Economic Impacts of Utility-scale Wind Turbine Generators on Rural Counties in the U.S.: Implications for Arkansas

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Summary

Wind turbines used for electricity generation have become a common sight across rural areas in the United States. Although Arkansas does not currently have any utility-scale wind capacity, parts of the state have wind resources with high potential for electrical generation. Wind turbine development projects can have both positive and negative effects on rural economies. To date, there is limited research on the full range of effects on rural communities in proximity to wind energy development projects. More evidence is needed to inform policymakers about these impacts, and how policy tools such as local siting restrictions may help to mitigate negative effects. This report uses national data to evaluate various economic impacts of wind energy development and related policy tools on rural communities with specific applications for Arkansas.

Source: Pexels

Objectives:

1. Describe the current trends in U.S. wind turbine location and electricity production. Review state and county rules for siting wind turbines.
2. Estimate the economic impact of wind energy projects on rural counties across the U.S. Examine how siting restrictions alter these impacts.
3. Discuss how these findings could apply to proposals for wind development in Arkansas.

Key Findings:

1. **Short-term** (years 1-3 of operation):
   - *Increases:* county GDP and farmland values.
   - *Decreases:* personal income, employment, population, and residential home values.
2. **Long-term** (about 10 years): Little change from the short run.
3. **Siting rules** can reduce—but not eliminate—negative impacts while keeping or even strengthening the benefits.

1. Background & Overview

This report provides a basic background on wind energy in the U.S.; reviews existing siting rules; presents statistical analysis on the economic impact of wind development; and determines the effectiveness of local restrictions in mitigating adverse impacts. The report uses national data to draw implications for Arkansas, but the results are applicable for any of the contiguous 48 states. This information is relevant for the interested public, community and industry organizations, as well as local, state, and national policymakers.

1.1. Wind Energy in the U.S.

Wind energy has expanded dramatically in the United States over the past two decades, as shown in Figure 1. Installed capacity[1] grew at an average annual rate of 23.1% between 2007 and 2024, reaching 135,447 megawatt (MW) capacity in utility-scale land-based wind turbines by 2023 (Hoen et al., 2025; authors' calculations). Power generated by wind turbines accounted for about 10.2% of total U.S. electricity consumption in 2023 (U.S. Energy Information Administration, 2024).

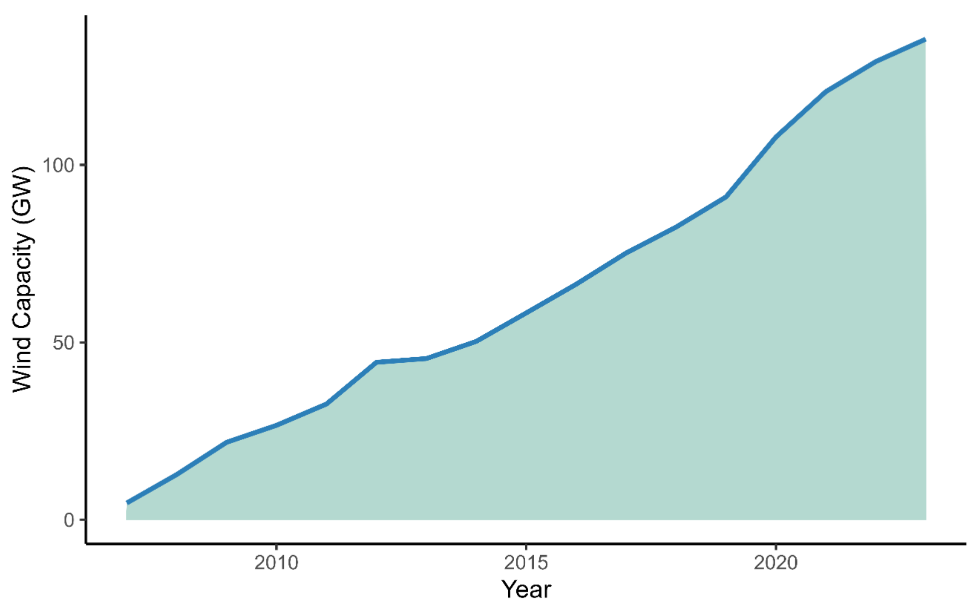

Figure 1. Gigawatts (GW) of Onshore Wind Energy Capacity in the Continental U.S.

Source: Hoen et al., (2025); authors' calculations.

[1] Note that capacity and production can be quite different as wind speeds are not always at optimal levels.

While most wind energy is consumed in urban and suburban areas, approximately 97% of wind turbines are located in rural[2] counties (Hoen et al., 2025; authors' calculations). When evaluating wind energy policy, policymakers should consider the potential for a disproportionate impact on rural communities relative to their urban counterparts.

1.2. Geographic Patterns

Most wind energy capacity in the U.S. is concentrated in the Great Plains and Midwest regions. These regions are characterized by open spaces, strong wind, relatively low population density, and are also home to substantial agricultural production. Figure 2 shows the geographic distribution of wind energy capacity, with dense clusters across Texas, Iowa, and Oklahoma, which rank as the top three states in capacity. Figure 3 shows the wind energy capacity by state, with Vermont, Massachusetts, and North Carolina ranking at the bottom. Arkansas, like many southeastern states, does not currently have utility-scale wind energy capacity.

