WIMBY: Wind In My Back Yard?

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Abstract

This paper examines how local costs and benefits shape political support for wind energy development in the United States. While wind projects generate substantial public health and climate benefits, they also impose concentrated local costs that can lead to opposition and blocked projects. Using data on proposed wind projects in Illinois, I estimate that environmental benefits exceed local property value losses by more than a factor of thirty, highlighting the inefficiency of project rejections. To better understand the political dynamics, I link spatial variation in local costs and benefits to precinct-level election results for the county officials responsible for project approval. I find that incumbents lose vote share in precincts that incur property value losses, but gain support in precincts that receive property tax revenues. These findings underscore the political challenges of renewable energy deployment in a decentralized regulatory system and point to the potential for policies that better align local incentives with national climate goals.

1 Introduction

Wind power has expanded rapidly in the U.S., growing from 1 percent of electricity generation in 2008 to 10 percent in 2023. This growth has reduced air pollution and carbon emissions, but local opposition and regulation increasingly constrain new development. While the environmental benefits of wind power are diffuse, the costs are concentrated. Hedonic pricing studies find that wind turbines reduce nearby property values by up to 11 percent within one mile, with smaller effects extending to two miles (Parsons and Heintzelman, 2022; Guo et al., 2024; Brunner et al., 2024). These localized costs have driven opposition to wind projects across the U.S. Eisenson et al. (2024) identified 378 examples of wind and solar projects that were contested or blocked at the local level. Furthermore, a recent survey of wind developers found that nearly 50 percent of wind siting applications within the last five years faced significant delays, with 30 percent outright cancelled, often due to local opposition (Nilson et al., 2024).

At the same time, wind projects can generate significant fiscal benefits for local communities through the property tax system. Brunner et al. (2022) find that wind turbine installation increases local school district revenues by roughly \$1,000 to \$1,500 per pupil, relative to a mean local revenue of \$6,000 per pupil in these districts. This creates a tension for local governments, which must weigh opposition from nearby landowners against fiscal benefits for the broader community.

This paper explores how local costs and benefits shape political support for wind energy development in the United States. The analysis proceeds in two parts. First, I estimate the local property value losses, local tax benefits, and diffuse environmental benefits associated with proposed wind projects in Illinois. Second, I link spatial variation in local costs and benefits to electoral outcomes for local officials responsible for project approval.

Across all projects, I find that estimated environmental benefits are substantially larger than estimated property value losses. As a result, project rejections due to local opposition are likely to generate large inefficiencies. Furthermore, I find that proposed projects with higher local tax revenue and lower local property value damages are more likely to be built. I take these cross project comparisons to be suggestive but not causal evidence of the relationship between local costs and benefits and project approval.

To study this relationship more rigorously, I turn to within county variation in the local costs and benefits associated with each built project. I estimate the local property value damages and school district tax revenue in each precinct within a county that approves a wind project. I then use a stacked difference-in-differences approach to analyze the precinct-level election performance of the local county board members responsible for wind project approval. Following project approval, I find that incumbent vote shares fall in precincts that primarily incur costs and rise in precincts that primarily receive benefits relative to control precincts in the same county.

These results contribute to a broad literature on NIMBYism and local opposition to undesirable projects (Glaeser, 2005; Hamilton, 1993). My work is most closely related to Jarvis (2023), who finds that local opposition leads to the spatial misallocation of wind energy in the UK. By focusing on the U.S. context, I am able to examine an expanded set of political dynamics. In particular, unlike in the UK, the U.S. property tax system channels direct fiscal benefits to local communities, creating an opportunity to study how these local benefits influence support for wind projects. This paper also relates to a growing literature on the electoral impacts of wind energy development (Stokes, 2016; Germeshausen et al., 2022; Urpelainen and Zhang, 2022). To my knowledge, it is the first to examine electoral consequences for local officials responsible for project approval and to assess how voters respond when they receive fiscal benefits without bearing local costs.

My findings highlight the political challenges of deploying renewable energy in a decentralized regulatory system. Concentrated local costs can create electoral pressures for local government officials to reject wind projects with broad environmental value. At the same time, local fiscal benefits can incentivize support. Recognizing these dynamics can help inform policies that better align local political incentives with national climate goals.

2 Institutional Background

County governments play a central role in regulating wind energy in the U.S., shaping both where turbines are sited and how the resulting tax revenues are distributed. This section provides institutional background on local permitting and taxation systems, with a focus on Illinois.

2.1 Permitting and Local Regulation

In the U.S., wind energy projects are typically subject to local county government regulation. Many counties require wind projects to obtain discretionary permits from county or zoning boards. Counties may also adopt zoning ordinances specific to wind energy that constrain where projects can be sited, most commonly through setback requirements from property lines or buildings. As documented by Winikoff (2022), the number of counties with separate wind ordinances and permitting systems has increased rapidly in the past two decades. The proliferation of such local regulations may present a barrier to the future growth of the wind industry. According to a recent survey by the Lawrence Berkeley National Laboratory, 80 percent of wind developers cited local zoning ordinances as a top reason for project delay and cancellation (Nilson et al., 2024).

2.2 Taxation and Fiscal Impacts

The taxation of wind turbines varies widely across states. In most states, turbines are assessed as real property and taxed at standard local property tax rates. Some states set these valuations centrally, while others allow local assessors to determine value (Kent, 2019). Four states levy production-based taxes, but in all others, local tax revenue from wind is decoupled from actual electricity generation (Brunner et al., 2022). Some states encourage payments in lieu of taxes (PILOTs) from wind developers to local governments, but these arrangements are not standardized.

Beyond tax payments, wind developers have some ability to increase local economic benefits in a community by making corporate donations to local institutions such as libraries, schools, or little league teams. However, in practice these payments appear to be somewhat limited in scope. The largest wind developer in the U.S., NextEra Energy Resources, report that they contributed $1.5 million to community organizations in 2017. The next largest developer, Invenergy, reports $1.7 million in donations in 2021. For comparison, the wind industry paid $912 million in local taxes in 2019 (AWEA). If NextEra and Invenergy paid a share of these taxes equivalent to their share of installed wind capacity, their corporate donations would amount to just 1.5 percent of their property tax payments.

