A Bureau of Business Research Report
From the University of Nebraska—Lincoln

Final Report

The Economic and Tax Revenue Impact of the Nebraska Wind Energy Industry

Prepared for the Nebraska Power Association

December 30, 2014

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Executive Summary

This study by the University of Nebraska-Lincoln Bureau of Business Research (UNL-BBR) explores the economic impact from the construction and operation of wind farms in Nebraska, focusing on those farms with 10 or more wind turbines. The study estimates: 1) the statewide economic and tax revenue impact of the Nebraska wind industry as it is currently configured, 2) the local economic and tax revenue impact of the existing industry in the counties where it operates and 3) the potential statewide economic impact from expansion of the industry through the addition of new wind farms.

Table ES.1 summarizes the impacts. Operation of existing wind farms supports an estimated 137 statewide jobs annually with $8 million in wages and salaries, $21 million in output and $6 million in tax revenues. A significant share of these state impacts occur outside of the county or counties where the wind farms are located.

Table ES.1: Economic Impact from Existing Nebraska Wind Farm Industry (Millions of 2014 Dollars)

EXISTING WIND FARMS				
	Jobs	Wage and Salary Earnings	Output	Tax Revenue
Annual Operations				
Statewide Impact	137	$8.0	$21.2	$6.0
Local Impact	91	$4.7	$8.7	$5.1
Construction Period				
Statewide Impact	949	$54.1	$131.8	$72.3
Local Impact	383	$18.7	$42.7	$0.3
PROPOSED WIND FARMS				
	Jobs	Wage and Salary Earnings	Output	Tax Revenue
Annual Operations	88	$5.0	$14.0	$3.7
Construction Period	636	$36.0	$90.7	$1.9

Construction of existing wind farms began in 2003 and currently includes 10 wind farms, each with 10 or more turbines. Construction of these 10 farms generated almost 950 job-years statewide, with $54 million in wage and salary earnings, $132 million in output and generated $72 million in taxes. Local economic impacts were smaller.

Construction of proposed wind farms may create 636 job-years, $36 million in wages and salaries, $91 million in output and $1.9 million in tax revenues. Annual operations would produce smaller gains.[1]

Economic impacts include both direct and total economic impact during construction and from operation. The direct economic impact during the construction period includes in-state employment and business activity from building wind farm facilities. The direct economic impact during operations include the annual wages and salaries, materials or service costs, fees, lease payments, tax payments and other costs incurred by wind farm operators. The total economic impact reflects the direct impact and also the multiplier impact on the Nebraska economy. The study also considers the tax revenue impact associated with wind farm construction and operation. The tax revenue impact includes the local taxes paid on wind tower capacity as well as relevant state and local income, sales and property taxes.

Estimates of future construction reflect a growth scenario based on wind capacity that will allow Nebraska utilities to meet (and partially exceed) stated goals for renewable energy use and meet additional demand for 80 MW of capacity from industrial customers who wish to utilize wind power as part of corporate goals.

All economic impact estimates represent increases in the Nebraska economy due to development and operation of wind power generation within the State of Nebraska. Utilities based in Nebraska have a wide variety of choices about where to obtain that power. In particular, utilities can purchase wind power generated in other states. The economic impact estimates reported in this study show the gains to the Nebraska economy from building and operating wind farms in the state versus the alternative of purchasing wind power generated in other states.

[1] For proposed wind farms, these results take account of sales and use tax refunds available under the Nebraska Advantage Act.

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I. Introduction

Wind power is an important part of the growing renewable energy industry, particularly in the northern Great Plains region. Wind power benefits from underlying climate conditions in this region and has grown substantially in Nebraska and nearby states. As such, the wind power industry has been an asset for utilities seeking to expand their renewable power portfolio, and more generally, diversify generation capacity. Individual industrial customers sometimes also demand wind power to meet their own corporate goals for renewable energy use.

Construction and operation of wind farms to meet this demand has generated local and state economic impacts, given business opportunities present in designing, building, and operating wind farms. It has also provided state and local tax revenue impacts. Development of new wind farms will generate additional economic impacts and tax revenues.

The following study from the University of Nebraska-Lincoln Bureau of Business Research (UNL-BBR) documents the economic and tax revenue impacts from the Nebraska wind energy industry. Analysis focuses on the economic impact of Nebraska's ten existing wind farms with 10 or more turbines. The study estimates: 1) the statewide economic and tax revenue impact of the Nebraska wind industry as it is currently configured, 2) the local economic and tax revenue impact of the existing industry in the counties where it operates and 3) the potential statewide economic impact from expansion of the industry through the addition of new wind farms. The expansion scenarios include additional capacity that Nebraska utilities would require in order to meet their renewable portfolio goals or capacity individual industrial businesses in Nebraska might request in order to meet corporate goals. The UNL-BBR research team worked with personnel from the Nebraska Power Association and NPPD to develop a specific scenario regarding which tax credit eligible wind farm projects in Nebraska are most likely to be built.

It is important to note that utilities have significant options for obtaining wind power; they can either develop wind farms in Nebraska or purchase wind power generated in other states. Results of the economic impact estimates represent increases in the Nebraska economy due to development and operation of wind power generation within the State of Nebraska.