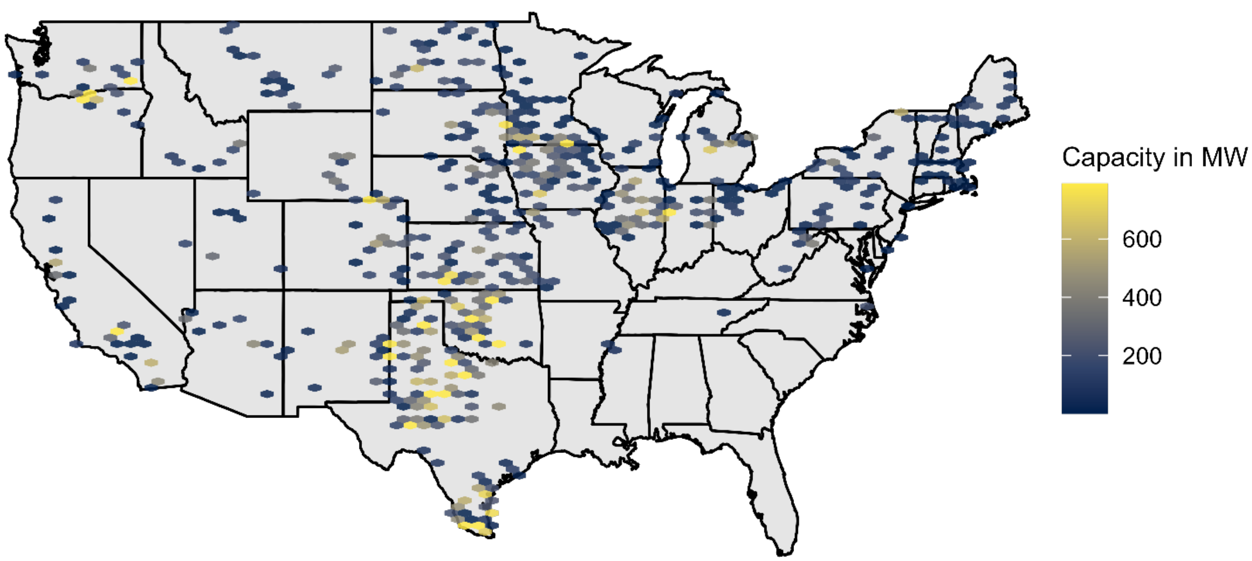

Figure 2. Location of Wind Energy Capacity in the U.S.

Source: Hoen et al., (2025); authors' calculations.

[2] Rural counties are defined by having a population density of less than 200 people per square mile. This comes from the US Census Bureau urban expansion threshold.

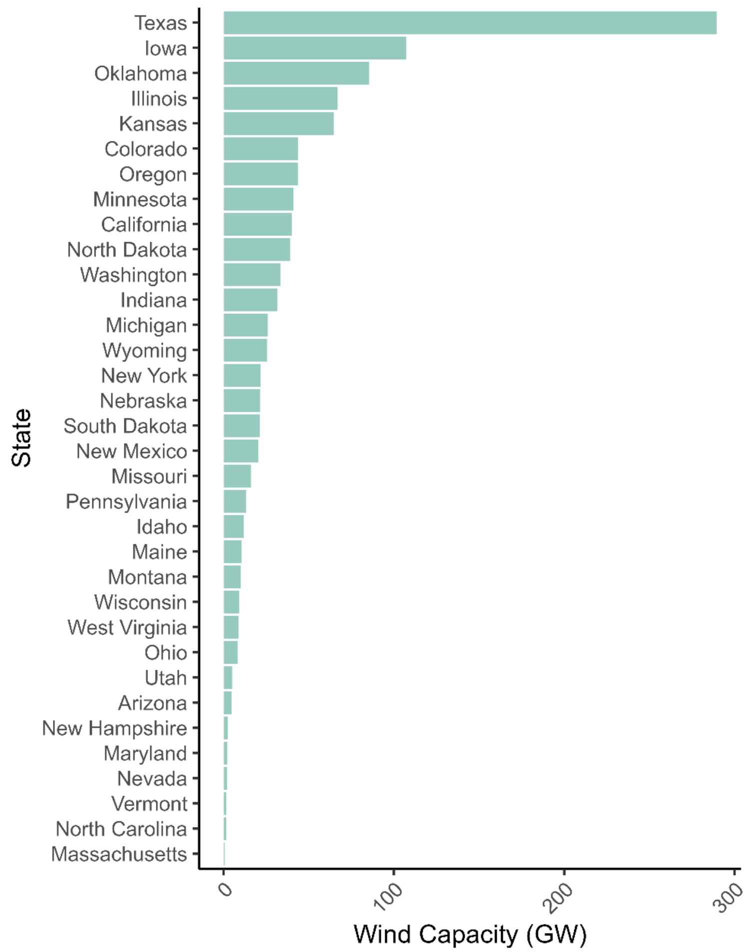

Figure 3. Gigawatts (GW) of Wind Energy Capacity by State

Source: Hoen et al., (2025); authors' calculations.

Capacity differences across states are reflective of natural wind resources, as shown in Figure 4, which represents an estimate of potential capacity utilization at the county level (Draxl & Hodge, 2024; authors' calculations). Regions with high wind resources are primarily in the Great Plains, Midwest, and extending into the Northeast. The states previously identified as leaders in wind energy capacity are primarily located in areas with plentiful wind resources. Although there are currently no utility-scale wind developments in Arkansas, a meaningful portion of the state lies within this belt of high wind resources, highlighting the potential for future capacity development (Hoen et al., 2025; authors' calculations). On the other hand, regions with relatively less potential for wind energy development are the Southeast and West—yet three western states are in the top 11 for wind development. This may suggest that wind resources are not the only factor in determining where wind energy development takes place.