2.3 Illinois as a Case Study

This paper focuses on Illinois, where the tax system offers key advantages for analysis. First, turbine assessment is standardized statewide at $360,000 per megawatt of nameplate capacity, creating a clear and predictable valuation for all parties. Second, because actual tax revenue depends on the local property tax rate, there is substantial heterogeneity in local fiscal benefits across similar projects. These revenues can also be distributed unevenly within a county due to the boundaries of overlapping taxing authorities, especially school districts.

Some other states also have standardized tax systems, most notably those using production taxes. However, these tend to generate limited variation in local revenue. States with PILOT arrangements or county-by-county assessments do show greater revenue heterogeneity, but these systems are less transparent and rely more on local discretion.

Beyond its tax system, Illinois serves as a good case study because it has the fifth highest installed wind capacity among U.S. states, almost all counties require wind projects to obtain discretionary permits, and wind energy is a contentious issue in the state (Winikoff, 2022,Eisenson et al., 2024, Stokes et al., 2023).

2.4 Political Salience and Local Elections

County government decisions to approve or reject wind project permits are often contentious and highly visible local issues.[1] Public meetings on wind siting frequently draw large crowds, and local media provide extensive coverage. School officials often testify in support of proposed projects, highlighting expected tax revenues for their districts.[2] Consequently, wind development can become a salient issue in county board elections. In several documented cases in Illinois, county board races have effectively become referenda on proposed wind projects.[3] These patterns motivate this paper's focus on the relationship between local elections and the distribution of local costs and benefits.

[1]Gelles, David. 2022. The U.S. Will Need Thousands of Wind Farms. Will Small Towns Go Along? *The New York Times.*

[2]For example, from the Kankakee County Board Meeting Minutes, August 11, 2015: "Mr. Jeff Bryan, Superintendent of the Tri-Point Schools, spoke in favor of the Kelly Creek Wind Farm expansion. He anticipated a little over $400,000 a year in tax revenues for the school district and urged the board to support this project."

[3]See, for example:
Lydersen, Kari. 2018, November 5. How a county election in rural Illinois became a referendum on wind energy. *Energy News Network.*
https://energynews.us/2018/11/05/how-a-county-election-in-rural-illinois-became-a-referendum-on-wind-energy/
Woods, Gordon. 2020, November 5. Four challengers win county board seats. *Clinton Journal.*
https://theclintonjournal.com/stories/four-challengers-win-county-board-seats,14088

3 Existing Literature

A growing body of work documents increasing local opposition to wind energy and the expanding role of local regulation in siting decisions. Eisenson et al. (2024) provide examples of 378 contested or blocked renewable energy facilities across the U.S., as well as 395 local policies intended to restrict renewable energy development. Winikoff (2022) and Lerner (2022) study the determinants of wind energy zoning law uptake in the United States, and document the increasing prevalence and stringency of these laws in recent years. Lopez et al. (2021) leverage detailed spatial data from the National Renewable Energy Laboratory to demonstrate that such zoning laws have significantly reduced the land area available for wind development in the U.S.

At the same time, wind turbine installations have been shown to produce significant local economic benefits. Brunner et al. (2022) and Brunner and Schwegman (2022) find that wind development leads to substantial increases in local government and school district revenues. Brunner et al. (2022) and Kahn (2013) show that some local governments have responded by lowering property tax rates. Gilbert et al. (2024) find that wind projects increase employment and earnings for workers within 20 miles.

Additionally, several studies have explored how wind development affects electoral outcomes. In Ontario, Stokes (2016) finds that the vote share of the political party responsible for a law promoting wind energy development declined by 5-10 percent in precincts with resulting turbine development. Similarly, in Germany, Germeshausen et al. (2022) find that an additional wind turbine in a community reduced the vote share for the Green Party by 17 percent in federal elections. In contrast to this evidence of backlash to wind turbine development, Urpelainen and Zhang (2022) find a positive association between wind turbine installations and democratic vote share in U.S. house elections. The authors attribute this finding to the level of geographic aggregation. Stokes and Germeshausen focused on the immediate geographic areas surrounding wind turbines, where negative externalities are likely to be concentrated. In contrast, Urpelainen and Zhang examined vote shares across entire congressional districts, which are likely to include individuals that see economic benefits from wind energy but do not experience negative externalities.

This paper contributes to this literature by focusing on the electoral consequences of wind development for the local officials responsible for project approval. To my knowledge, this is the first study to analyze electoral consequences for such local government officials. Given that these local officials are the primary decision makers for wind project approval, their electoral incentives are likely to have particularly large consequences for wind energy development. Second, I build on the literature documenting local fiscal benefits from wind by testing whether electoral outcomes vary across areas that receive different levels of local tax revenue and property value impacts. While prior survey-based research has linked favorable attitudes toward wind development to perceptions of economic benefit (Hoen et al., 2019; Rand and Hoen, 2017), no existing study, to my knowledge, has tested whether realized local benefits shape voter behavior in actual elections.

In related work, Jarvis (2023) examines the spatial misallocation of wind energy in the UK due to local opposition. Jarvis estimates the project-level costs and benefits of proposed wind projects, and finds that the UK could have achieved the same wind capacity with £8 to £23 billion greater net benefits by approving a different set of projects. Jarvis also finds that projects with high local costs in wealthy areas were significantly less likely to be approved, while diffuse environmental benefits appear to have little influence on approval decisions. The first component of my analysis is conceptually similar but focuses on the U.S., where the cost-benefit profile of wind development differs substantially due to a more carbon-intensive electric grid and the presence of local property tax revenues.

Finally, this paper also relates to broader work on NIMBYism and the siting of locally undesirable facilities. Prior studies have shown that governments often locate polluting facilities near jurisdictional borders or away from politically active constituencies (e.g., Hamilton 1993; Helland and Whitford 2003; Morehouse and Rubin 2021). A large literature on housing has documented how local opposition can prevent new development, with substantial economic costs (e.g., Glaeser and Gyourko 2005; Gyourko and Malloy, 2014). This paper adds to this literature by studying a setting where the locally undesirable facility produces large positive externalities and spatially distinct local costs and benefits.

4 Empirical Analysis

4.1 Estimating Project Costs and Benefits

In the first part of the analysis, I estimate the local costs, local fiscal benefits, and broader external benefits associated with proposed wind projects in Illinois. Specifically, I quantify property value losses to nearby residents, tax revenue accruing to local school districts, and the health and climate benefits from reduced emissions. While local tax revenue is a transfer from wind developers to local governments and not an external benefit, it is important to the political economy of project approval. Overall, I find that the estimated health and climate benefits of wind projects are significantly larger than the estimated property value damages for all proposed projects in Illinois, suggesting that local opposition can result in inefficient project rejections.

