result of taxes, savings, or purchases of non-locally produced goods and services.

The economic modeling framework that best captures these direct, indirect, and induced effects is called *input-output modeling*. Input-output models provide an empirical representation of the economy and its inter-sectoral relationships, enabling the user to trace out the effects (economic impacts) of a change in the demand for commodities (goods and services). We utilized a specific input-output model called IMPLAN (for IMpact Analysis for PLANning) to develop the estimates of economic impact reported below.[16]

In the case of this study, IMPLAN data was utilized to conduct an input/output analysis on county-level data from Big Stone County, Minnesota to determine the potential impact that a 10 MW project developed by various community ownership structures versus commercial or corporate structures would impose on the local economy. The numerical results will help determine how large the local economic impacts will be under corporate vs. community wind ownership structures.

Other studies (in particular Bolinger, et al. (2004)) have thoroughly analyzed ownership models for the purpose of determining viability and optimal profitability under

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[16] IMPLAN is a non-survey input/output modeling program that utilizes a national set of structural matrices borne out of state level value added data extracted from the Bureau of Economic Analysis (BEA) reports for the purpose of economic impact analysis. IMPLAN allocates estimates for state total gross outputs across counties according to each county's employment earnings, which are calculated using data from the BEA County Business Patterns Reports in order to derive national models that represent the average condition for a particular industry. For more details, see the IMPLAN user's manual, available from the Minnesota IMPLAN Group: www.implan.com

the reigning tax and incentive schemes. Our effort, below, incorporates some (not all) of this detail, but focuses rather on the relative economic impacts of these structures for the community, as opposed to the more narrow question of profitability for investors.

Findings:

In the first scenario, we analyze a 10.5 MW project,[17] consisting of 5 Suzlon S88 2.1 MW turbines. We assume that the project is fully financed by local equity. Table 5.1 reports our assumptions regarding upfront costs, as provided to us by local wind developers and as derived from the default parameters in the JEDI model:

Table 5.1: Upfront Costs of a 10 Turbine Development

Turbines & Towers (5 Suzlon S88 2.1 mW)	10,250,000
Total Installation Cost	2,500,000
Interconnection	
High Voltage Line Extension	50,000
Meters	30,000
Interconnection	75,000
Interconnection Studies	50,000
Professional Services	
Qualified Wind Developer	500,000
Legal	100,000
Permitting	10,500
Engineering	100,000
Extended Warranty	112,500
Total	**13,778,000**

Table 5.2 presents the estimates used for annual operating expenses:

Table 5.2: Annual O&M Costs

Wind turbine manufacturer service	100,000
Third party service	65,000
Property Insurance	37,500
Liability Insurance	25,000
Land Lease/Easement	25,000
Electricity	5,000
Repair Account	100,000
Professional Services	35,000
Administrative	10,000
Information Services (tel, internet)	7,500
Management Fee	30,000
Total	**440,000**

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[17] A development of this size is likely to be feasible without the construction of an electrical substation.

For present purposes, we assume that the power is sold via a PPA to the local utility at a price of $33.60/MWh (inclusive of the green tags), that the entire PTC ($19/MWh) is captured by the equity holders, and that the overall project achieves 40% efficiency (i.e. actual energy generated as a fraction of nameplate capacity). Thus the 36,790 MWhs generated annually yield gross revenues of $1,802,710, and net revenues (after expenses including land leases and the production tax) of $1,362,710. Assuming a 5% opportunity cost of capital,[18] an annual "payment" of $688,900 must be subtracted from this figure, yielding a direct income impact of $673,810 for the project as a whole. For economic impact analysis which captures local spending multipliers, both the direct increment to income and the (allocated) $440,000 in annual expenses must be entered into the model.

A simple alternative scenario is to assume that a corporate developer leases land locally, capitalizes the project remotely, and retains the residuals. The consequences for the local economy include simply the expenses of the project, inclusive of land leases. Unlike several of the studies reviewed above, here we assume that these expenditures—and their allocation in the local economy—are identical to those modeled in the community wind scenario. Table 5.3 presents comparative results for these two scenarios, including an alternative discount rate for the community wind case.