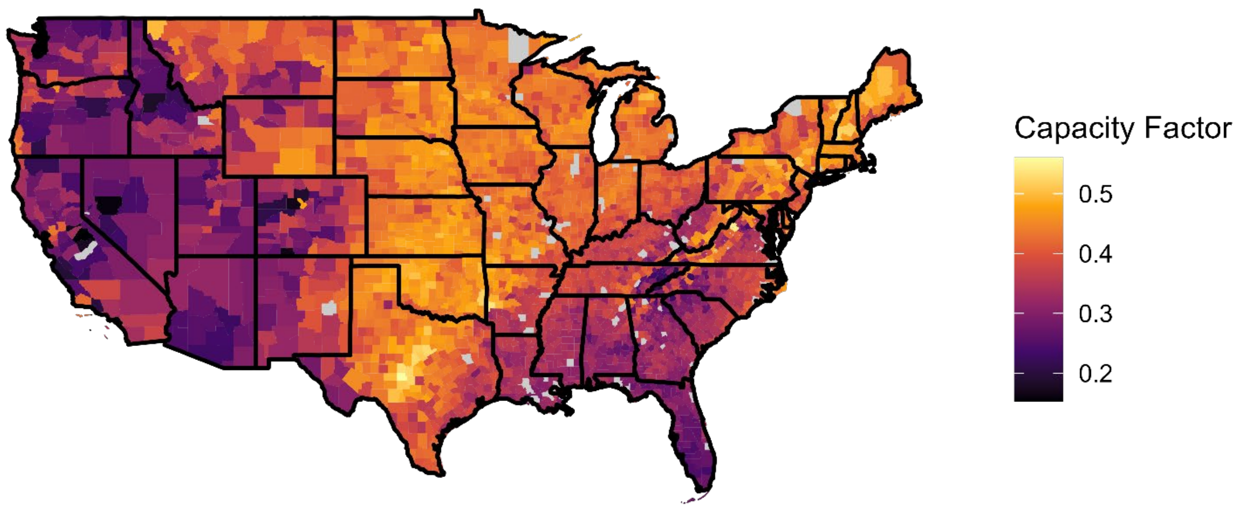

Figure 4. Wind Energy Potential Measured by Capacity Factor
Note: Capacity factor is the share of a wind turbine's nameplate capacity expected to be generated over time, based on local wind conditions and adjusted for the class of turbine suited to the site. Higher values indicate stronger wind resources.
Source: Draxl & Hodge, (2024); authors' calculations.

In addition to wind resources, geographic differences in capacity are also likely a function of policy environments—at both the state and local levels. Policies such as siting rules, tax incentives, or subsidies play a role in determining where projects are built. The geographic patterns for policies are shown in Figure 5, which is based on siting rule data (*not* tax incentives or subsidies), and transformed into the Relative Restrictiveness index (Lopez et al., 2022; authors' calculations). The index represents the average restrictiveness across eight types of siting rules—with 0 being the least restrictive and 1 being the most. The policy environment is somewhat sporadic, with many states having counties with values on both extremes. Kansas, Oklahoma, and Texas, three of the top five states in terms of developed wind capacity, stand out as states with some of the least restrictive siting policies. Moreover, Oregon, California, and Washington also have relatively less restrictive siting policies and substantial wind capacity, despite relatively weak wind resources.

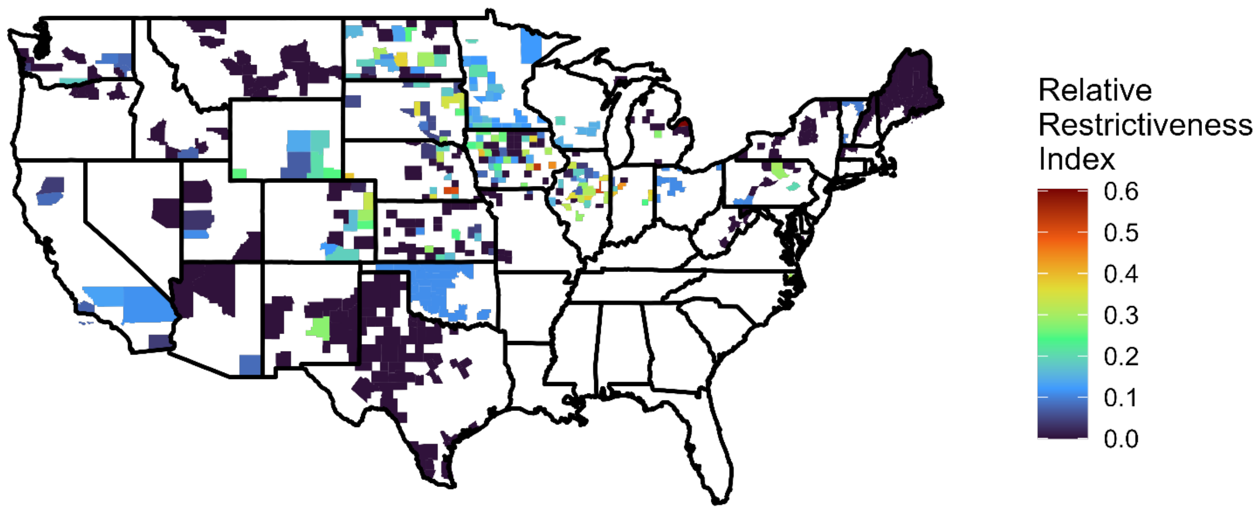

Figure 5. Relative Siting Policy Restrictiveness in Counties with Wind Turbines
Note: The Relative Restrictiveness Index (RRI) is calculated by averaging percentile ranks across siting restrictions in the dataset, including minimum setbacks, sound limits, maximum heights, and spacing requirements. Higher values indicate counties with relatively more restrictive policies, while a value of zero represents counties with no restrictions recorded. Only counties with existing turbines are displayed in this map.
Source: Lopez et al., (2022); authors' calculations.

In summary, wind energy development in the U.S. is concentrated in areas with high wind resources. Furthermore, it appears that less restrictive siting rules are also correlated with more wind electrical generation capacity. There may be other drivers, but in any case, there are clear geographic patterns to the substantial capacity of installed wind capacity across the U.S.

1.3. Wind Turbine Characteristics

Across 1,441 development projects in the U.S., there are more than 70,000 utility-scale turbines installed (see Table 1). On average, projects consist of about 95 turbines, although there is wide variation: some developments include only a handful of turbines, while the largest projects exceed 450 turbines with over 1,000 MW of installed capacity.

The average turbine has a rated capacity of just over 2 MW[3], with some reaching as high as 6 megawatts. Physical dimensions similarly vary, the average hub height is around 84 meters, with average tip heights of nearly 135 meters. The average rotor diameter exceeds 100 meters,

[3] A 2 MW wind turbine operating at a typical 35–40% capacity generates about 5,900–7,000 MWh of electricity annually, which is enough to supply roughly 540–640 average U.S. households—based on ~11 MWh per household per year (EIA, n.d.).

creating a rotor sweep of more than 8,500 square meters. These dimensions can be helpful for policymakers in understanding and creating siting restrictions, which are often based on turbine dimensions.