Impact estimates are developed for both the initial construction and consequent operation of wind farms and include both the direct and total economic impact of the wind power industry. The direct economic impact during the construction period includes in-state employment and

business activity from building wind farm facilities. The direct economic impact during operation includes the annual wages and salaries, materials or service costs, fees, lease payments, tax payments and other costs of wind farm operators. Beyond the direct economic impact, the study also considers the additional indirect and induced economics impacts (jointly referred to as the multiplier impact) resulting from wind farm projects. These multiplier impacts are calculated utilizing economic multipliers for the State of Nebraska developed through the IMPLAN model. The total economic impact is the sum of the direct and multiplier impact.

The study also considers the tax revenue impact associated with wind farm development. The tax revenue impact includes the local taxes paid on wind tower capacity. Further, the state and local tax revenue impact reflects additional revenues generated due to the economic impact of the wind farm industry. For example, state income taxes will be generated on the wages earned as a result of building and operating wind farms. State and local sales and property taxes will be paid since workers will spend a portion of those wages on items subject to the sales tax at stores and other buildings which are subject to the property tax, or on homes and rental properties which are subject to the property tax.

Overall the study will generate economic impact estimates for the Nebraska wind energy industry during the construction period and during an annual operating year. Impact estimates will be generated for the existing wind energy industry at the state and local level and for the most likely new wind energy projects in the next few years. Impact estimates will be generated for four key concepts: 1) output, 2) labor income, 3) employment and 4) tax revenue.

The next section of this report describes the two models which are used in the analysis, the JEDI model and the IMPLAN model. Section III describes the wind farm characteristics and data which are used in the report and the sources for that information. Section IV presents results on the statewide economic impact of the existing Nebraska wind energy industry. This includes a discussion of building new generation facilities in Nebraska versus buying into wind projects in other states. Section V presents results for the local economic impact of the existing Nebraska wind energy industry. Section VI presents results for the anticipated expansion of the industry. Section VII is a conclusion.

II. Economic Multipliers Analysis and the JEDI-W Wind Model

Economic impact modeling relies on economic multiplier analysis to assess the impact that business activity, such as the development of a wind farm, has on a state or local economy. Economic activity is typically assessed in three categories: the direct economic impact, the indirect economic impact, and the induced economic impact. The direct economic impact reflects the initial expenditure, payroll and employment from the relevant geographic region associated with the project. In the case of wind farm construction, the direct economic impact on the State of Nebraska economy would refer to wind turbine components, if any, purchased from Nebraska-based manufacturers, other building materials such as cement which are purchased from Nebraska businesses, and Nebraska-based construction crews involved in site preparation and installing wind turbines at the wind farm site. In the case of wind farm operations, the direct economic impact includes lease payments to Nebraska-based landowners, taxes and fees, purchases of vehicles, fuel, professional services, supplies and parts from Nebraska-based businesses, and Nebraska workers employed at the wind farm site. These are the direct statewide economic impacts. The local economic impacts would refer to activity by county-based businesses in construction or operation of a wind farm.

The indirect economic impact refers to the additional economic activity which occurs when wind farm operators, or firms involved in wind farm construction, purchase goods and services from other Nebraska-based firms. The induced impact refers to household purchases made by employees of wind farm operators or Nebraska-based firms involved in wind farm construction. Workers who reside in the state will spend their paychecks on a full range of household purchases, supporting businesses throughout the state economy. The indirect and induced impacts taken together are known as the multiplier impact, which includes all of the additional economic activity which occurs in the Nebraska economy as a result of the direct economic impact. The total economic impact, therefore, is simply the sum of the direct economic impact and the multiplier impact.

The Jobs and Economic Development Impacts Wind (JEDI-W) model developed by the National Renewal Energy Lab is used to conduct economic impact analysis. At the state level JEDI-W provides: 1) detailed input and labor costs for building a wind farm and operating a wind farm for one year 2) estimates of the share of this spending captured by a state's businesses and workers (i.e., direct impact), and 3) embedded economic multipliers which can be used to

estimate the multiplier impacts for that state. The sum of the multiplier impact and the direct impact is the total economic impact on a state economy. Economic multipliers utilized in the JEDI-W model are developed using the IMPLAN model, a software and data package which can be used to calculate economic multipliers for hundreds of industries for every state, county and combination of state and counties in the United States. IMPLAN data regarding local economies also can be input into JEDI-W model to calculate economic impact in the county or counties in which a wind farm is located.

Given the important role of IMPLAN data and concepts in the operation of the JEDI-W model, we utilize a combination of the JEDI-W model and IMPLAN to calculate the economic impact of Nebraska wind farms to the state economy, and in the local economies where wind farms are located. For statewide analysis, we utilize the JEDI-W model estimates of the direct economic impact of individual Nebraska wind farms for the State of Nebraska. We also utilize JEDI-W to estimate the multiplier impact and the total economic impact; however we also conduct our own multiplier analysis using IMPLAN for one wind farm in order to check the multiplier estimates from JEDI-W.[2] For local analysis, we modify the JEDI-W model estimates of the direct economic impact to reflect that some of the Nebraska-based materials, construction firms, and repair firms used to build and operate wind farms may come from outside of the local area (i.e., from a different Nebraska county). We also calculate local economic multipliers using the IMPLAN model and data for the county or counties in which each wind farm is located.

