Center for Rural Energy Security
University of Missouri

Research Brief

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Powering Rural Prosperity: The Local Economic Impact of Utility-Scale Wind and Solar Developments

by
Adrienne Ohler
Austin Landini
Michael Sykuta

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Executive Summary

Using county-level data on U.S. energy installations between 2001-2023, the authors examine how renewable energy adoption shapes sector-specific economic activity, focusing on GDP, employment, and wages in rural counties. The authors find that wind development is associated with significant GDP gains concentrated in the utilities sector, while solar development is associated with modest wage and employment gains driven largely by utilities and construction. For very large utility-scale solar (e.g. 5MW or 20MW) projects, agriculture, construction, and utility GDP increase with solar adoption. Neither technology reduces agricultural GDP, employment, or wages, providing little evidence of substantial disruption to agricultural production or related labor markets. These findings provide a more nuanced understanding of the local economic consequences of the energy transition and highlight the importance of technology type and sectoral composition in shaping rural development outcomes.

Research Background

The expansion of utility-scale wind and solar generation has transformed national energy policy into a series of place-based investments. Although electricity generated by these facilities is often transmitted into regional and national markets, the infrastructure itself is concentrated in hosting communities, many of which are rural and often dependent on agriculture. Because these projects may compete with agricultural land use, particularly solar projects, there are often concerns about how these investments affect local economic activity.

Prospective economic-impact studies routinely accompany renewable energy project proposals, typically using input-output models (e.g., IMPLAN, JEDI) that attempt to measure the expected direct and indirect economic benefits of the large capital investments and jobs that come with such projects. However, these studies do not consider potential losses in, or substitution away from, other economic activity in the region that may result from energy project investments.

Retrospective studies measuring the realized effects of renewable project development are much more limited. Previous studies have focused primarily on wind projects, often in narrow geographic areas, and have produced mixed results.

The present study is unique in that it focuses on all rural counties in the U.S. and includes analysis of both wind and solar project developments. It provides a direct comparison of counties that experienced wind and/or solar project developments with those that do not over the 2001 to 2023 period.

Research Findings

The U.S. Bureau of Economic Analysis (BEA) measures economic activity using "gross domestic product," or GDP, which measures the value of final goods and services sold. The authors control for the county population and focus on changes in county-level GDP per capita that may be attributed to renewable generation projects. The authors also examine the effects of renewable projects on employment and average hourly wages, as reported by the U.S. Bureau of Labor Statistics (BLS). BEA and BLS also report data for each county for individual industry sectors within the county, allowing the researchers to examine whether economic effects are specific to particular industries and whether there is any reallocation of economic activity between industries in the county. The authors focus on wind projects greater than 50MW and solar projects greater than 1MW. They then expand the threshold for solar to 5MW and 20MW to see whether size of the projects affects the results.

At the county level, on average:

- Counties with wind power projects had a 7.22% higher GDP per capita by the second year of operation than counties that had no wind power projects.
- Counties with 1MW or 5MW solar projects experience no significant change in GDP per capita (positive or negative).
- Counties with 20MW solar projects had GDP per capita that was approximately 2% higher after two years of operation, but that difference reduces in subsequent years.
- Neither wind nor solar had a significant effect on either county-level employment or wages, except for very large solar projects (>20MW). For the large solar projects, there again was a modest, positive effect on both employment and wages in the first three years, but that difference diminished in subsequent years.

While the aggregated county-level effects suggest that the only long-lived economic effect of these utility-scale renewables projects were wind power's relationship with GDP per capita, the authors do find lasting and significant effects in specific industries within counties. For counties with wind or solar, the authors find that, on average:

- Wind power projects lead to sustained increases in utility industry GDP per capita of close to 200%, reflecting the relatively small size of the utility industry in most rural counties. This is the primary driver of the county-level GDP result above.
- Smaller solar projects (1MW) result in higher utility industry GDP per capita over the first three years of operation, but that effect diminishes in subsequent years. However, construction GDP per capita is approximately 10% higher five years after operation.
- Larger solar projects (5MW and 20MW) result in higher construction and utility sector GDPs that are sustained through five years of operations. Results for agriculture GDP are positive, but not strongly significant.

For employment and wages, only solar projects are associated with significant changes in industry-level performance.

- Solar projects are associated with positive and significant increases in employment in both the construction and utilities sectors of approximately 14% and 18%, respectively.
- Similarly, counties with solar projects experience increases in average wages of 17% and 21%, respectively, compared to similar counties without large-scale solar projects.

Takeaways

The results of this study highlight that the local economic effects of large-scale renewable energy projects are varied and depend on the type and size of renewable technology projects. The economic effects are often concentrated in specific industries and may not be reflected in aggregate economic measures. Importantly, there is no evidence of negative economic outcomes in the aggregate or in any specific industry sector. These results may inform policy discussions about the perceived benefits and costs associated with large-scale renewable projects and policies that affect their development.

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About CRES

The Center for Rural Energy Security (CRES) is the first-of-its-kind energy policy think tank in the U.S. that focuses specifically on understanding the implications of federal and state energy policies and technology innovation for rural America. Housed at the University of Missouri, CRES achieves its mission through conducting objective, unbiased, policy-based research; producing timely policy reports, white papers and op-eds; authoring scholarly academic studies; facilitating contracted research projects for private stakeholders and government agencies; and performing grant- and philanthropic-funded research.