The specific methodologies I use to estimate these costs and benefits are described below. Importantly, I make a number of simplifying assumptions and often rely on estimates developed in prior studies. I intend for my results to be suggestive of the relative magnitudes of costs and benefits, but not necessarily precise for each project.

4.1.1 Identifying Proposed Projects

I rely on the Federal Aviation Administration (FAA) permit application database to identify proposed wind projects in Illinois. The FAA requires permits for all structures in the U.S. exceeding 200 feet above ground level, which includes all commercial scale wind projects built in Illinois. Wind developers typically undertake this permitting process early in project development, often before local permits are procured. As a result, this dataset includes a large number of proposed projects that were cleared by the FAA as presenting no hazard to aviation but never built. I do not observe the reasons these projects were not built. Local permitting and zoning challenges are one hurdle, though other factors such as project economics or grid interconnection could also halt development.

Since the FAA dataset was not designed to track wind projects specifically, significant cleaning was required to make it usable. I grouped permit applications for individual turbines into projects based on similarities in location, application sponsor, and date. I also identified and removed permitted turbines that were never built that nonetheless had a slightly revised permit built on nearly the same location by the same developer. I split groups of permits that span multiple counties into separate projects, since each county requires separate local permitting. Altogether, I identify 99 proposed wind projects in Illinois based on the FAA permit data. Only 51 of these projects were ultimately built.

4.1.2 Health and Climate Benefits

I estimate the health and climate benefits of each project as a function of estimated electricity production and the estimated emissions displaced by that production. To estimate electricity production for each project, I start by estimating the nameplate capacity and capacity factor for each turbine.[4] The FAA database lacks information on turbine nameplate capacity but includes turbine height, which correlates strongly with capacity. Using the USGS U.S. Wind Turbine Database, I estimate a relationship between height and capacity (see Figure **??** in the appendix), where height and its square explain 73% of capacity variation. I apply this model to estimate nameplate capacity for turbines in the FAA database. Next, I assign each turbine a capacity factor based on National Renewable Energy Laboratory (NREL) estimates of wind turbine capacity factors at the 10 kilometer grid cell level across the U.S. (National Renewable Energy Lab, 2023). Finally, I estimate the annual electricity generation for each project as a function of the estimated nameplate capacity and capacity factor for each turbine:

$$\text{ElectricityGen (MWh)} \quad = \quad \text{NameplateCapacity (MW)} \times \text{CapacityFactor} \times 365 \left(\frac{\text{days}}{\text{year}}\right) \times 24 \left(\frac{\text{hours}}{\text{day}}\right) \tag{1}$$

Next, I map these estimates of annual power output to health and environmental benefits using estimates from existing studies. In particular, I rely on the U.S. DOE's estimate that the marginal MWh of wind generation produces $37 of health benefits from reduced air pollution (Wiser et al., 2023). Additionally, I rely on Fell and Johnson (2021), who estimate that one MWh of wind generation reduces CO_2 emissions by 0.65 tons in the Midwest.[5] I combine this estimate of CO_2 reductions with year-specific EPA estimates of the social cost of carbon (SCC) (EPA, 2023) to calculate the climate benefits of each project. The EPA estimates the SCC as $190 per ton in 2020, rising to $310 per ton by 2050.

[4] Nameplate capacity refers to the maximum output of a generator while it is producing electricity. Capacity factor refers to the ratio of the actual output of a generator to its nameplate capacity over a given period of time. For wind projects, the capacity factor is heavily dependent on wind speed and consistency at the project location.

[5] The estimate of avoided emissions is based on a regression analysis of coal and natural gas generation on hourly wind generation.

Finally, I convert annual estimates to present value by discounting at a 2 percent rate over a 30 year project lifespan.[6] Equations 2 and 3 summarize the calculations.

$$\text{PV of Health Benefits} = \sum_{t=1}^{30} \left[\frac{\text{ElectricityGen (MWh)} \times \$37 \text{ / MWh}}{(1+0.02)^t} \right] \tag{2}$$

$$\text{PV of Climate Benefits} = \sum_{t=1}^{30} \left[\frac{\text{ElectricityGen (MWh)} \times 0.65 \left(\frac{\text{tCO}_2}{\text{MWh}}\right) \times \text{SCC}_t \left(\frac{\$}{\text{tCO}_2}\right)}{(1+0.02)^t} \right] \tag{3}$$

4.1.3 Local Tax Revenue

The tax treatment of wind turbines in Illinois was standardized under state law beginning in 2007. All wind turbines in Illinois are assessed at $360,000 per megawatt of nameplate capacity, adjusted by a year specific trending factor and a standardized depreciation schedule (Illinois Department of Revenue (IDOR), 2024). Wind turbines are then subject to the same property tax rates as other properties in the same jurisdiction. Using the estimated nameplate capacity for each project and Illinois's standardized assessment formula, I calculate each project's assessed value in each year. I then multiply these values by the relevant school district tax rate in the year of the permit application to estimate project tax revenues.[7]

Since school districts often span multiple counties, I adjust the revenue estimate to isolate the share that accrues to the county responsible for permitting. Specifically, I multiply each project's school district tax revenue by the share of housing units in the school district that are located within the county containing the project. This adjustment ensures that I focus on the fiscal benefits relevant to the local permitting authority. Finally, I calculate the present value of the stream of revenues over a 30-year project lifespan, discounted at 2 percent. Equations 4 and 5 summarize the calculations.

$$\text{AssessedValue}_t = \text{ProjCapacity (MW)} \times \$360{,}000 \times \text{TrendFactor}_t \times \text{DeprFactor}_t \tag{4}$$

$$\text{PV of Tax Revenue} = \sum_{t=1}^{30} \left[\frac{\text{TaxRate}_1 \times \text{AssessedValue}_t \times \text{CountyPct}}{(1+0.02)^t} \right] \tag{5}$$

[6] I use a 2 percent discount rate to be consistent with the Office of Management and Budget's Circular A-4 guidance for regulatory analysis.

[7] I collected tax rates by year from the Illinois Department of Revenue.

