Siting Resource Center
Renewable Energy and Property Prices: A Summary of Literature

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Introduction to this Document

This document presents a preliminary literature review of fourteen of the most relevant and recent studies examining the impacts of wind and large-scale solar (LSS) energy development on property prices in the United States. The studies summarized here are published in peer-reviewed academic journals. Collectively, these reports represent the current frontier of empirical research on this topic and are frequently cited in scholarly and policy discussions. The summaries are organized below by technology (first solar, then wind) and in chronological order from most recent to oldest.

This review is not intended to be exhaustive. A substantial body of additional peer-reviewed research, gray literature, government reports, and practitioner analyses also provide important context on property values, local economic impacts, land use, and community outcomes related to renewable energy development. Many of those resources add nuance, historical perspective, or place-specific insight that complement the findings summarized here.

The findings of these studies are sensitive to research design, data sources, and econometric methods; therefore, understanding how the analyses were conducted is essential to interpreting their results, applicability, and transferability. Differences in approaches, such as parcel-level versus community-level analysis, treatment timing, distance definitions, and causal inference techniques, help explain why results may vary across studies. The document includes a Key Terms and Definitions section and a Description of Methods section with plain-language overviews of the key methodologies used in these papers, to support informed and careful use of the findings summarized below.

Summary of the State of the Science

Taken together, these studies show a consistent but nuanced pattern. Renewable energy projects can affect nearby property values, but those effects are not uniform. When impacts are detected, they are typically concentrated very close to projects, fade quickly with distance, and are relatively small; often a few percentage points and rarely more than about 6%. In many cases, studies find no statistically significant effects at all, or a mix of positive and negative outcomes depending on local conditions. This means that property value impacts are best understood as localized and highly dependent on context, rather than as a single consistent outcome. Differences in findings across studies are often explained not by contradictions in the data, but by differences in geography, project type, and research design.

Consider the following when reading through these summaries:

- Estimated "effects" represent changes in property values relative to a counterfactual—what those values would have been in the absence of the project—rather than absolute changes in prices.
- Many of the estimated effects in this literature are small in magnitude and can be difficult to detect statistically. In some cases, true underlying impacts may exist but are not statistically distinguishable from zero due to data limitations, sample size, variability across markets, or because the effect is in-fact very small.
- Most studies rely on observed property transactions, meaning they capture how buyers and sellers behave in the market rather than how all homeowners perceive impacts.
- The studies summarized here evaluate a range of project types including utility-scale solar, community solar, and wind energy facilities, which differ in size, siting patterns, and community integration.

Report Summaries: Solar Energy

Gao et al. (2026) – The impacts of community solar projects on housing prices: Evidence from Maryland, the U.S (China University of Petroleum, University of Maryland, and others)

Link to report – Journal: Energy Economics

Summary

This study examines whether community solar projects are associated with changes in nearby residential property values in Maryland. The analysis uses property transaction data from 2013 to 2023, covering 74,610 transactions (with a matched sample of ~15,500 transactions) linked to detailed community solar project location and installation data. The study focuses on properties located within 3 km (1.86 miles) of these facilities, with a primary treatment area defined as within 700 meters. The authors estimate changes in property values using hedonic regression, propensity score matching, and difference-in-difference approaches. The study measures how transaction prices vary before and after installation relative to nearby control properties. The study focuses on community solar based on Maryland's Community Solar Pilot Program dataset.

Key findings

- Homes within ~700 meters (~.4 miles) experience ~1.8% to 2.1% increases in value, with estimates statistically significant overall; however, some finer near-distance bins (e.g., 100–200 m, 300–400 m) are statistically insignificant, likely reflecting smaller sample sizes very close to projects.
- Increases in property values are concentrated within ~700 meters (~.4 miles); effects beyond this distance are not evident, with no clear differences in prices outside the treatment buffer.
- Increases in property values are concentrated in urban areas, higher-income and higher-education areas, and Democratic-leaning regions, while estimates in complementary groups are generally statistically insignificant.
- Properties near larger community solar projects and those on brownfield sites show statistically significant premiums, while effects near smaller projects and greenfield sites are not statistically significant.
- Magnitude varies by context, with stronger and more consistent effects in settings where CSPs are more visible or aligned with local preferences, indicating heterogeneity tied to socioeconomic and siting factors.