Table 1: Summary of Project Specifications & Wind Turbine Characteristics

Feature	Number	Avg	Min	Max
Project turbines[1]	1,441	94.5	1.0	454.0
Project capacity MW[2]	1,441	192.4	0.5	1,055.6
Turbine capacity kW[3]	70,060	2,152.9	500.0	6,000.0
Hub height[4]	70,060	83.8	30.0	344.0
Rotor diameter[5]	70,060	101.7	39.0	162.0
Rotor sweep[6]	70,060	8,524.6	1,194.6	20,612.0
Tip height[7]	70,060	134.7	51.0	419.0

Notes: Table 1 includes all turbines with greater than 500 kw capacity.
For project features, Number refers to the number of projects in the US.
For turbine features, Number refers to the number of turbines in the US.
[1]Project turbines is the total number of turbines in each project.
[2]Project capacity (MW) is the total installed capacity per project.
[3]Turbine capacity (kW) is the rated capacity of individual turbines.
[4]Hub height is the distance in meters from ground to the turbine's hub.
[5]Rotor diameter is the diameter of the circular area swept by the blades in meters.
[6]Rotor sweep is the total swept area of the blades in square meters.
[7]Tip height is the maximum height in meters reached by a blade at its highest point.
Source: Hoen et al., (2025); authors' calculations.

1.4. Potential Economic Impacts

Wind turbines can affect local economies through several direct and indirect channels. The direct effects are mostly potential benefits. When electricity is generated in a county, a portion of the value of that output is reflected in the county's Gross Domestic Product (GDP[4]), which is the total dollar value of final goods and services produced. The project may also provide construction and maintenance jobs in the county. Landowners who host turbines receive lease payments, which increase their personal income and can raise the value of development-suitable land. Turbines occupy relatively little land, so only a small share of agricultural production is displaced. Wind projects may also increase local tax revenues that could support infrastructure and public amenities, reinforcing local economic activity. In this report, this tax effect is not measured directly due to restraints on data availability. The indirect effects consist primarily of

[4] The official statistics divide the value of electricity generated in the county between the location of production and the location of management.

potential costs to the local economy. Wind projects can create visual and noise disamenities that reduce the appeal of rural landscapes. As a result, net migration may decline. This, in turn, lowers local economic activity by reducing the number of jobs held, the income earned within the county, and the spending those residents would have contributed. If these residents commuted elsewhere for work, their departure also reduces the inflow of personal income from outside the county. Demand for homes may also weaken, leading to lower property values. Similarly, visitors may be deterred if the presence of turbines diminishes recreational or scenic value, which could reduce local tourism jobs and spending. Between the direct and indirect channels, it is evident that wind energy development can generate both benefits and costs, and the overall value of wind development to rural communities depends on the relative size of the positive and negative impacts.

In Table 2, select economic variables that could be affected by wind turbines are compared[5] between counties with and without wind development. There are 491 rural counties nationwide with approximately 18.5 million residents.. These counties represent a total GDP of $1.2 trillion. The relationship between personal income and GDP is also noteworthy; counties with turbines have higher GDP than personal income, while counties without turbines the opposite is true. This may indicate that counties without turbines are more likely to have residents working or otherwise receiving income from outside the county. Table 2 provides a useful profile of these counties, *but must be interpreted with caution*[6], as many factors influence these outcomes. Nevertheless, the data in Table 2 underscores the scope of economic activity in proximity to wind turbines and the number of people potentially affected nationally. It also gives insights into the type of counties that experience wind energy development.

[5] Avoid using this county profile to draw *causal* conclusions about the impact of wind turbines on local economies. The statistical analysis later in this report will determine the effects while accounting for the many additional factors that could impact these outcomes. Table 2 is meant as a profile, not an analysis.

[6] Section 2 contains a statistical analysis to parse out the actual impact of wind turbines on economic outcomes, while accounting for many other factors that may influence these outcomes.

Table 2: Rural County Summary With & Without Wind Turbines

	With Turbines (n = 491)		Without Turbines (n = 1,999)	
Variable	**Mean**	**Sum[1]**	**Mean**	**Sum**
Real GDP[2]	2,453,105	1,204,474,692	1,749,861	3,497,971,665
Personal Income[2]	2,012,802	988,285,952	1,776,074	3,550,372,127
Employed Persons	17,165	8,428,074	14,554	29,093,272
Population	37,818	18,568,872	33,376	66,719,185
Single-Family Home Value ($)	188,445	-	220,768	-
Ag Land Value ($/acre)	4,499	-	4,572	-

Notes: Data are for rural counties in 2022.
[1]Sums are totals across all rural counties within each group.
[2]Real GDP and personal income are in thousands of dollars.
Source: Hoen et al., (2025); Lopez et al., 2022); USDA–NASS (2025); BEA, (2025); Zillow (2025).

Because there are benefits and costs of wind energy development, local policymakers should consider *both* when making decisions about allowing wind development. This includes considering the distribution of impacts—which may vary for different groups within a local area (e.g., landowners and homeowners). Moreover, policymakers may consider well-crafted restrictions that may allow their jurisdiction to enjoy the benefits while minimizing the negative impacts.

1.5. Wind Turbine Siting Restrictions

The potential downsides of wind energy development, along with the practical realities of placing large turbines on the landscape, have led many states and local governments to adopt siting restrictions. Most restrictions take the form of a setback, which requires turbines to be placed a minimum distance away from a particular feature, such as homes, property lines, roads, or waterbodies. Setbacks are typically expressed as a distance (e.g., meters, feet) or as a multiplier of turbine dimensions (e.g., hub height, tip height). Other restrictions use different measures—for example, sound rules are expressed in decibels, while height limits cap the height of turbines that can be built. Although rare, 37 rural counties across the country have adopted outright bans on utility-scale wind development.