As noted above, economic impact estimates are developed for two time periods. Construction period impacts accrue during the months when construction occurs. Operating impacts occur on an annual basis during operation. Construction period results are inherently short term. Operations period results are long term, for the life of the project, and are reported as annual values which continue to occur throughout the operating life of the facility. While annual operating impacts are generally smaller than construction period impacts, operating impacts are the best measure of the long-term economic impact of wind farms.

As a way to check the model estimates, we were able to obtain actual employment figures for two wind farms constructed in Nebraska and operating employment data from four operators.

[2] Our analysis of the statewide economic impact of the Steels Flats wind farm using our own multiplier calculations based on the IMPLAN model lead to impact estimates that were somewhat lower than those from the JEDI-W model. Generally speaking both construction period and annual operations impacts were approximately 80% of those estimated via the JEDI-W model.

Their data suggest that the JEDI-W model over-estimates state-level employment during construction by a factor of four. In contrast, the model produces reasonable state employment figures for operation. Consequently, the model employment figures were adjusted downward to one-fourth the model estimates. This has ramifications for wage, output and tax figures as well that were carried through our calculations.

Construction Period Impacts

There are two components of wind farm construction costs: labor and materials. Labor costs includes wages and salaries for people working to develop the project such as environmental technicians and lawyers, and people who construct the project such as road builders, construction companies, tower erection crews, crane operators, and concrete pourers. According to the developers of the JEDI-W model, labor costs can be divided into two subcategories:

- Construction and Interconnection Labor, including: Foundation, Erection, Electrical, Management/Supervision, and HV Sub/Interconnection Labor fields.
- Construction related services: These jobs are calculated based on cost and local share information entered in the Engineering and Legal Services fields in the JEDI-W model.

Material costs include components such as towers, turbines and the blades, materials for site development such as concrete and smaller parts used in construction such as wiring and transformers. There also would be incidental purchases for operating a construction site. The construction project also would include development costs such as such as land easements and costs for site certificate/permitting.

Operating Period Impacts

Labor and materials also are the two components of the annual cost of operating a wind farm. Labor includes managers, office workers, and field technicians to monitor and maintain wind turbines.

Material costs include goods and services such as vehicles, fees, permits, licenses, utilities, insurance, fuel, tools or equipment used in operation, replacement parts and equipment and the inventory. The JEDI-W model contains estimates of the annual cost for each of these types of equipment and services based on the number of turbines located at each site.

Operations also include two other types of key costs: land leases and property tax payments. These costs must be paid on an annual basis.

JEDI-W Default Data and Multipliers

In developing the JEDI-W model, the National Renewable Energy Laboratory determined appropriate default values for use based on interviews. Model developers estimated values for:

- Construction Costs (materials and labor)
- Equipment Costs (components)
- Annual Operating and Maintenance Costs (personnel, materials and services)
- Other Parameters (land lease, property taxes)
- Other Costs (engineering)

Many wind farm developers are hesitant to discuss this information given that it is proprietary in nature. Indeed, the UNL research team was only able to gather aggregate information such as total construction employment from Nebraska wind farm developers. Developers of the JEDI-W were able to develop average costs and spending patterns based on information gathered from multiple sources, personal communications and anecdotal evidence based on ten years of research and analysis of wind farms. Some of the default values of the JEDI-W model, which were incorporated into this analysis, include:

- Construction costs of $1,940 per kW of capacity, three-fourths of which are in equipment costs (turbines, blades, towers and transportation).
- Operating and maintenance costs of $20 per kW of capacity.

Economic multipliers contained within the model are derived using the IMPLAN accounting software.

Caveats

The JEDI-W model has certain caveats to consider. Developers of the JEDI-W model list the following caveats:

- Potential increases or decreases in electricity rates or fuel prices resulting from investments in new electricity or fuel infrastructure.
- Local economic development losses associated with the possible displacement of other local energy sources.

- The displacement of some other type of economic activity due to investment in this particular project.
- Potential price changes due to demand for local factors.
- Other intangible effects, such as changes in transmission or grid reliability, changes in land use, and stability of electricity prices that might result from the reduced fuel price risk of renewable sources of electricity.

These caveats in most cases apply to the current study. However, the second and third caveats may be a lessor concern. This is because utilities and companies which demand wind power have a wide variety of choices about where to obtain that power. Utilities can and frequently do purchase wind power generated in other states, in many cases states located at a great distance. The alternative to generating wind power within Nebraska, therefore, should be understood to be purchasing wind power generated in other states, rather than to generating power from Nebraska-based power plants using fossil fuels or other energy sources.

III. Wind Farm Data

Table 1 below shows information related to wind farms either constructed or currently under construction in Nebraska. Information includes the project name and location, date commissioned, the number of turbines, total capacity (in megawatts) and the megawatts per turbine. The information presented in Table 1 is based on a description of wind power projects maintained by the Nebraska Energy Office (http://www.neo.ne.gov/statshtml/89.htm). The largest wind farm is Prairie Breeze with 118 turbines and 200 MW of capacity. The smallest are Crofton Bluff and Petersburg, each with just over 40 MW of capacity. Most wind farms have a MW/turbine in the range of 1.5 to 1.7. However, Crofton Bluff and Elkhorn Ridge have turbines rated at 3.0 MW. Across all wind farms, there are 453 turbines and 794 MWs of generating capacity.