Strengths and Limitations

- Fills a gap by providing one of the first empirical analyses of community solar, distinct from utility-scale and rooftop systems.
- The study reports no conflicts of interest and **acknowledges funding from Chinese national and regional science foundations**.
- Analysis is limited to Maryland, which may constrain generalizability to other states with different policies and market conditions.

Hu et al. (2025) – Impact of large-scale solar on property values in the United States (Virginia Tech)

Link to report – Journal: Proceedings of the National Academy of Sciences

Summary

This study examines how large-scale solar projects (1MW+) affect nearby residential property values across the United States and why those effects differ by location. The authors link 8.3 million home sale transactions, from approximately 1993 through 2020, with 3,699 solar project locations across all U.S. states with large-scale solar facilities. Using causal methods, including difference-in-difference designs, they compare price changes for homes near solar projects with similar homes farther away before and after development. The analysis also explores mechanisms behind observed effects, such as visual changes and local economic activity, to explain why impacts vary rather than follow a single national pattern.

Key findings

- Large-scale solar causes both positive and negative property value effects, with direction and magnitude varying substantially across regions and land-use contexts.
    - National average residential property value change is -4.8% within 3 miles of an LSS site.
    - Agricultural or vacant land within 2 miles of large-scale solar facilities increases the sales price per acre by an average of 19.4%.
- The study finds statistically significant regional differences in estimated residential price effects, with the Northeast showing more negative effects on average than other census regions.
    - Non-significant average effects in other regions do not indicate an absence of impacts, but instead reflect greater variation, with both positive and negative outcomes depending on local conditions.
- Negative effects of projects are concentrated in their immediate vicinity, particularly for adjacent homes.
- Residential property value losses are largest shortly after installation and decrease over time.
- Using GIS-based viewshed modeling to estimate whether a solar facility is visible from each property, the authors find that visibility alone does not explain price effects. The study finds that nearby price effects are tied to community perceptions rather than visibility alone.
- Positive price effects appear in some locations, which the authors link to increased local economic activity and increased local tax base.
- Average national effects mask substantial local heterogeneity, meaning outcomes differ extensively from place to place.

Strengths and Limitations

- This is by far the most comprehensive and largest scale analysis of large-scale solar effects on property prices. The authors applied state of the art methods and leveraged a massive dataset.
- Analysis includes only observed property transactions; impacts on homes that did not sell are not captured.
- The study emphasizes that heterogeneity limits broad generalization from national averages.

Hao and Michaud (2024) – Assessing property value impacts near utility-scale solar in the Midwestern United States (Loyola University)

Link to Report – Journal: Solar Compass

Summary

This study examines whether utility-scale solar projects are associated with changes in nearby property values across ten Midwestern state of the U.S. (IA, IL, IN, KS, MI, MN, MO, NE, OH, WI). The analysis covers uses 70 utility-scale solar projects built between 2009 and 2022 and monthly housing value data (Zillow Zestimate) from 2000 to 2022. The study focuses on average home values at the zip code level, with a subset analysis using Case-Shiller-adjusted values (a housing price index based on repeat home sales that accounts for inflation and market trends) from 2013 to 2019. The authors estimate changes in property values using a difference-in-differences approach that compares zip codes with solar projects to nearby control zip codes before and after project operation. The analysis also evaluates variation by project size, rurality, and geography.

Key Findings

- Nearby properties (defined as homes located in the same zip code as a utility-scale solar project) had Zestimate increases by approximately 0.5–2.0% (about $700 to $3,199), and these effects are statistically significant in most model specifications (5 of 6 models).
- Positive effects are consistent across both unadjusted and Case-Shiller-adjusted models, strengthening confidence in the direction of results despite modest magnitude.
- Pre-existing differences are present: treatment zip codes have ~2.0–3.1% lower property values than control zip codes prior to development, suggesting projects are more likely to be sited in relatively lower-value areas.
- Rural properties have substantially lower values (approximately −$10,000 to −$25,000) than non-rural properties and these effects are statistically significant; indicating rurality is a stronger driver than solar presence.
- Properties near smaller projects (5–20 MW) have higher absolute home values than those near larger projects (>20 MW), with most estimates statistically significant; this reflects baseline level differences rather than differential price changes attributable to project size.