Figure 6 provides an overview of the most common restrictions. The boxplots show the distribution of values for each type of restriction, while the width of each box indicates how frequently that type of rule is applied. Some rules, such as sound, have a relatively narrow range of limits, while others, like setbacks from structures or waterbodies, differ substantially across jurisdictions. This diversity highlights the wide range of approaches that jurisdictions take when regulating wind turbines. Each locality adopts policies with its own objectives in mind, and much of the variation can likely be explained by local contexts—such as geography, dominant industries, population density, or political priorities. For example, counties that rely heavily on tourism or have high population density may be more sensitive to the visual impacts of turbines, while agricultural regions may be more receptive if landowners stand to benefit from lease payments.

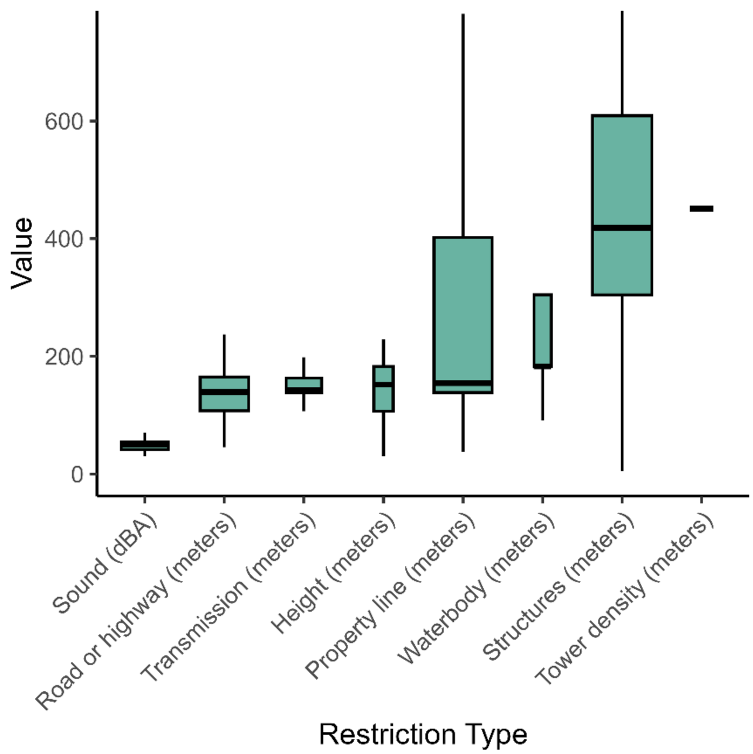

Figure 6. Distributions of Wind Turbine Siting Restrictions

Source: Lopez et al., (2022); authors' calculations.

The summary in Figure 6 serves as a useful reference point for policymakers when considering various siting restrictions on wind turbines. It shows how commonly each restriction is used nationwide and allows local officials to see how any proposed rule would compare to the broader national picture. More detailed summary tables are provided in the Appendix for readers who wish to examine the restrictions in greater depth.

2. Statistical Analysis of Economic Effects

The objective of this analysis is twofold: (1) to determine the impact of wind turbines on surrounding communities in terms of GDP, personal income, employment, population, home values, and farmland values; and (2) to explore the effectiveness of wind turbine siting policies in limiting negative economic outcomes.

2.1. Statistical Analysis

In the context of this report, it is important to recognize the potential for *"invisible impacts."* These are impacts of wind turbines that are hard to detect because the counterfactual—the "what would have happened otherwise"—is missing. For instance, suppose home values rise after turbines are installed in a county. A simple interpretation would be that wind turbines caused the increase. If otherwise similar neighboring counties without wind turbines experienced an even larger rise in home values over the same period, however, the more accurate conclusion would be that wind turbines reduced home values relative to what they would have been. This illustrates why simple before-and-after comparisons can be misleading.

Another concern arises when comparing counties with turbines to those without. Imagine finding that GDP is higher in counties without wind turbines. The intuitive interpretation might be that turbines reduce GDP. However, underlying factors such as wind availability, which tends to be greater in more rural, less densely populated counties, may also be correlated with lower economic activity. In that case, turbines could in fact increase GDP, but a simple comparison could show the opposite. These kinds of confounding factors make direct cross-county comparisons problematic.

In this report, changes in county-level economic outcomes are analyzed using a regression model that considers both differences between counties *and* changes over time. In simple terms, the model isolates the impact of wind turbines, while accounting for many other factors that could affect economic variables. A more detailed description of the statistical methods is provided in the Appendix.

2.2. Data description

Data are combined from multiple sources for this analysis. Wind turbine information came from the U.S. Wind Turbine Database maintained by the USGS (Hoen et al., 2025). Data on local siting regulations and zoning ordinances were obtained from the Open Energy Data Initiative (Lopez et al., 2022). Agricultural variables, including farmland values and cash rents, were sourced from USDA–NASS (2025). Measures of personal income, employment, population, and real GDP were taken from the Bureau of Economic Analysis (BEA, 2025). Lastly, data on single-family home values were provided by Zillow (2025).

The data covers the years from 2007-2025 with annual[7] observations. The dataset is organized at the county-year level with variables for each of the economic outcomes we are considering, in addition to wind turbines (count, capacity, density) and local siting regulations and zoning ordinances measured by relative restrictiveness.

The economic outcome variables considered are mapped in Figure 7, and the following paragraphs discuss the geographic patterns observed. Each map depicts a county's percentile rank relative to all other rural counties for each variable. As a reminder, counties with population densities greater than 200 people per square mile are excluded, since this report focuses on rural areas.

Several patterns stand out. Farmland values are highest across the Corn Belt and along the West Coast, which is expected given that these regions host highly productive agricultural land with high per-acre values. Data on cash rents are more limited because of USDA confidentiality rules and incomplete reporting. For Arkansas, the non-irrigated cropland series covers most of the state, while irrigated cropland data cover the Mississippi Delta region.