Table 1: Existing Wind Farm Data

Project Name	Location	Date Commissioned	Turbines	Capacity (MW)	MW / Turbine
Ainsworth	Ainsworth	10/1/2005	36	59	1.7
Broken Bow I	Custer County	12/1/2012	50	80	1.6
Broken Bow II	Broken Bow	12/1/2014	43	75	1.7
Crofton Bluff	Crofton	11/1/2012	14	42	3.0
Elkhorn Ridge	Bloomfield	3/1/2009	27	81	3.0
Flat Water	Humboldt	11/1/2010	40	60	1.5
Laredo Ridge	Boone County	11/1/2010	54	81	1.5
Petersburg	Petersburg	11/30/2011	27	41	1.5
Prairie Breeze	Antelope, Boone, Madison Counties	5/1/2014	118	200	1.7
Steele Flats	Steele City and Odell	11/1/2013	44	75	1.7
Total			453	794	

Source: Nebraska Energy Office

Table 2 below shows information related to proposed wind farms in Nebraska. There are two specific farms proposed, one for Verdigre in 2015 and one for O'Neill in 2016. There may be additional demand for wind farms if particular industrial customers ask for a wind power portfolio as part of their company's corporate strategy. We assume that one 80 MW facility will be built for this purpose at some future date. For sake of our analysis, we assume that the plant will be commissioned 1/1/2020. The three proposed farms will have a total of 336 turbines capable of generating 562 MWs of energy.

Table 2: Proposed Wind Farm Data

Project Name	Location	Date Commissioned	Turbines	Capacity (MW)	MW / Turbine
Grand Prairie	O'Neill	1/1/2016	235	400	1.7
Verdigre	Verdigre	6/1/2015	47	82	1.7
To Be Named	To Be Named	1/1/2020	54	80	1.5
Total			336	562	

IV. Statewide Economic Impact of Existing Wind Industry

The statewide economic impact of Nebraska's existing wind farms with 10 or more turbines is estimated below. The impact is shown for each of these 10 existing wind farms as well as the overall total. The economic impact during the construction period is presented first. The annual economic impact during operations is presented second while the tax revenue impact during both the construction and operations phase is presented last.

Construction Period Impacts

Table 3 below shows impacts from construction of the existing wind farms in Nebraska. Column (1) shows the number of full-time equivalent jobs created in the year of construction – 949 in total. If projects take two years to complete, there would have been only 475 full-time equivalent jobs created annually. Thus, the projects created 949 job-years.

Table 3: Construction Impacts from Existing Wind Farms (Millions of 2014 Dollars)

Name	(1) Jobs	(2) Wage and Salary Earnings	(3) Output
Ainsworth	73	$4.2	$10.0
Broken Bow I	96	$5.4	$13.3
Broken Box II	90	$5.2	$12.5
Crofton Bluff	55	$3.2	$7.3
Elkhorn Ridge	97	$5.5	$13.4
Flat Water	74	$4.2	$10.1
Laredo Ridge	97	$5.5	$13.4
Petersburg	54	$3.1	$7.2
Prairie Breeze	224	$12.7	$32.1
Steele Flats	90	$5.2	$12.5
Total	949	$54.1	$131.8

Column (2) of Table 3 shows wage and salary earnings in millions of year 2014 equivalent dollars. These 10 projects generated over $54 million in wage and salary income in 2014 dollars. Column (3) shows millions of year 2014 dollars in output generated by the construction of each wind farm. These 10 projects together generated almost $132 million in output.

Operating Period Impacts

Table 4 below shows the impacts from operation of the existing wind farms in Nebraska. Column (1) shows the number of full-time equivalent jobs created via operation – 137 each year. Column (2) shows that these 10 projects generate about $8.0 million annually in wage and salary income due to operation. Column (3) shows output in millions of year 2014 equivalent dollars. These 10 projects generate about $21.2 million annually in output due to operation.

Table 4: Operating Impacts from Existing Wind Farms (Millions of 2014 Dollars)

Name	(1) Jobs	(2) Wage and Salary Earnings	(3) Output
Ainsworth	11	$0.63	$1.64
Broken Bow I	14	$0.81	$2.13
Broken Box II	13	$0.77	$2.02
Crofton Bluff	8	$0.50	$1.23
Elkhorn Ridge	14	$0.82	$2.16
Flat Water	11	$0.64	$1.66
Laredo Ridge	14	$0.82	$2.16
Petersburg	8	$0.49	$1.21
Prairie Breeze	31	$1.78	$4.98
Steele Flats	13	$0.77	$2.02
Total	137	$8.01	$21.21

Nebraska electric utilities maintain the option to purchase wind power from both in-state and out-of-state sources. A purchase from either source would yield the environmental benefits stemming from wind power. The economic consequences, however, might differ. A purchase from an out-of-state source would not generate an economic impact from building and operating a wind farm within the state of Nebraska, of the kinds reported in Tables 3 and 4. However, there could still be an economic benefit if wind power was purchased at a lower rate from an out-of-state supplier. This is because the utility savings for residential, commercial and industrial

customers would spur economic growth on the margin. Savings for residential customers also would free up household income for other purchases in the local economy.