4.1.4 Housing Damages

Brunner et al. (2024) analyze the universe of commercial wind projects and residential property transactions in the U.S. Using a difference-in-differences approach, they estimate that wind projects reduce property values within one mile by 11 percent and property values within one to two miles by 3 percent. To estimate housing damages for each project, I identify the number of housing units within U.S. Census blocks zero to one miles from each project and one to two miles from each project in the same county. I then assign a housing value to the housing units in each block based on the average housing value in the corresponding Census block group[8]. Using the Brunner et al. (2024) estimates, I then estimate the total housing damages incurred by each project as follows:

$$\begin{aligned} \text{Housing damages} \quad &= \quad \text{HousingUnits (0-1 miles)} \times \text{AvgValue (0-1 miles)} \times -11\% \\ &\quad + \text{HousingUnits (1-2 miles)} \times \text{AvgValue (1-2 miles)} \times -3\% \end{aligned} \tag{6}$$

I assume that the negative externalities of wind projects are fully capitalized into property values in the year of project approval.[9] Thus, housing damages do not need to be discounted over the project life.

4.1.5 Results

I find that the average proposed project reduces local housing values by \$9 million, generates \$17 million in school district tax revenue, and produces over \$300 million in health and climate benefits. Figures 1 and 2 compare the housing value damages to the health and climate benefits and local tax revenue respectively for each proposed project. While tax revenues exceed local costs on average, there is considerable variation. In some cases, housing damages exceed tax benefits. However, the external health and climate benefits are consistently much larger than both. Even for the least favorable proposed project, the external benefits are still four times larger than the housing damages.

[8](Census block groups are smallest geographic unit for which the Census Bureau reports housing value data)

[9]This is consistent with existing literature. Many studies also find that effects on property values decline over time, though I do not account for that here.

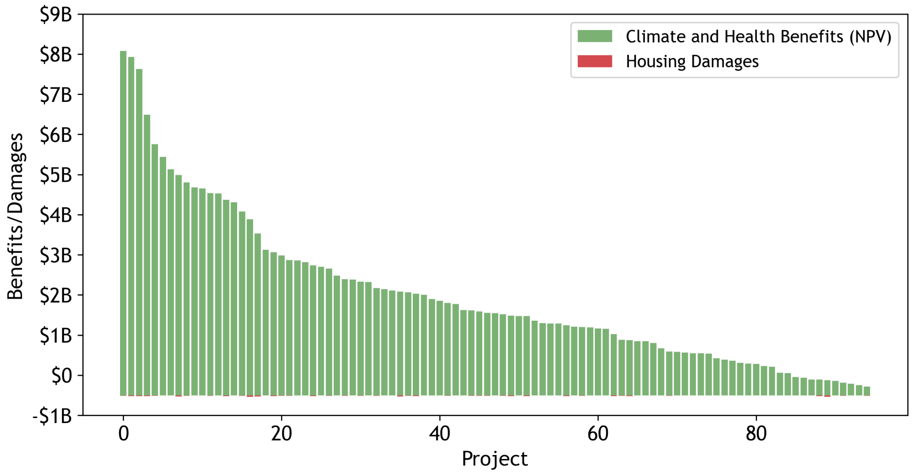


Figure 1: Global benefits and local costs of proposed wind projects

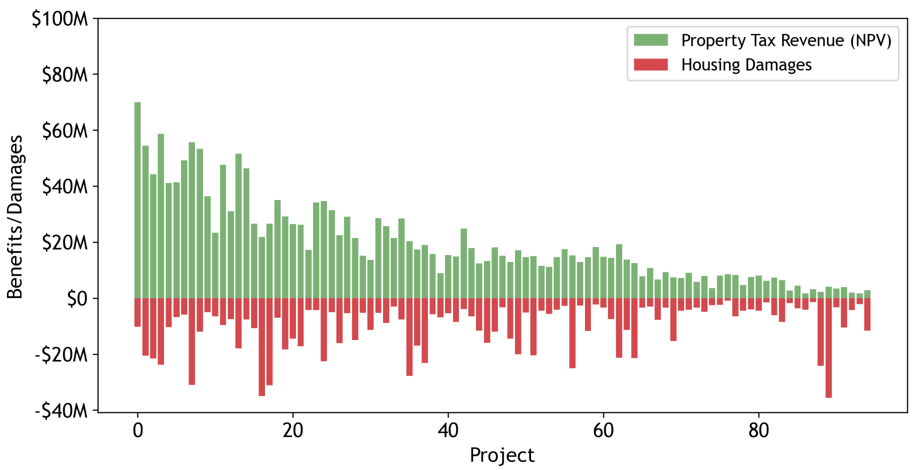


Figure 2: Local benefits and local costs of proposed wind projects

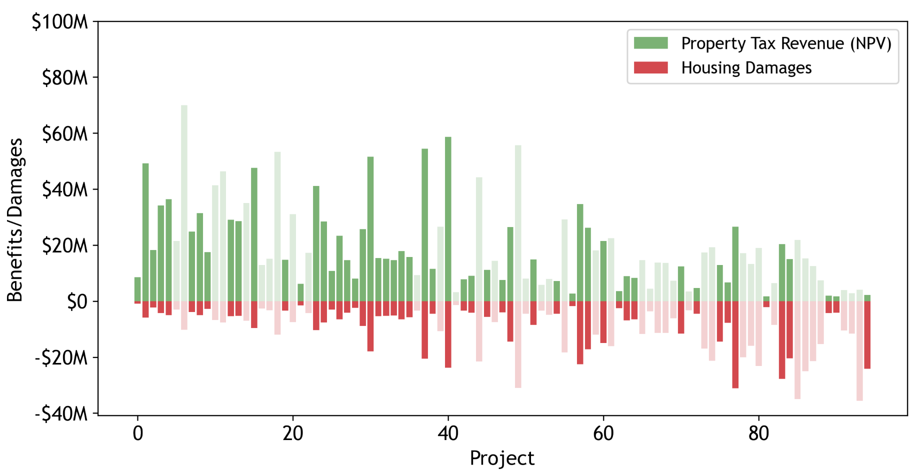


Figure 3: Local benefits and local costs of proposed wind projects. Sorted by ratio of benefits to costs. Faded projects not built.

Next, I examine differences in estimated costs and benefits across projects that were built and projects that were not built. Figure 3 shows the same local costs and benefits as Figure 2, but sorted by the ratio of benefits to costs. Faded bars represent proposed projects that were not built. As the figure demonstrates, projects with higher estimated benefits relative to costs were more likely to be built.