Population is relatively higher in rural counties near metropolitan areas, where many residents may commute for work or prefer proximity to urban services. By contrast, the Plains states—including western Texas, western Oklahoma, Kansas, Nebraska and the Dakotas—have sparse rural populations, an important fact given these areas also have some of the nation's strongest wind resources. The distribution of employment closely mirrors that of population,

[7] Ag land values and rental rates are at a 5 year time scale because they are only available during agricultural census years.

though the two are worth considering separately since small changes in either can be meaningful. The map of population should be interpreted carefully as some counties are larger than others—especially west vs east—so large counties with low population density may still rank high in total population.

Personal income is an aggregate measure and therefore strongly reflects population patterns, while real GDP in rural counties shows less distinct geographic clustering. Finally, single-family home values are generally highest in the western United States, in counties near major cities, and across parts of the upper Midwest and Northeast.

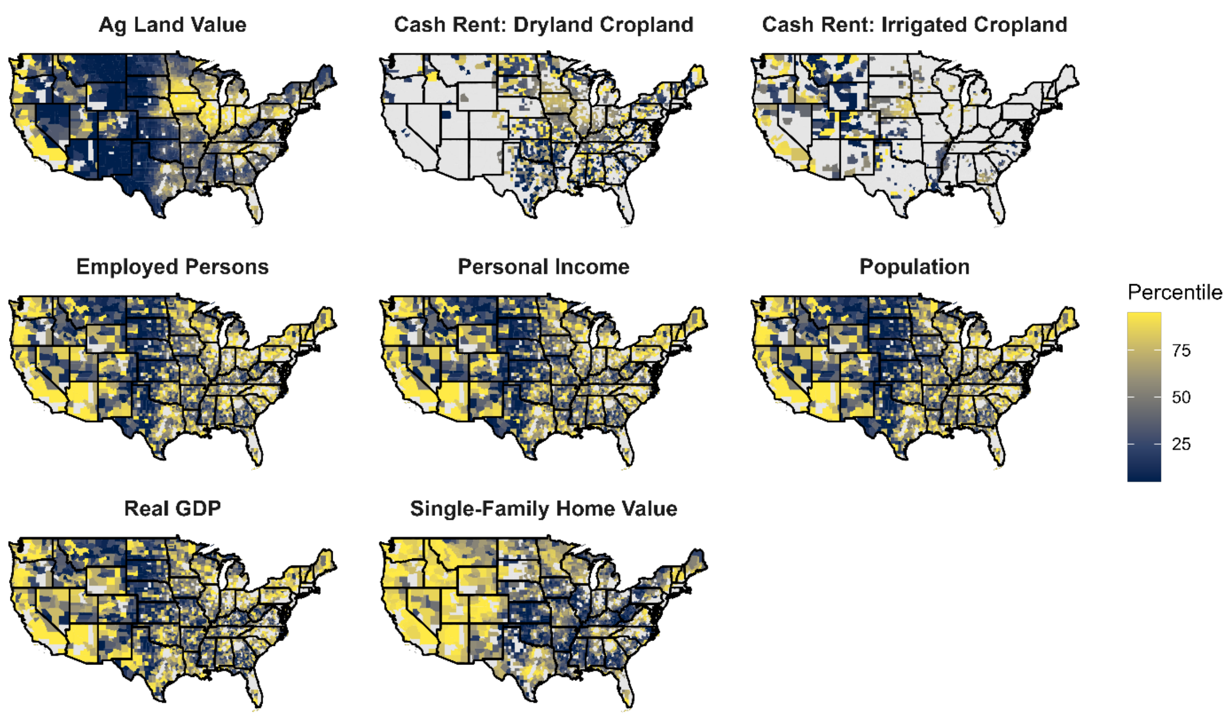

Figure 7. Economic Outcome Variables at the County Level in 2022
Notes: Missing counties are either missing in the source data or were filtered out because they were non-rural (greater than 200 persons per square mile).
Source: Hoen et al., (2025); Lopez et al., 2022); USDA–NASS (2025); BEA, (2025); Zillow (2025).

2.3. Results

The first results we present in this section aim to determine the impact of wind energy development on local economic variables and how quickly these effects materialize. Table 3 contains these estimates, with columns for the short-run effects (years 1-3) and long-run effects (average of 10 years). The results indicate that most economic impacts occur within the first three years after a project begins operating. Beyond the initial years, only relatively small additional changes are observed.

Real GDP rises by just over 4%, suggesting that electricity generation and related operations provide a meaningful boost to output. Agricultural land values also increase substantially, by about 7–8%, consistent with lease payments to landowners and capitalization of development potential. However, there are no statistically significant effects on agricultural cash rents, including both irrigated and non-irrigated cropland. Thus, we conclude that there is no meaningful impact on these variables. At the same time, however, several household-level measures experience declines. Personal income, employment, and population each fall by less than 1%, and single-family home values decline by just over 1%. These reductions likely reflect the reduced aesthetic appeal of the rural landscape caused by wind turbines, resulting in outmigration and potentially fewer visitors. In short, there are benefits and costs for rural communities, and importantly they accrue to *different* groups of people.

Table 3: Projected Effects of a Wind Project on County-Level Outcomes

Economic Variable	Short-Run Effect*	Long-Run Effect**
Real GDP	3.84%	4.11%
Personal Income	-0.82%	-0.55%
Employment	-0.69%	-0.96%
Population	-0.69%	-0.82%
Single-Family Home Value	-1.23%	-1.51%
Agricultural Land Value	8.36%	6.72%
Cash Rent: Irrigated Cropland	--	--
Cash Rent: Non-Irrigated Cropland	--	--

Notes: The Projected effects assume a county of 689 square miles (Arkansas average) and a wind project of 95 turbines (national median).
*Short-run effects are during years 1-3 of operation.
**Long-run effects are estimated on all data points, with an average duration of about 10 years.
Dashes indicate no statistical significance.
These effects are an average across all counties with utility-scale wind turbines, each having various siting restrictions or none at all.