Lincoln Electric System signed an agreement in 2013 to purchase power from a wind farm to be built in the State of Oklahoma, the Arbuckle Mountain Wind Farm. This wind farm would have a nameplate capacity of 100 megawatts and LES would purchase all of the power generated. This example provides an opportunity to consider the alternative economic impacts from purchasing wind power from an in-state versus out-of-state source. A purchase from an out-of-state source, naturally, only yields an economic benefit for Nebraska if the power is lower cost. This was the case for LES, which provided the research team with the estimate that the agreement with Arbuckle Mountain Wind Farm would save LES customers $50 million in utility costs cumulatively over twenty years relative to the lowest cost proposal for a wind farm built in Nebraska.

As noted earlier, this savings would generate both marginal economic growth and enhance the purchasing power of residential customers. The research team utilized a REMI model for the State of Nebraska in order to estimate these economic impacts. The UNL Bureau of Business Research purchased and operates a REMI model for Nebraska. The model, developed by Regional Economic Models, Inc., is a flexible model of the economy which captures how changes in prices influence the economic competitiveness of firms, import and export activity, household migration, and consumer spending. The IMPLAN model, utilized in other parts of this report, does not have this capability.

The research team assumed customer savings in the amount of $2.5 million for each of the next 20 years and allocated lower relative prices (relative to provision from an in-state wind farm) to residential, commercial and industrial customers according to each group's current share of LES electricity consumption. Table 5 shows the average annual impact on the Nebraska economy due to the annual savings on electricity costs. Most of these economic impacts would occur within the local economy of the Lincoln Metropolitan Area. Column (1) shows the number of full-time equivalent jobs created – 8 each year. Column (2) shows an average annual personal income impact of $0.7 million in the Nebraska economy. The REMI model reports increases in personal income rather than employee compensation. Column (3) indicates an average annual output impact of $1.8 million on Nebraska over the 2014-2033 period.

Table 5: Economic Impacts from Customer Savings
Average Annual Impact 2014-2033

(Millions of Nominal Dollars)

Name	(1) Jobs	(2) Personal Income	(3) Output
Customer Savings	8	$0.7	$1.8

These impacts can be compared with those in Tables 3 and 4. While these tables do not contain any projects with precisely 100 MW of capacity, there are quite a few projects (Broken Bow I, Elkhorn Ridge and Laredo Ridge) which have capacity at or near 80 MW. The annual employment impact from customer savings reported in Table 5 is about 60 percent as large as the estimated annual employment impact of operating these wind farms and the output impact is about 80 percent as large. For example, the estimated annual employment impact for operating the Broken Bow 1, Elkhorn Ridge and Laredo Ridge wind farms is 14 jobs. There is also no construction period impact for the Nebraska economy when purchasing wind power from another state.

These comparisons suggest that economic impacts for Nebraska from purchasing power from an out-of-state source have significant impacts for the Nebraska economy as well as save customers money, relative to a wind farm built within the state. The key issue is the amount of savings for Nebraska electric power customers. There were substantial savings in the example from LES, and also significant economic impacts, although somewhat lower impacts then expected for a wind farm built within the state. The relative benefits of the two approaches must be considered on a case by case basis depending on the amount of customer savings which are available.

Tax Revenue Impacts

Table 6 below shows the annual tax impact from existing wind farms in thousands of 2014 dollars. Column (1) shows that during initial construction, over $69 million was collected by the state in sales taxes on materials used in construction.[3] Income and sales taxes on wage and salary earnings derived from construction add almost $3 million in tax revenues.[4]

Table 6: Tax Impacts from Existing Wind Farms (Thousands of 2014 Dollars)

Name	(1) Sales Tax on Initial Construction Materials	(2) Income Tax on Initial Construction Earnings	(3) Sales Tax on Initial Construction Earnings	(4) Annual Property Tax on Real Property Base	(5) Annual Turbine Tax	(6) Annual Income Tax on Land Lease Payment	(7) Annual Sales Tax on O&M Materials	(8) Annual Income Tax on O&M Earnings	(9) Annual Sales Tax on O&M Earnings
Ainsworth	$5,110	$113	$116	$195	$208	$5	$35	$17	$18
Broken Bow I	$6,988	$147	$151	$224	$279	$7	$49	$22	$22
Broken Bow II	$6,538	$139	$143	$203	$262	$6	$46	$21	$21
Crofton Bluff	$3,585	$86	$88	$115	$147	$2	$23	$13	$14
Elkhorn Ridge	$7,078	$148	$152	$238	$284	$4	$50	$22	$23
Flat Water	$5,200	$114	$117	$175	$209	$6	$36	$17	$18
Laredo Ridge	$7,078	$148	$152	$238	$283	$7	$50	$22	$23
Petersburg	$3,496	$84	$86	$116	$141	$4	$23	$13	$13
Prairie Breeze	$17,704	$342	$351	$549	$699	$16	$132	$48	$49
Steele Flats	$6,538	$139	$143	$206	$261	$6	$46	$21	$21
Total	$69,314	$1,460	$1,499	$2,260	$2,774	$63	$491	$216	$222

Columns (4) and (5) show that property taxes on real property associated with the turbines (concrete pads, road construction and maintenance buildings, for example) plus the annual turbine tax add another $5.0 in annual tax revenues.[5] Columns (6) through (9) show that

[3] This uses the state's 5.5 percent sales tax rate and assumes all wind farms were built before the Nebraska Advantage Act was implemented.