Table 5.3: Economic Impact of Local vs. Corporate Ownership (operations phase)

Scenario	Annual Direct, Indirect, and Induced Effect on Value Added	Annual County-Wide Employment Impact
Community Wind (5% opportunity cost of capital)	$1,259,188	14.5
Community Wind (8% opportunity cost of capital)	$639,739	8.2
Corporate Wind	$249,388	4.3

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[18] If the locally supplied capital were invested elsewhere, an alternative revenue stream would be generated. We calculate the payment as a straight 5% of the original investment, assuming that straight-line depreciation recuperates the initial investment over the project's lifespan.

The direct effect on value added, in the first scenario, is the $673,000 in "excess" income (compared to an alternative investment) plus the $25,000 in land leases. By the time these income streams—combined with the annual input expenditures outlined above—have leaked out of the local spending stream, they will have generated nearly another half million dollars in local value added, and some 14.5 full-time jobs. If investors consider this project risky enough to require an 8% return (e.g. if they face a project with comparable risk that yields 8%) then the net effect on value added decreases by about 49% (from $1.25M to $639K), and the effect on job creation falls by about 43% (from 14.5 to 8.2 jobs in the county).

In the corporate wind scenario, the direct effect is reduced to the $25,000 paid for land leases. Together with the annual expenses of the project (some of which fall on local goods and services), this economic stimulus raises county-wide value added by $249,388. This amounts to just 20% of the value added impact of the first scenario (@5% discount rate) and 39% of the value added impact of the second scenario (@8% discount rate). The county-wide job creation effect is 4.3 jobs, which is 29% of the impact of the first scenario, and 52% of the impact of the second scenario. While we do not estimate them formally, we expect county property tax collections would be slightly higher under the community wind scenario.[19]

The estimate is only as good as the assumptions underlying the scenario, of course. On the one hand, unlike several previous studies, we have been generous to the corporate wind scenario by assuming local purchase coefficients equal to those of the community wind scenario. Other researchers, as outlined above, have estimated that such differences can lead local labor income impacts of community wind to exceed those of corporate wind by 42%. On the other hand, to the extent that we overestimate turbine efficiency or the price specified in the PPA, or to the extent that we underestimate the opportunity cost of capital or the operational phase costs of the project, we will have overestimated the absolute and the relative economic impact of the community wind scenario. To the extent that we underestimate turbine efficiency or the PPA price, or to the extend that we overestimate the cost of capital or the annual operations and

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[19] Improvements to property consisting of the wind development itself should be equal in the two cases. Any difference would arise from the increase property values stemming from the job creation and increased economic activity associated with the community wind scenario.

maintenance costs of the project, we will have underestimated the absolute and the relative economic impact of the community wind scenario.

It should also be noted that scalability of costs is not a straightforward matter. If the relevant project were a 100 MW development, site-specific estimates of substation development costs and other transmission issues would be necessary. Nor do the permitting, licensing, or administrative costs scale in a linear fashion.

Note that we only analyze the simplest capital structures, and we do not consider the possibilities of grants, additional state-level incentives, retention of green tags, or other dimensions that could come into play. For the most part, incorporating variation along these lines changes the final numbers in predictable ways.

One possible exception to this is the case of a more complex capital structure, involving, for example, an ownership "flip" (as discussed in Part 2 above). In this case, the PTC is essentially sold to an outside investor, effectively at a discount. The net effect is thus a smaller local stimulus than if the PTC is entirely consumed by the original investors, and yet a larger stimulus than that reflected in the corporate ownership model, since the non-PTC part of the revenue stream is still locally captured. This scenario might also skew the major effects on local income toward the time period beginning 10 years out, when full ownership flips from the corporate partner to the local residents.

A municipal-ownership model most likely has a somewhat smaller economic impact than our baseline case of full local equity financing. The greatest difference is the lack of ability to exploit the PTC (@ roughly $.019/kWh, which amounts to 38% of the revenue stream). Factors weighing in the opposite direction include the potential sale of green tags, and the ability to finance the investment at the municipal bond rate. While the price of green tags is quite low (for the most part under $.005) in most locales at present, the future price is enormously uncertain, and will be determined largely by the advance of renewable portfolio standards legislation at the state level, as well as by future regulation of carbon emissions. The ability to finance at municipal bond rates could be a great advantage: each 1% reduction in interest costs raises the annual savings to the project by $330,000, which effect in turn is magnified through the spending multiplier. At current rates, however the 5% used above as an "opportunity cost" in the full local equity scenario is probably a reasonable estimate of the cost of municipal financing, as well.