To more formally examine how estimated costs and benefits predict project approval, I regress an indicator for whether a proposed project was ultimately built on per-household measures of local costs, local fiscal benefits, and external health and climate benefits. Expressing costs and benefits on a per-household basis provides a more relevant scale for assessing how these factors might influence the decisions of voters and government officials.[10]

$$\text{Built} = \alpha + \beta_1 \text{HousingDamages} + \beta_2 \text{TaxRevenue} + \beta_3 \text{ExternalBenefits} + \varepsilon \tag{7}$$

Table 1 summarizes the results. Column 1 presents the baseline specification, while Column 2 adds year fixed effects. Across both specifications, projects with higher estimated property tax revenue per household and lower housing value losses per household are more likely to be built. In contrast, external climate and health benefits show no relationship to project construction.

Column 3 includes additional measures of housing damages and property tax revenue that accrue to neighboring counties rather than the county with permitting authority. These out-of-county variables have smaller and statistically insignificant coefficients, while the estimated effects of within-county costs and benefits remain significant. This pattern provides some suggestive evidence that the observed relationships are not just confounded by omitted spatial characteristics that might be correlated with both the costs and benefits of wind projects and the likelihood of project construction (e.g., demographics, land uses, or political preferences).

Overall, these findings are consistent with a model in which local permitting authorities respond to the concentrated costs and benefits experienced by their own constituents, but not necessarily the impacts that accrue outside of their jurisdiction, either to neighboring counties or to society broadly. However, these findings should be interpreted as descriptive and exploratory, rather than causal.

[10] For example, \$1 million in local revenue is more impactful in a school district serving 1,000 households than in one serving 10,000.

Table 1: Effects of costs and benefits on project construction

	Dependent variable: *Built*		
	(1) Baseline	(2) + Year FE	(3) + Out-of-county
Housing damages	-0.0710***	-0.0701***	-0.0730***
	(0.0209)	(0.0232)	(0.0220)
Out-of-county			0.0683
			(0.0847)
Property tax revenue	0.0419*	0.0476**	0.1162**
	(0.0246)	(0.0218)	(0.0516)
Out-of-county			0.0765
			(0.0575)
Climate and health benefits	-0.0000	0.0001	-0.0006
	(0.0002)	(0.0002)	(0.0005)
Constant	0.6028***	0.6288***	0.5789***
	(0.0720)	(0.1411)	(0.1504)
Observations	97	97	97
R-squared	0.103	0.344	0.363
Year fixed effects	No	Yes	Yes
Mean of dep. var.	0.55	0.55	0.55

Notes: All monetary variables are in $100s per capita. Out-of-county refers to local costs or benefits that accrue outside the county responsible for project approval. Robust standard errors in parentheses.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

4.2 Local Election Results

In the prior section, I show that built wind projects in Illinois tend to have higher local benefits and lower local costs than proposed projects that are not built. However, there may be unobserved differences across projects that are associated with both costs and benefits and likelihood of project completion. To more credibly estimate the relationship between costs and benefits and project support, I exploit the fact that costs and benefits are not shared equally across all residents of a county. On average, only 5 percent of county residents live close enough to a proposed project site to incur property value losses, while 32 percent live in a school district that would receive project revenues.

In this section, I analyze differences in project support among residents with different levels of costs and benefits within the same county as each wind project. I proxy for local support using vote shares for the incumbent county board members responsible for approving wind project permits. Specifically, I test whether voters in precincts with local costs punish incumbents at the polls, and whether voters in precincts with local benefits reward them.

4.2.1 Data

I assembled a novel dataset of county board election results at the precinct level in Illinois. This required the collection and standardization of results from individual county websites in a variety of formats. Some counties publish data files with election results, while others only publish PDF scans which required significant processing. Once I collected this data, I canonicalized candidate names to identify repeat candidates across elections. Additionally, I reviewed county board meeting minutes, archival county websites, and local newspaper articles to identify the dates of wind project approvals as well as the incumbent candidates at the time of each election.

Notably, county board structures vary across Illinois counties. The number of representatives serving a county board district ranges from one to ten, and the number of seats up for election varies by board district and election year. Most counties stagger elections, with roughly half of the board elected every two years, though typically all seats are up for election following the decennial redistricting process. Voters can cast votes for as many candidates as there are seats up for election in their district. As a result, candidate vote shares are not directly comparable across districts or even across years within the same district.[11] To measure incumbent performance over time, I thus do not rely on raw vote shares for individual candidates. Instead, I measure aggregate incumbent performance by calculating the total vote share received by all incumbents within a given precinct and election year.[12]

So far, I have collected county board election results for 36 wind projects in Illinois. There are

[11] For example, earning 10 percent of the vote in a district with 10 seats up for election is more impressive than earning 10 percent of the vote in a district with 1 seat up for election.

[12] Appendix X provides results using alternative measures of incumbent performance.

approximately 15 additional wind projects in Illinois for which I have not yet been able to obtain data, either because (1) the project is too recent for post-approval election results to be available, or (2) the county has not publicly posted precinct-level election results for the relevant years. [13].

After cleaning the election data, I matched precinct names from the election results to 2020 precinct boundary shapefiles from the U.S. Census Bureau. I then combined these boundaries with spatial data on wind project locations and school district boundaries to estimate the costs and benefits of each project for each precinct, using the same methods described in the previous section. I divided these totals by the number of households in each precinct to calculate average costs and benefits per household.

Based on these per-household estimates, I assign each precinct within a county to one of four groups: [14]

- **Cost:** Precincts with estimated damages greater than $1,000 per household and estimated tax revenue less than $1,000 per household.
- **Benefit:** Precincts with estimated tax revenue greater than $1,000 per household and estimated damages less than $1,000 per household.
- **Cost-Benefit:** Precincts with estimated damages greater than $1,000 per household and estimated tax revenue greater than $1,000 per household.
- **Control:** Precincts with estimated damages and tax revenue less than $1,000 per household.

The $1,000 per-household threshold ensures that precincts with negligible costs or benefits are not included in the treatment groups. For example, precincts for which only a small portion of households are located within 2 miles of a turbine or within a school district that receives tax revenue. Results are robust to alternative thresholds (Appendix X). Figure 4 demonstrates the assignment of precincts to the four groups for a single wind project in DeWitt County, Illinois.

[13] Some counties only publish election results for recent years, while others only publish aggregate results without precinct-level detail. I reached out to all counties that do not publish precinct-level results to inquire about data availability. Several counties did not respond to initial attempts at contact or did not have access to the data. I plan to continue to follow up with these counties.