[4] Income taxes are calculated as construction Wage and Salary Earnings from Table 3 times the average Nebraska income tax rate of 2.7 percent. Sales taxes are calculated as construction Wage and Salary Earnings from Table 3 times the percentage of earnings going toward taxable items – 39.6 percent – times a sales tax rate of 7 percent.

[5] Annual property taxes on the real property base are calculated as 50 percent of expenditures on non-turbine related materials during initial construction times the average property tax rate of 1.76 percent. The annual turbine tax is $3,518 per turbine minus the value of land removed from agricultural production to accommodate the turbine. Based on research, each turbine replaces one acre of crop land.

income taxes on lease payments, sales taxes on operation and maintenance (O&M) equipment, income and sales taxes on O&M earnings add another $1.0 million annually in tax revenues.[6]

V. Local Economic Results

Local economic impact estimates focus on the increase in economic activity in the county or counties where each Nebraska wind farm is located. These counties were identified in Table 1. As noted earlier, to estimate local economic impacts we modify the JEDI-W model estimates of the direct economic impact to reflect that some of the Nebraska-based materials, construction firms, and repair firms used to build and operate wind farms may come from a Nebraska county that is different than the county where the wind farm is located. Specifically, for the construction period, many of the counties where wind farms are located utilize out-of-county suppliers of concrete used in site development. In terms of the IMPLAN model, these counties have "local purchasing coefficients" below 100%, and therefore, have lower direct economic impacts.

Given these considerations, we make the following assumptions in our model of local economic impacts. First, we assume that the "local purchasing coefficients" for various industries in the county IMPLAN models can be applied to the wind farm construction projects considered in this study. In other words, we assume that the typical industry patterns for purchasing goods and services from within the county versus another part of the state apply to purchases by the wind farms. Second, wind farms which provided information on construction costs indicated that only about one in six construction jobs originated in a business located in the same county as the wind farm. Third, we assume that a portion of workers at the wind farm site commute in from other counties, and therefore have a much smaller multiplier impact on the local economy. Their induced spending occurs in their home county rather than the county where the wind farm is located. This adjustment is based on the share of county workforce that commutes in from adjacent counties, using data from the *American Community Survey* of the U.S. Bureau of Census. This share varies from county to county but typically runs just 10% to 20%, implying that 80% to 90% of workers at wind farms also live in the county where the wind farm is located. We assume that these county averages for commuting apply to workers involved in the wind energy industry. We also calculate local economic multipliers using the IMPLAN

[6] Land lease payments are $5,115 per turbine.

model and data for the county or counties in which each wind farm is located. County multipliers are typically smaller than statewide multipliers, which is another reason why local economic impacts are typically lower than statewide economic impacts.

Construction Period Impacts

Table 7 below shows the local impacts from construction of the existing wind farms in Nebraska. The local impacts are in the county or counties where the wind farm is located. Local impact estimates during the construction period are substantially lower that the statewide impact estimates reported in previous tables, given that few construction materials are produced within the county and some firms involved in construction are located in other parts of the state. Local economic multipliers also are smaller. Column (1) shows the number of full-time equivalent job-years created in the year of construction – 383 in total. If projects take two years to complete, there would have been only 192 full-time equivalent jobs created annually.

Table 7: Local Construction Impacts from Existing Wind Farms (Millions of 2014 Dollars)

Name	(1) Jobs	(2) Wage and Salary Earnings	(3) Output
Ainsworth	34	$1.6	$4.0
Broken Bow I	34	$1.6	$3.2
Broken Box II	32	$1.6	$3.0
Crofton Bluff	15	$0.9	$1.1
Elkhorn Ridge	21	$1.2	$1.6
Flat Water	32	$1.5	$4.0
Laredo Ridge	41	$1.9	$4.8
Petersburg	24	$1.2	$2.6
Prairie Breeze	107	$5.2	$13.3
Steele Flats	43	$2.0	$5.1
Total	383	$18.7	$42.7

Column (2) shows wage and salary earnings in millions of year 2014 equivalent dollars. These 10 projects generated over $18 million in wage and salary income. Column (3) shows millions of year 2014 dollars in output generated. These 10 projects together generated over $42 million in output. In aggregate, local impacts are roughly one-third of the statewide impacts.

Operating Period Impacts

Table 8 below shows the local impact from operation of the existing wind farms in Nebraska. Generally speaking, local operations impacts are much closer to statewide operations impacts, in contrast to our findings regarding construction period impacts. The reason is that labor needed to operate wind farms is more likely to be located on-site. Further, inputs to operations include vehicles, fuel, utilities, and maintenance services, all of which are items which are much more likely to be available locally. Column (1) shows the number of full-time equivalent jobs present via operation – 91 each year. Column (2) shows wage and salary earnings in millions of year 2014 equivalent dollars. These 10 projects generate about $4.7 million annually in local wage and salary income due to operation. Column (3) shows output in millions of year 2014 equivalent dollars. These 10 projects generate $8.7 million annually in output to the local economy due to operation.