Table 4 compares outcomes for counties *with* siting restrictions to those *without*. The results show that restrictions help to slow the negative impacts while enhancing or preserving the benefits of wind development. In counties without restrictions, employment falls by more than 3% and home values by almost 3.5%. In counties with restrictions, the declines are much smaller—less than 0.5% for employment and 1.4% for home values. Meanwhile, GDP gains are larger in counties with siting restrictions, and increases in agricultural land values are similar regardless of restrictions. Taken together, these results indicate that siting policies can be an important tool for limiting negative impacts and preserving gains.

Table 4: Siting Restrictions and Economic Outcomes in the Long-Run

Economic Variable	Without Siting Restrictions	With Siting Restrictions
Real GDP	2.06%	3.98%
Personal Income	-1.65%	-1.65%
Employment	-3.15%	-0.41%
Population	-1.51%	-0.55%
Single-Family Home Value	-3.43%	-1.37%
Agricultural Land Value	6.58%	6.58%
Cash Rent: Irrigated Cropland	--	--
Cash Rent: Non-Irrigated Cropland	--	--

Notes: The Projected effects assume a county of 689 square miles (Arkansas average) and a wind project of 95 turbines (national median).
These effects are estimated on all data points (except year of construction), with an average duration of about 10 years.
Dashes indicate no statistical significance from zero. Those where "with" and "without" are the same number had no statistical difference from each other, so the "without" estimate was used for both. However, instances with different numbers are indeed statistically different.

3. Discussion and Conclusion

The results of this analysis indicate that the economic effects of utility-scale wind energy development in rural counties are mixed, with both positive and negative consequences. In the following section, the results are discussed in more detail and in terms of their implications.

3.1. Impacts of Wind Development

Wind energy development is associated with increases in county-level GDP. The increase in GDP likely comes from the value of electricity generated by the wind turbines. However, as other economic variables declined at the same time, this effect is likely the net result. This is probably the reason that siting restrictions that moderate the decline in other economic variables increase the net GDP impact—not that siting rules improve the value of electrical output but rather limit the decline of other economic activity. Another consideration for the increase in GDP is to *whom* this benefit accrues. The value counted toward GDP accrues primarily to the operating company, while any value benefiting the local economy would need to come though pathways of costs to the company. Examples include jobs in construction and maintenance, or other inputs purchased within the county. However, construction jobs are temporary, and skilled workers may be brought in from outside the county. Furthermore, only a few long-term maintenance jobs are created. Overall, it appears that any jobs, income, and other economic activity created by wind projects are offset by relatively larger declines associated with the visual or audio disamenity of having wind turbines. In general, we conclude that the increase in GDP likely does not significantly benefit residents of the county.

Other variables associated with economic activity experience declines after wind energy development within about 3 years. Personal income declines more in the short run than in the long run; while employment, population, and home values continue to decline in the long run. Eventually, all these declines are likely tied directly or indirectly to reduced tourism, out-migration, and diminished residential demand resulting from audio or visual disamenity associated with wind turbines. As previously indicated, this means that the negative aspects of wind turbines are the dominant force, overcoming any additional jobs, taxes, and input purchases. It is important to note that these costs accrue broadly to a large group of residents in rural counties.

The increase in farmland values is likely due to revenue from lease payments and future wind development potential. These impacts diminish over time, as wind development matures and future development becomes less likely. The absence of impacts on agricultural cash rents is expected, as the increase in land values is not related to changes in the value of agricultural production. In this case, farmers and other landowners benefit from the lease payments and higher land values. The increased value of land assets improve financial balance sheets and help farmers improve access to credit among other benefits. Additionally, agricultural tenants are not made worse off, as rents do not follow land values. However, these benefits are concentrated among a relatively small group of residents.

3.2. Implications for Policy

The siting policy analysis underscores how local siting rules can influence these outcomes. On average, the results show that siting rules typically reduce—but do not eliminate—the negative impacts of wind turbines. This is likely due to the effect of restrictions to limit the disamenity of turbines by keeping them less prominent for residents and visitors. For GDP the improvement from siting rules likely comes from the arrest of the decline in other economic activity that subtracts from the value of electricity generated. Importantly, siting rules do not reduce the benefits to farmers, as land values have similar improvements regardless of such restrictions. The implication for rural counties is that any policies that make wind projects less conspicuous within the county may be effective in limiting the costs of wind development.

3.3. Conclusion

After more than 15 years of substantial wind energy development in the U.S., the local economic impacts have had time to materialize. The results are mixed, suggesting that counties considering wind projects face trade-offs. Moreover, well-designed siting restrictions can help counties capture economic benefits while limiting some of the downsides. In Arkansas, while no utility-scale wind projects are currently operating, there is strong wind resource potential in parts of the state. Our analysis aims to help inform policy discussions and provide the public with actionable information. However, our report is limited to a few measurable economic outcomes. Measuring additional economic variables—like local tax revenue—was limited by data availability. Moreover, this analysis does not quantify environmental and ecological impacts which are outside the scope of our expertise. Thus, decision makers and interested members of the public should seek additional information to explore these various costs and benefits.

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5. Appendix

Table A1: Summary of State Level Wind Turbine Siting Restrictions

Restriction Type	Unit	No. of States	No. of Counties	Avg	Min	Max
Structures	Meters	4	307	903.9	152.4	2,414.0
Structures	Max Tip-Height Multiplier	1	72	3.1	3.1	3.1
Structures	Hub Height Multiplier	1	9	1.5	1.5	1.5
Property Line	Max Tip-Height Multiplier	4	291	1.7	1.0	3.5
Property Line	Meters	1	88	403.9	403.9	403.9
Sound	dBA	4	254	46.8	35.0	60.0
Road/Highway	Meters	1	87	76.2	76.2	76.2
Road/Highway	Max Tip-Height Multiplier	1	72	1.1	1.1	1.1
Tower Density	Rotor Diameter Multiplier	1	87	5.0	5.0	5.0
Transmission	Max Tip-Height Multiplier	1	72	1.1	1.1	1.1

Notes: Restriction types with only a single instance are excluded.
Most listed restrictions refer to setbacks from existing features.
dBA (A-weighted decibels) measures sound adjusted for human hearing sensitivity.
Rotor Diameter, Hub-Height, and Max Tip-Height Multipliers define setbacks as multiples of turbine dimensions.