[14] Appendix X provides results using alternative methods of assigning precincts to groups.

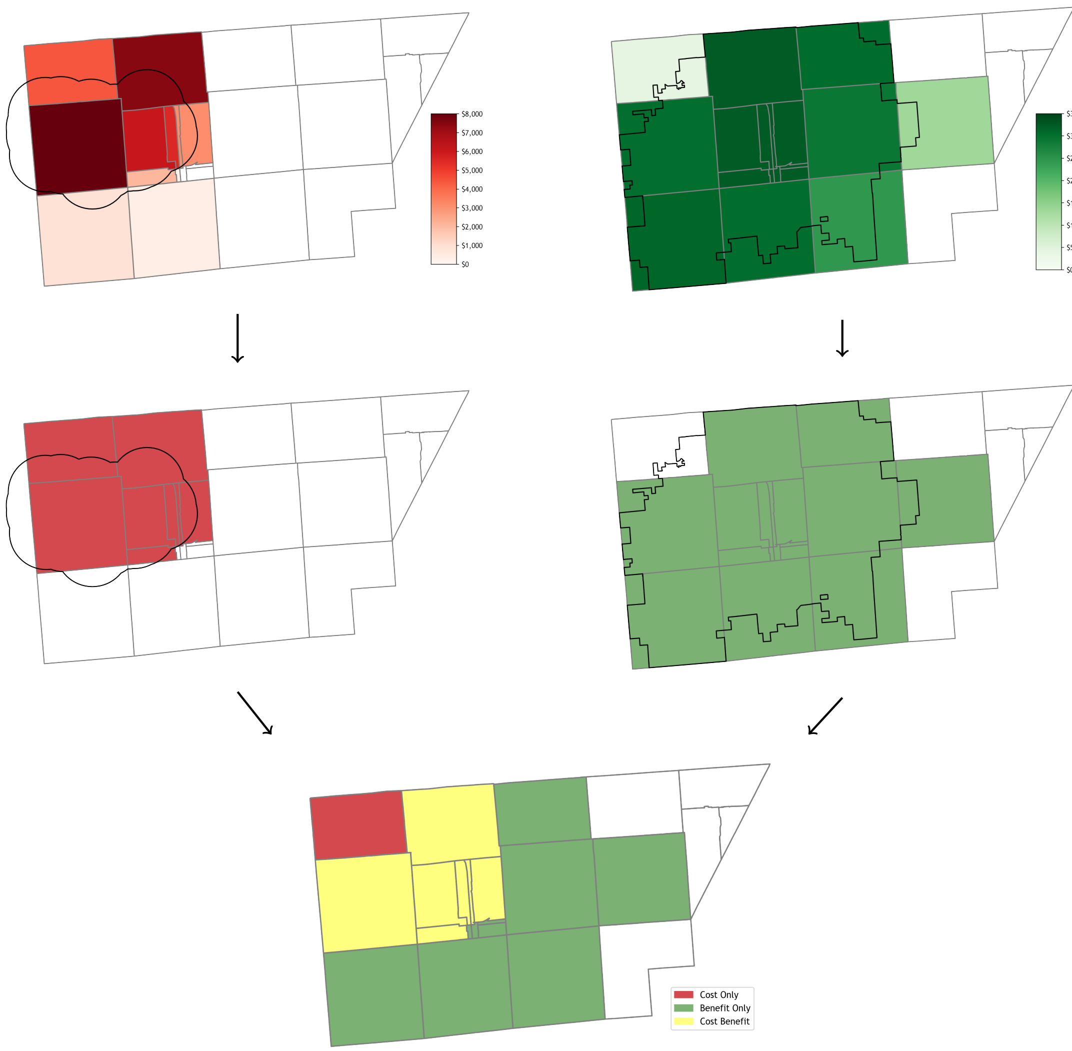


Figure 4: Precinct assignment for a single wind project in DeWitt County, Illinois
Note: Need to update this figure with clearer labels

4.2.2 Empirical Strategy

To test whether exposure to wind project costs or benefits produces a local electoral response, I estimate a stacked difference-in-differences model using precinct-level county board election results. For each of the 36 wind projects, I construct a panel of incumbent vote shares at the precinct-level for the two elections before and after project approval, then stack these into a single dataset indexed by relative time. To isolate within-county variation and account for project-specific time trends, I include fixed effects for precinct $\times$ project and event time $\times$ project. The outcome variable is the combined vote share for incumbent county board candidates in a given precinct (p) and election year (t) for a given project (j). The treatment variables are indicators for whether a precinct falls into the cost, benefit, or cost-benefit groups in the post-approval period, with the control group comprising precincts in the same county that fall into none of these categories. The estimated equation is:

$$Y_{ptj} = \gamma_{pj} + \delta_{tj} + \beta_1 \text{Cost}_{ptj} + \beta_2 \text{Benefit}_{ptj} + \beta_3 \text{CostBenefit}_{ptj} + \varepsilon_{ptj} \tag{8}$$

In addition to the baseline model, I estimate an extended specification that allows for both direct and spillover effects of treatment exposure. I construct leave-one-out measures of the share of other precincts within the same electoral district that are exposed to each type of treatment. These district-level exposure variables allow me to test whether changes in incumbent support reflect not only a precinct's own exposure to costs or benefits, but also broader political dynamics at the district level.

The main reason to expect such spillovers is that wind projects may affect local elections by changing the entry decisions of challengers. For example, a wind project that produces high costs in several precincts in a district might induce a challenger to enter the race in that district. This challenger appears on all ballots in the district, even in precincts that are not directly affected by the project. Thus, the challenger's entry is likely to mechanically reduce incumbent vote share in all precincts of the district, not just those directly exposed to project costs.

The extended regression that estimates these spillover effects is as follows:

$$\begin{aligned} Y_{ptj} = \gamma_{pj} + \delta_{tj} + \beta_1 \text{Cost}_{ptj} + \beta_2 \text{SpilloverCost}_{ptj} + \beta_3 \text{Benefit}_{ptj} + \beta_4 \text{SpilloverBenefit}_{ptj} \\ + \beta_5 \text{CostBenefit}_{ptj} + \beta_6 \text{SpilloverCostBenefit}_{ptj} + \varepsilon_{ptj} \end{aligned} \tag{9}$$

This specification allows me to separately identify whether voters punish or reward incumbents for their own precinct's treatment status (direct effects), or for the broader level of treatment across the district (spillover effects).

