

The Impact of Wind Development on County-Level Income and Employment: A Review of Methods and an Empirical Analysis

Introduction

The economic development potential from wind power installations has been a driver of public and policy support for the industry at the local and state levels for many years. The possibility for economic development has been particularly salient in rural areas of the country where new investment, earnings growth, and employment opportunities have, in many cases, otherwise trended downward for some time. Despite frequent mention of the economic development potential of wind power projects, however, questions persist on the magnitude, distribution, and durability of these impacts. Of particular concern for rural communities is whether new investment in wind power projects stimulates long-term local economic growth and employment.

Questions about the economic development and employment impacts of wind power also persist at the national level. However, such debates tend to be more concerned with potential economic losses associated with displacement of other energy sources or land uses and the macroeconomic effects of policy support for renewable energy and changes in electricity rates that might result from wind energy deployment. The present analysis focuses solely on county-level impacts.



Photo by Ruth Baranowski, NREL/PIX 16410

Historically, analyses of the state and local economic development potential of wind power installations have largely been based on project-level case studies and input-output modeling. The National Renewable Energy Laboratory's (NREL's) Jobs and Economic Development Impacts (JEDI) Wind Model is one of the more well-known input-output tools used to conduct this type of analysis.

Past studies have provided notable insights into potential economic development impacts at the state and local levels from the construction and operational phases of wind power projects. Table 1 summarizes operations-period results from studies that have evaluated long-term impacts at a local or county level. However, much of this work has been based on hypothetical or proposed projects and spending patterns. Moreover, generic methodological concerns associated with input-output modeling, including the assumption that impacts are linear or insensitive to large changes in demand, the use of potentially non-representative industry and input data, and an emphasis on gross rather than net impacts (e.g., a failure to capture displacement or opportunity costs), have resulted in criticism of the results of previously published analyses.

Table 1. Past Input-Output Modeling Studies: Range of Estimated County-Level Employment, Earnings, and Economic Output Impacts for the Operations Phase of Wind Power Projects

	Employment Impacts (Jobs per MW)	Annual Earnings ¹ Impacts (\$/MW)	Annual Economic Output (\$/MW)
Absentee-Owned Projects	0.1 - 0.6	\$5,000 - \$18,000	\$13,000 - \$55,000
Projects with a Local Ownership Component	0.5 - 1.3	\$18,000 - \$43,000	\$82,000 - \$140,000

For a full listing of the data sources from which these ranges were derived, please see Science Direct, *Energy Economics*.²

To gain an enhanced understanding of the long-term county-level impacts from a large sample of operating wind power projects and to understand the potential significance of methodological criticisms, the Economic Research Service of the U.S. Department of Agriculture, the Lawrence Berkeley National Laboratory, and NREL recently joined efforts. The goal was to complete a first-of-a-kind study that quantifies the annual impact on county-level employment and personal income resulting from wind power installations in nearly 130 counties across 12 states. The results of this study, as well as a comparison of those results with the prior county-level estimates generated from input-output models, are summarized here. The full study results are available at Science Direct, *Energy Economics*.²

¹ A measure of labor income that includes wages and employer-based benefits.

² <http://www.sciencedirect.com/science/article/pii/S0140988312001466>. For access to the full article, a subscription may be required.

Methods

The study evaluates the actual (empirical) county-level impact from wind power development on personal income and employment, focusing on the effects from 2000 to 2008 in the wind-rich Great Plains and Rocky Mountain Region (Figure 1). Statistical methods and controls are applied to properly evaluate and isolate the impacts of wind power installations on personal income and employment from other variables that also affect county-level income and employment. Based on the methods applied, the results are dominated by operations-period impacts but are also affected by construction-period impacts from projects under construction in 2008.

Results and Conclusions

The findings of this work indicate that, on average, wind power installations within the study area and occurring between 2000 and 2008 resulted in an increase in total county-level personal income of approximately \$11,000 per megawatt (MW). The median increase in total county-level personal income resulting from this sample of wind power installations was estimated to be 0.2% with a range of 0.03% and 0.9% at the 25th and 75th percentiles, respectively. On average, the impact of these same wind power installations on total

Installed Wind Capacity (MW)

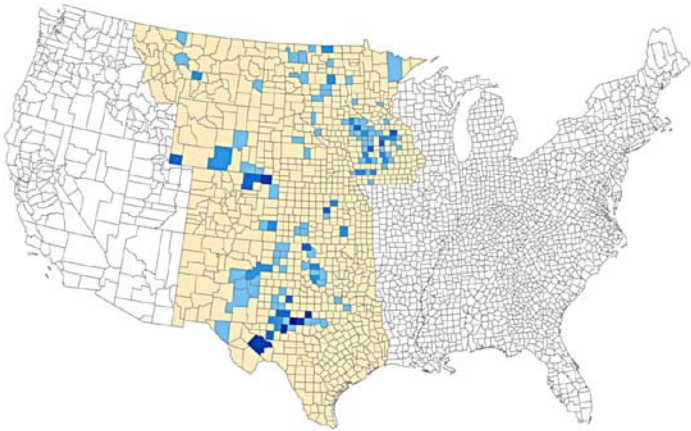
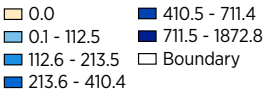


Figure 1: Total installed county-level wind power capacity from 2000 to 2008 in the 12-state study area. Illustration by Jason Brown, USDA-ERS

county-level employment was 0.5 jobs per MW. The median increase in county-level employment was estimated at 0.4%, with an increase of 0.1% and 1.4% at the 25th and 75th percentiles, respectively.

Table 2. New Empirical Study: Average and Median Impact on County-Level Employment and Personal Income Resulting from Wind Power Projects Completed between 2000 and 2008 within the Study Area

	Average Increase per MW of Wind Power Capacity	County-Level Median Increase for Counties with Wind Development
Employment	0.5	0.4%
Total Personal Income	\$11,000	0.2%

Source: Science Direct, *Energy Economics*³

Although not strictly comparable to the results summarized in Table 1, these empirical results are of similar magnitude to input-output-derived estimated impacts on labor income and employment.⁴ Such a finding suggests that input-output models, including the JEDI model, that are commonly used to assess the economic development impacts of wind energy (at least when applied at the county or local level) may not be unduly impacted by the generic methodological limitations highlighted earlier and appear to be reasonably accurate in their estimation of impacts. Future work may evaluate similar impacts at the state or national levels, analyze impacts across additional time periods and regions, or more fully isolate construction-period impacts from operations-period impacts.

For a full listing of the data sources, please visit Science Direct, *Energy Economics*.³ Views are those of the authors and may not be attributed to the USDA Economic Research Service, U.S. Department of Energy's (DOE's), Lawrence Berkeley National Laboratory (LBNL), or the National Renewable Energy Laboratory (NREL). The U.S. DOE (Wind & Water Power Program) funded LBNL's and NREL's contribution to this work under Contract No. DE-AC02-05CH11231.



Photo by Klaus Obel, NREL/PIX 16082

3 <http://www.sciencedirect.com/science/article/pii/S0140988312001466>. For access to the full article, a subscription may be required.
4 The results reported here are not directly comparable to traditional input-output estimates because they emphasize personal income rather than the narrower category of labor income or the broader category of total economic output and because they include construction-period impacts for 2008 installations. Moreover, the results presented here reflect the estimated net impact of wind power development at the county level, whereas input-output analyses often emphasize gross impact.

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