Table 8: Local Operating Impacts from Existing Wind Farms (Millions of 2014 Dollars)

Name	(1) Jobs	(2) Wage and Salary Earnings	(3) Output
Ainsworth	7	$0.4	$0.7
Broken Bow I	9	$0.5	$0.9
Broken Box II	8	$0.4	$0.8
Crofton Bluff	6	$0.3	$0.5
Elkhorn Ridge	9	$0.5	$0.9
Flat Water	7	$0.4	$0.7
Laredo Ridge	9	$0.4	$0.7
Petersburg	6	$0.3	$0.5
Prairie Breeze	21	$1.0	$2.1
Steele Flats	9	$0.5	$0.9
Total	91	$4.7	$8.7

Tax Revenue Impacts

Local tax revenue impacts are calculated using the same methodology utilized to calculate statewide impacts, but are generally smaller since: 1) local direct impacts are smaller than statewide direct impacts; 2) local economic multipliers are smaller than statewide economic multipliers; 3) local sales tax rates are lower than the state sales tax rate and 4) income taxes are not collected at the local level. Sales taxes collected on turbine components also are not typically subject to local sales taxes, which primarily are levied in cities and towns.

Table 9: Local Tax Impacts from Existing Wind Farms (Thousands of 2014 Dollars)

Name	(1) Sales Tax on Initial Construction Earnings	(2) Annual Property Tax on Real Property Base	(3) Annual Turbine Tax	(4) Annual Sales Tax on O&M Earnings
Ainsworth	$24	$195	$208	$2
Broken Bow I	$24	$224	$279	$3
Broken Bow II	$24	$203	$262	$2
Crofton Bluff	$14	$115	$147	$2
Elkhorn Ridge	$18	$238	$284	$3
Flat Water	$23	$175	$209	$2
Laredo Ridge	$29	$238	$283	$2
Petersburg	$18	$116	$141	$2
Prairie Breeze	$78	$549	$699	$6
Steele Flats	$30	$206	$261	$3
Total	$281	$2,260	$2,774	$28

Table 9 shows the annual local tax revenue impacts from existing wind farms in thousands of 2014 dollars. Column (1) shows that during initial construction, sales taxes on wage and salary earnings derived from construction add $281 thousand in tax revenues.[7] Columns (2) and (3) show that property taxes on real property associated with the turbines (concrete pads, road construction and maintenance buildings, for example), along with local

[7] An average sales tax rate of 1.5 percent is used and it is assumed that all spending occurs within the boundaries of areas able to impose local sales taxes.

turbine taxes add another $5 million in annual local tax revenues. Column (4) shows that sales taxes on operation and maintenance (O&M) equipment and sales taxes on O&M earnings add another $28 thousand annually in local tax revenues. As noted earlier, there are no sales taxes on initial construction materials as it is assumed the wind farms are built on farmland rather than within the limits of a local sales taxing authority.

VI. Statewide Economic Impact from Wind Industry Expansion

The statewide economic impact of Nebraska's wind industry will grow as the industry expands. This section of the report estimates the economic impact from the projected expansion of the wind industry in the coming years. The expansion scenario is conservative in that it only includes growth in wind farm capacity sufficient for Nebraska utilities to meet (and partially exceed) stated goals for renewable energy use as well as meet additional demand for 80 MW of capacity from industrial customers who may wish to utilize wind power as part of corporate renewable energy goals. The expansion is significant, however, in that is calls for an additional 562 MW of wind power production capacity beyond the 793 MW already in place. This is because the expansion scenario assumes that the 400 MW Grand Prairie wind farm will be completed as planned.

The statewide economic impact during the construction period is presented first. The annual economic impact during operations is presented second while the tax revenue impact for Nebraska is presented last.

Construction Period Impacts

Table 10 shows the expected economic impact from expansion during the construction period. These projects will produce 636 construction job-years, $36 million in wages and salaries and $91 million in output.

Table 10: Construction Impacts from Proposed Wind Farms (Millions of 2014 Dollars)

Name	(1) Jobs	(2) Wage and Salary Earnings	(3) Output
Grand Prairie	443	$25.1	$63.9
Verdigre	98	$5.6	$13.6
To Be Named	96	$5.4	$13.3
Total	636	$36.0	$90.7

Operating Period Impacts

Table 11 reports the increase in the annual economic impact of the Nebraska wind industry after expansion. Annual operations of the additional wind farms would generate an annual output increase of $14.0 million. The annual impact in terms of wages and salaries is $5.0 million. These wages would support an additional 88 jobs.

Table 11: Annual Operating Impacts from Proposed Wind Farms (Millions of 2014 Dollars)

Name	(1) Jobs	(2) Wage and Salary Earnings	(3) Output
Grand Prairie	60	$3.35	$9.64
Verdigre	14	$0.83	$2.18
To Be Named	14	$0.81	$2.14
Total	88	$4.99	$13.96

Tax Revenue Impacts

Table 12 shows the tax revenue impact from the proposed wind farms in thousands of 2014 dollars. Columns (1) and (2) show that during initial construction, income and sales taxes on wage and salary earnings derived from construction would add another $2 million in tax revenues. Columns (3) and (4) show that property taxes on real property associated with the turbines (concrete pads, road construction and maintenance buildings, for example) add another $3.4 in annual tax revenues. Columns (5) through (7) show that income taxes on lease payments, income and sales taxes on O&M earnings would add another $0.3 million annually in tax revenues.