Finally, I estimate an event study model to allow for differential effects of wind projects over time and to visually inspect for pre-trends:

$$Y_{ptj} = \gamma_{pj} + \delta_{tj} + \sum_{\tau \neq 0} \big(\beta_{1,\tau} \, \text{Benefit}_{pj} \, \mathbf{1}\{t = \tau\} + \beta_{2,\tau} \, \text{Cost}_{pj} \, \mathbf{1}\{t = \tau\}$$
$$+ \beta_{3,\tau} \, \text{CostBenefit}_{pj} \, \mathbf{1}\{t = \tau\} \big) + \varepsilon_{ptj} \tag{10}$$

In all models, by including precinct × project FEs and event time × project FEs, I ensure that my results are identified off of within project variation in precinct-level election results over time. Specifically, I rely on the parallel trends assumption that in the absence of the wind project, the precincts that received costs or benefits from the project would have experienced similar changes in incumbent vote share as the precincts in the county that did not receive costs or benefits. By ensuring that I only make within project comparisons to carefully selected control groups, this stacked approach avoids the potentially problematic comparisons between early- and late-treated units that can arise in traditional TWFE designs with staggered treatment timing (Cengiz et al., 2019; Baker et al., 2022).

4.2.3 Results

Table 2 presents the results of the stacked difference-in-differences regressions. Column 1 shows the baseline specification. Following project approval, Cost precincts see a statistically significant 14 percentage point decline in the share of votes going to incumbent county board members, relative to other precincts in the same county. In contrast, Benefit precincts exhibit a 10 percentage point increase in incumbent vote share after project approval. These results suggest that voters reward or punish incumbents based on how their precinct is affected by wind project siting.

The coefficient on the CostBenefit term is positive but statistically insignificant, suggesting a muted or heterogeneous electoral response in areas that experience both local disamenities and fiscal gains. To explore this heterogeneity more directly, Column 2 of Table 2 disaggregates the mixed-exposure group into “net benefit” and “net cost” precincts, based on whether estimated local tax revenue exceeds estimated property value losses. The results reveal divergence within this mixed-exposure group. In precincts where estimated benefits outweigh costs, incumbents gain roughly 8 percentage points in vote share following project approval. In contrast, there is no discernible electoral response in precincts where costs exceed benefits.

Column 3 incorporates measures of indirect spillover exposure, defined as the leave-one-out share of other precincts in the same electoral district experiencing each treatment type. The results show that district-wide treatment exposure affects incumbent support. A one standard deviation increase in the share of cost-exposed precincts in the district reduces incumbent vote share by 3 percentage points, while a one standard deviation increase in the share of benefit-exposed precincts raises it by 4 percentage points. These findings suggest that precinct-level costs and benefits can shape the district-wide political environment, likely by encouraging or discouraging challenger entry.

Figure 5 plots the results of the event study stacked regression. The coefficients on the pre-treatment periods are close to zero for each of the treatment groups, indicating no clear pre-existing trends in incumbent support. Following project approval, incumbent vote share declines in precincts exposed to costs and increases in precincts receiving benefits.

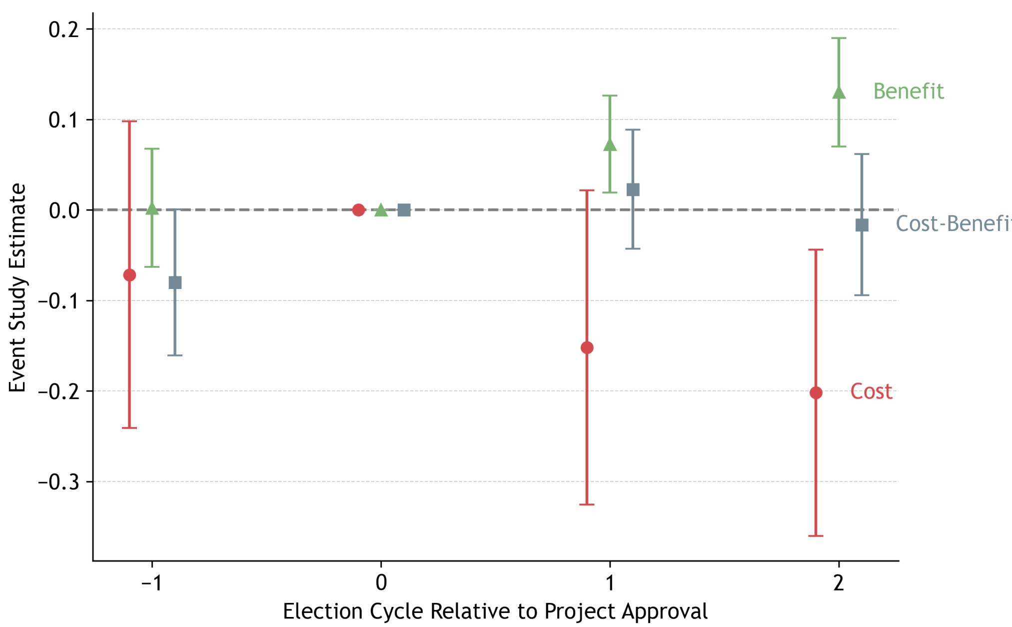


Figure 5: Event study of incumbent vote share by precinct group

Table 2: Effects of Wind Project Exposure on Incumbent Vote Share

	(1) Baseline	(2) Split Mixed Exposure	(3) Add Indirect Effects
	Dependent Variable: Combined Incumbent Vote Share		
A. Cost Exposure			
Direct: Cost precinct	−0.143**	−0.143**	−0.163**
	(0.061)	(0.061)	(0.076)
Indirect: Share of other Cost precincts in district			−0.030*
			(0.017)
B. Benefit Exposure			
Direct: Benefit precinct	0.097***	0.098***	0.025**
	(0.022)	(0.022)	(0.012)
Indirect: Share of other Benefit precincts in district			0.043***
			(0.016)
C. Mixed Exposure (Cost + Benefit)			
Direct: Cost-Benefit precinct	0.042		
	(0.027)		
Direct: Net Cost precinct (Cost > Benefit)		−0.001	−0.006
		(0.032)	(0.024)
Indirect: Share of Net Cost precincts in district			−0.010
			(0.017)
Direct: Net Benefit precinct (Benefit > Cost)		0.083**	0.039
		(0.041)	(0.038)
Indirect: Share of Net Benefit precincts in district			0.018
			(0.016)
Observations	2,765	2,765	2,765
R-squared	0.658	0.658	0.667