Part 6: Conclusion

In this study we have reviewed the ownership models for community wind development, conducted a literature review of economic studies of local economic impacts of wind developments generally, and conducted an empirical analysis of the differential economic impact of a potential corporate vs. a potential community wind development in Big Stone County, Minnesota.

We have relied on local wind developers and data from the NREL's JEDI model for cost estimates and some questions of methodology. We have employed county-level input-output data from the Minnesota IMPLAN group, including regional purchase coefficients. We used the IMPLAN software to run the input-output model, in order to generate the estimates reported above.

Our simple scenario analysis for a 10.5 MW project suggests that community wind has 5 times the economic impact on local value added, and 3.4 times the impact on local job creation, relative to a corporate-owned development. These numbers should probably be considered an upper bound on the differential impacts, since most projects in practice will involve an outside-the-region equity partner, or at the very least a discounted sale of the PTC.

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Appendix: Additional Literature Review

The Ernest Orlando Lawrence Berkeley National Laboratory conducted an analysis on the impact of existing and proposed state and federal incentives of developing small residential grid-connected community wind projects and compiled a report entitled *Evaluating State Markets for Residential Wind Systems: Results from an Economic and Policy Analysis Tools* in December 2004. The Berkeley Lab designed a Small Wind Analysis Tool (SWAT) to analyze the effectiveness of current state incentive structures across the US.

The Berkeley Lab SWAT is a spreadsheet-based cash-flow model that calculates the customer economics of residential, grid-connected wind systems in each U.S. state for different wind resource regimes. The primary purpose of the model is to analyze the effects of existing state incentives on the economics of small wind systems. In addition, SWAT can incorporate potential future federal income tax incentives and federal grant or rebate programs, as well as possible new state-level incentives. The tool is specifically designed to help policymakers choose combinations of incentives that will effectively spur the market for residential, grid-connected wind systems. (Edwards, Wiser, & Bolinger, 7, 1, 2004)

Swat uses the following three classifications of wind resources for each state; Break-Even Turnkey Cost (BTC), Simple Payback (SP) and Levelized Cost of Energy (LCOE). "The metrics of BTC, SP, and LCOE provide different approaches to quantifying the economics of customer-owned small wind systems." (Edwards, Wiser, & Bolinger, 7, 3, 2004) With the BTC being the rate of return necessary for a wind project to reach the break even point[20] on the investment, the SP being the number of years that it takes an investor to receive the amount of cash payments necessary to cover the costs of the wind project with assuming a zero discount on future revenue and payments,[21] and finally, the LCOE assumes a cash purchase of the turbine and a real discount rate of 5.5%, and is the incremental cost of generating a kWh of electricity over the project's lifetime. "SWAT calculates the BTC, the SP period, or the LCOE of small, residential wind systems. These outputs are generated for a given state, wind resource class, and installed system cost (the latter being applicable only to SP and LCOE)." (Edwards, Wiser, & Bolinger, 7, 2, 2004)

The study found that New York is the only state that provides a BTC for a project as small as 10 kW in a Class 3 wind resource regime; California, New Jersey, Vermont, Rhode Island, Hawaii, and Montana all provide BTCs that meet about half of the BTC burden. However, if Class 4 wind resources were available, then Maine, Illinois, Connecticut, Alaska, Tennessee, New Hampshire, Massachusetts, and Delaware would provide BTCs that met half of the BTC burden. The study also found that under existing policy nine states offer system paybacks less than 25 years at an installed cost of $4/Watt and 21 additional states at an installed cost of $2.50/Watt.

Researchers in the study concluded that economic activities generated by small wind projects vary greatly by state and wind resource class, and that viable markets for smaller wind projects are limited to states that have high electricity rates or that have

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[20] The break even point is the point at which total costs equal generated revenues

[21] Assuming the zero discount on future revenues and payments ignores the time-value of money

strong policy incentives. Thus, in order to stimulate and expand small thriving community wind development, cost reductions and strong federal and state support are essential. Researchers found that although cash incentive programs have the greatest impact on the small community wind market, there are also numerous other policy incentives that can foster a viable environment for the growth of community wind. Expansion of programs such as; property tax payments, state ITCs, low-interest loan programs, net metering, and USDA grant could create a more attractive community wind market for investors.