Table 12: Tax Impacts from Proposed Wind Farms
(Thousands of 2014 Dollars)

Name	(1) Income Tax on Initial Construction Earnings	(2) Sales Tax on Initial Construction Earnings	(3) Annual Property Tax on Real Property Base	(4) Annual Turbine Tax	(5) Annual Income Tax on Land Lease Payment	(6) Annual Income Tax on O&M Earnings	(7) Annual Sales Tax on O&M Earnings
Grand Prairie	$677	$695	$1,058	$1,398	$32	$91	$93
Verdigre	$150	$154	$218	$285	$6	$22	$23
To Be Named	$147	$151	$192	$279	$7	$22	$22
Total	$973	$999	$1,468	$1,962	$46	$135	$138

There are two important caveats to consider relating to taxes from proposed wind farms. First, we assume the farms are large enough to receive refunds of their sales and use taxes during initial construction as allowed under the Nebraska Advantage Act. Second, under the same Act, investments in operating and maintenance materials would receive a refund of sales taxes for the first six years of operation during the Act's "Entitlement Period". These taxes are omitted from the analysis but would be about $371,000 in 2014 dollars once they are required to be paid.

VII. Conclusion

This study examined the economic impact of the Nebraska wind energy industry both as it is currently configured and under expansion which is underway in the form of new wind farms. Analysis focuses on wind farms with 10 or more turbines. These new wind farms have made sufficient progress to qualify for tax credits and can help Nebraska utilities meet their renewable energy portfolio goals as well as demand by industrial firms for wind power. The study considers the impact in terms of industry output, wage and salary earnings, employment and tax revenue. Economic impacts reflect both the direct economic impact from wind farm construction and operations as well as the multiplier impact on businesses throughout the economy. Tax revenue impacts reflect sales tax collected on wind farm components, property taxes paid on improved land, revenue from the turbine tax, as well as taxes on income earned in Nebraska due to wind farm construction and operation, and taxable sales on purchases with that income.

Table 13: Economic Impact from Existing Nebraska Wind Farm Industry (Millions of 2014 Dollars)

Name	(1) Jobs	(2) Wage and Salary Earnings	(3) Output	(4) Tax Revenue
Construction Period				
Statewide Impact	949	$54.1	$131.8	$72.3
Local Impact	383	$18.7	$42.7	$0.3
Annual Operations				
Statewide Impact	137	$8.0	$21.2	$6.0
Local Impact	91	$4.7	$8.7	$5.1

Impact estimates were developed both statewide for Nebraska and locally in the county or counties in which wind farms are located. Generally speaking, construction period impacts are larger due to the substantial investment and construction activity associated with the development of wind farms and the efficiency with which wind farms can be operated once built. Statewide impacts also are larger, particularly during the construction phase, since a portion of

the businesses that provide supplies, professional services, construction services and maintenance services during wind farm construction are located outside of the particular county where wind farms are constructed. Total impacts are summarized in Table 13 for Nebraska's existing wind farm industry including 10 facilities. Impacts are shown both for the construction period and annual operations.

Statewide, construction of the existing 10 wind farm projects generated 949 job-years and the equivalent of over $54 million in wage and salary income in 2014 dollars. These existing projects together generated $132 million in output in 2014 dollars. The local impact from these projects during the construction period was $42.7 million in output, $18.7 million in wage and salary earnings and 383 job-years. Local economic multipliers are smaller than statewide economic multipliers. Statewide tax revenue impacts during the construction period were $72.3 million versus a local tax revenue impact of $0.3 million.

In terms of annual operating impacts, the statewide impact is $21.2 in output each year, including $8.0 million in wage and salary earnings. These earnings support 137 jobs. Local impacts are once again lower, at $8.7 million each year in output, $4.7 million in wage and salary earnings and 91 jobs. The tax revenue impact is $6.0 million statewide and $5.1 million locally.

Estimates for growth in the Nebraska wind farm industry reflect a conservative scenario based on wind capacity that will allow Nebraska utilities to meet (and partially exceed) stated goals for renewable energy use and allow additional demand for 80 MW of wind power capacity to meet demand from industrial customers who may wish to utilize wind power as part of corporate renewable energy goals. These scenarios call for an additional 562 MW of wind power production capacity beyond the 793 MW already in place.

Table 14 shows the statewide expected statewide construction impact and annual operations impact from future growth of the wind power industry in Nebraska. This expansion scenario would yield a statewide economic impact of $91 million of output during the construction period. This impact would include $36 million in wage and salary earnings supporting 636 construction job-years. The state and local tax revenue impact would be $1.9 million. Annual operations of these facilities would generate an additional economic impact on Nebraska of $14.0 million per year in output. Annual operations would include $5.0 million in wage and salary earnings each year paid out to workers in an estimated 88 jobs. State and local tax revenue of $3.7 million also would be generated each year.

Table 14: Statewide Economic Impact from Nebraska Wind Farm Industry Expansion
(Millions of 2014 Dollars)

Name	(1) Jobs	(2) Wage and Salary Earnings	(3) Output	(4) Tax Revenue
Construction Period	636	$36.0	$90.7	$1.9
Annual Operations	88	$5.0	$14.0	$3.7