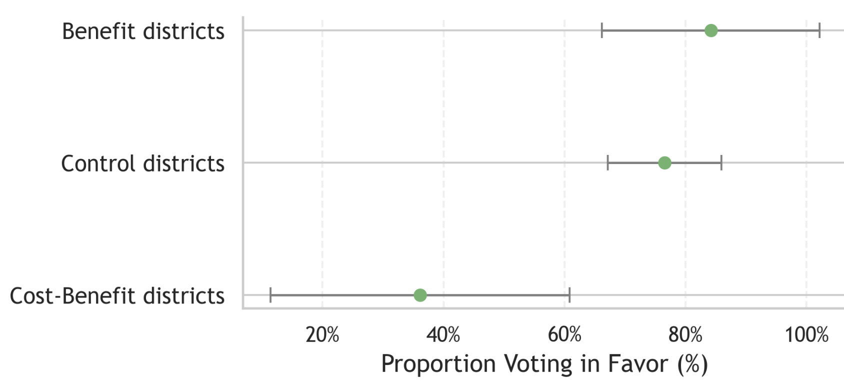
Notes: All models include event time × project and precinct × project fixed effects. Indirect effects are measured using leave-one-out shares of other treated precincts in the same district-election. These shares are standardized to have mean zero and standard deviation one for ease of interpretation. Standard errors, shown in parentheses, are clustered at the precinct × project level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

4.2.4 County Board Votes

The prior section presents estimates of the effects of wind project exposure on aggregate incumbent vote share. However, these aggregate results may mask heterogeneity in the electoral response to wind project approval in precincts with incumbents that supported versus opposed projects. To explore such heterogeneity, I collected data on the votes of individual county board members to approve or reject wind permits for a subset of 16 projects. I collected these votes from a combination of board meeting minutes and local news articles.[15]

Figure 6 summarizes the average share of county board members voting in favor of project approval, disaggregated by district type. I classify districts using the same $1,000 per-household threshold as in the previous section. On average, 76 percent of county board members in control districts voted in favor of each project, compared to 84 percent of county board members in benefit districts and just 36 percent in cost-benefit districts. In this subsample, I do not observe any cost-only districts.

Figure 6: Average Support for the Project by District Type



Note: This figure shows the average proportion of county board votes cast in favor of a wind project, disaggregated by district type. Error bars represent 95% confidence intervals, computed using district-level variation.

To formally assess whether voters' electoral responses vary based on how their representatives voted, I extend the stacked difference-in-differences framework by interacting each precinct's treatment group with the share of its board members who voted against the project. The estimating

[15]For the remaining projects, I was unable to locate public records of individual votes. I plan to contact the relevant counties to inquire about the availability of this information.

equation is:

$$Y_{ptj} = \gamma_{pj} + \delta_{tj} + \beta_1 \text{Cost}_{ptj} + \gamma_1 \left(\text{Cost}_{ptj} \times \text{VoteNo}_{pj}\right) \tag{11}$$

$$+ \beta_2 \text{Benefit}_{ptj} + \gamma_2 \left(\text{Benefit}_{ptj} \times \text{VoteNo}_{pj}\right) \tag{12}$$

$$+ \beta_3 \text{CostBenefit}_{ptj} + \gamma_3 \left(\text{CostBenefit}_{ptj} \times \text{VoteNo}_{pj}\right) + \varepsilon_{ptj} \tag{13}$$

where $VoteNo_{pj}$ is the share of board members representing precinct p who voted against wind project j. Table 3 presents the results of this regression. Column 1 replicates the baseline specification from Table 2 for the 16 project subsample. Column 2 adds the interaction terms between the treatment groups and the share of board members who voted against the project. I find that incumbents representing cost precincts see a significantly smaller decline in their vote share when a greater proportion voted against the project. Conversely, incumbents in benefit precincts see smaller increases in their vote share when a greater proportion voted against the project. These results suggest that voters are not responding solely to the presence of a project, but also to the behavior of their elected representatives. However, these estimates should be interpreted cautiously. Board member votes are not exogenously assigned, but rather are likely to reflect underlying variation in political ideology or constituent preferences. As such, the observed correlations between voting behavior and electoral outcomes are descriptive rather than causal.

Table 3: Effects of County Board 'No' Votes on Incumbent Vote Share

	(1) Baseline	(2) Add Interactions
	Dependent Variable: Combined Incumbent Vote Share	
A. Cost Exposure		
Cost precinct	-0.309^{***}	-0.376^{***}
	(0.065)	(0.043)
Cost precinct × Vote no share		0.291^{**}
		(0.123)
B. Benefit Exposure		
Benefit precinct	0.090^{***}	0.120^{***}
	(0.027)	(0.034)
Benefit precinct × Vote no share		-0.122^{**}
		(0.048)
C. Mixed Exposure (Cost + Benefit)		
Cost-Benefit precinct	0.030	-0.001
	(0.035)	(0.036)
Cost-Benefit precinct × Vote no share		0.103
		(0.078)
Observations	1,716	1,716
R-squared	0.645	0.648

Notes: All models include event time × project and precinct × project fixed effects. × Vote no share indicates interaction of each treatment group with the share of board members representing the precinct who voted against the wind project. Standard errors, shown in parentheses, are clustered at the precinct × project level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

5 Conclusion

Wind energy projects in the U.S. are increasingly facing opposition and regulation at the local level. This opposition is often driven by concerns about localized costs, such as reduced property values. However, based on an analysis of proposed wind projects in Illinois, I find that these local costs are small relative to the health and climate benefits. As a result, local county government decisions to delay or reject wind projects are likely to be inefficient.

This paper provides new evidence that the distribution of costs and benefits within counties shapes political support for wind energy development. Incumbent vote shares decline in precincts located near wind projects but outside the tax districts receiving most of the fiscal benefits. In contrast, incumbents gain support in precincts that benefit from increased school district revenues. Furthermore, I find that these electoral effects are muted in precincts where incumbents voted contrary to the interests of their constituents.

Together, these findings highlight how the distribution of local costs and benefits can shape political support for renewable energy projects. Even when projects generate large net social benefits, concentrated local costs can create political barriers to development. At the same time, local fiscal benefits can help build political support. Understanding how these political dynamics operate at the local level can help with the design of institutions that better align community incentives with broader environmental goals.

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