Table A2: Summary of County Level Wind Turbine Siting Restrictions

Restriction Type	Unit	No. of Counties	Avg	Min	Max
Road/Highway	Max Tip-Height Multiplier	324	1.3	1.0	6.5
Road/Highway	Meters	49	458.8	45.7	4,828.0
Road/Highway	Rotor Diameter Multiplier	12	1.4	0.5	5.0
Road/Highway	Hub Height Multiplier	2	1.3	1.1	1.5
Structures	Meters	222	503.7	3.0	3,218.7
Structures	Max Tip-Height Multiplier	131	14.0	1.0	457.2
Structures	Rotor Diameter Multiplier	4	5.1	5.0	5.5
Structures	Hub Height Multiplier	2	3.2	1.5	5.0
Property Line	Max Tip-Height Multiplier	242	1.5	0.5	6.5
Property Line	Meters	59	566.6	45.7	4,828.0
Property Line	Rotor Diameter Multiplier	26	1.7	0.5	5.0
Property Line	Hub Height Multiplier	4	1.6	1.0	3.0
Sound	dBA	197	52.8	30.0	70.0
Transmission	Max Tip-Height Multiplier	155	1.3	1.0	6.5
Transmission	Meters	14	383.4	61.0	3,218.7
Height	Meters	80	133.7	24.3	228.6
Waterbody	Meters	60	813.5	76.2	4,828.0
Waterbody	Max Tip-Height Multiplier	6	1.2	1.1	1.5
Banned		37			
Tower Density	Max Tip-Height Multiplier	15	1.2	1.1	2.0
Tower Density	Rotor Diameter Multiplier	9	3.3	3.0	6.0
Tower Density	Meters	3	127.0	61.0	228.6
Minimum Lot Size	Acres	20	45.7	1.0	500.0
Shadow Flicker	Hours/Year	13	18.9	0.0	36.0
Total Installation	Turbines	3	245.3	51.0	535.0
Oil & Gas Pipeline	Max Tip-Height Multiplier	2	1.0	1.0	1.1

Notes: Restriction types with only a single instance are excluded.
Most listed restrictions refer to setbacks from existing features.
dBA (A-weighted decibels) measures sound adjusted for human hearing sensitivity.
Shadow flicker is the recurring light-and-shadow effect caused by turbine blades passing in front of the sun, typically evaluated at occupied dwellings.
Rotor Diameter, Hub-Height, and Max Tip-Height Multipliers define setbacks as multiples of turbine dimensions.

Statistical methods

The baseline regression model is a classic two-way fixed effects approach with some additional control variables:

$$y_{it} = \alpha + \beta Turbines_{it} + \boldsymbol{\theta Z}_{it} + \lambda_i + \mu_t + \varepsilon_{it}$$

Where y_{it} is the economic outcome variable (GDP, personal income, employment, population, home values, or farmland values), $Turbines_{it}$ is the number of turbines, electrical generation per 100 square miles of land area, $\boldsymbol{Z}_{it}$ is a vector of controls (i.e. other economic variables, drought, government payments to farmers), λ_i is a county level fixed effect, μ_t is a time fixed effect, and ε_{it} is the error term. The county fixed effect accounts for county characteristics that do not change over time, while the time fixed effect accounts for factors that have a broad impact in a given year. In this model β is the coefficient of interest, which is reported in the tables X and Y and indicates the effect of wind turbines on economic outcomes.

The interaction model to measure the heterogenous effects by siting restrictions is:

$$y_{it} = \alpha + \beta Turbines_{it} + \delta Turbines_{it} * Restrictions_i + \boldsymbol{\theta Z}_{it} + \lambda_i + \mu_t + \varepsilon_{it}$$

Where all the definitions are the same as above, except δ is an interaction coefficient and $Restrictions_i$ is an indicator of the presence of any known siting restrictions including setbacks for, structures, property lines, roads or highways, transmission lines, waterbodies, as well as limits on sound, tower density, and height. The models we estimated via ordinary least squares using the “within” transformation for fixed effects. Additionally, heteroskedasticity robust standard errors were calculated using the MacKinnon–White estimate.

Contact Andrew Anderson (aa216@uark.edu) for additional information.

6. Key Terms

Agricultural Land Value – Average dollar value per acre of farmland.

Capacity Factor – How much electricity a turbine actually produces compared to its maximum.

Cash Rent – Price farmers pay per acre to rent land (irrigated or non-irrigated).

County GDP – Total value of goods and services produced in a county.

Employment – Number of jobs located in a county.

Hub Height – Height from the ground to the turbine hub (center of blades).

Rotor Diameter – Distance across the circle made by spinning blades.

Rotor Sweep – Total area the blades cover when spinning.

Tip Height – Maximum height reached by a blade at its top point.

Personal Income – Total income for all residents in a county.

Real GDP – GDP adjusted for inflation to compare over time.

Restrictiveness Index (RRI) – A score showing how strict a county's siting rules are, combining setbacks, sound, height, and spacing rules.

Setback – Required distance between turbines and homes, property lines, roads, transmission lines, or waterbodies. Measured in meters or multiples of turbine dimensions.

Sound Limit (dBA) – A rule limiting the maximum sound level from a turbine at a nearby property. Typical limits range from 30 to 55 decibels (dBA).

Height Limit (meters) – A rule capping the maximum tower or tip height of turbines.

Tower Density Restriction – Spacing requirements that limit how close turbines can be to each other. Measured in meters or multiples of turbine dimensions.

Siting Restrictions (Zoning Ordinances) – Local or state rules controlling where and how turbines can be built, including setbacks, sound limits, and height caps.

Single-Family Home Value – Average home price in a county.

Turbine Density – Number of turbines per 100 square miles in a county.

Utility-Scale Turbines – Grid-connected wind turbines for commercial electricity production. Defined here as turbines with capacity above 500 kW.

Wind Project – A group of turbines built together typically by the same developer.