Strengths and Limitations

- The analysis relies on Zillow Zestimate data rather than transaction-level sales, which may reduce precision.
- Geographic resolution is limited to zip codes, preventing detailed distance-based or visibility analysis.
- Results may not generalize beyond the Midwest or to different market conditions and siting contexts.

Elmallah et al. (2023) – Shedding light on large-scale solar impacts (Lawrence Berkeley National Laboratory)

Link to Report – Journal: Energy Policy

Summary

This study examines whether proximity to large-scale solar projects affects residential property values across six U.S. states (California, Connecticut, Massachusetts, Minnesota, New Jersey, North Carolina). The authors link home sale transactions between 2000 and 2021 with solar project locations and timing and apply hedonic pricing and difference-in-differences methods, allowing them to isolate the effect of proximity to solar projects on sale prices while controlling for other property and neighborhood characteristics that also influence home values. By comparing prices for homes at varying distances before and after solar development, the study evaluates how property value effects change with proximity and whether impacts extend beyond homes closest to projects.

Key findings

- Homes located within roughly 0.5 miles of large-scale solar experience average price declines of ~1.5%, with larger effects (~2.3%) observed within 0.25 miles.
- Homes located 0.5–1 mile away experience smaller declines (~0.8%), while no statistically significant effects are detected beyond 1 mile.
- Effects are heterogeneous: price declines are concentrated in rural areas (~4.2%), near projects on agricultural land (~3.0%), and near larger facilities (~3.1%).
- State-level results vary, with larger declines (~4–5.6%) observed in MN, NC, and NJ, and no statistically significant effects detected in CA, CT, and MA.
- The study finds no evidence of widespread or large-scale declines in residential property values, with effects generally small in magnitude and highly localized.

Strengths and Limitations

- This is among the earliest peer-reviewed, multi-state analyses of utility-scale solar property value impacts.
- The analysis focuses on short- to medium-term impacts, not long-term price trajectories.
- Results depend on transaction data coverage and geocoding accuracy.
- Findings may not apply to unusual projects or atypical siting contexts.

Gaur & Lang (2023) – House of the rising sun: The effect of utility-scale solar arrays on housing prices (University of Rhode Island)

Link to Report – Journal: Energy Economics

Summary

This study examines whether nearby utility-scale solar installations affect residential property values in Massachusetts and Rhode Island. It uses housing transaction data from 2005 to 2019 and evaluates 282 solar installations (≥1 MW), focusing on repeat sales of 107,291 transactions within 2 miles of solar sites. The analysis compares properties within 0.6 miles of solar installations to those 0.6 to 2 miles away, using a difference-in-differences, repeat-sales approach. The study measures changes in sale prices before and after construction, with treatment defined as beginning approximately 6 months prior to operation.

Key Findings

- Homes within 0.6 miles experience ~1.5% to 3.6% declines in value following construction, with estimates statistically significant across all models.
- Homes within 0.6 miles experience ~1.5% to 3.6% declines in value, with larger estimates (~2.8% to 3.6%) in models that compare treated properties to themselves over time, and smaller estimates (~1.5% to 2.4%) when using nearby properties as controls, indicating results are sensitive to model specification.
- Effects are concentrated within 0.6 miles; estimates beyond 0.6 miles are small and statistically insignificant, indicating no detectable impact at greater distances.
- Homes within 0.1 miles may experience larger declines (~3.8% to 4.2%), but these estimates are not statistically significant and are based on a small sample.

- Homes near greenfield projects experience ~2.0% to 4.4% declines, with results statistically significant, while estimates for non-greenfield sites (~1.1% to 1.3%) are not statistically significant.
- Homes in rural areas experience larger declines (~2.5% to 5.8%), while estimates in non-rural areas (~0.5% to 0.6%) are statistically insignificant.
- No statistically significant differences are found by project size or over time since construction, indicating effects do not vary meaningfully across these dimensions.
- Results show clear heterogeneity: average negative effects are driven primarily by greenfield and rural projects, while other contexts show small, statistically insignificant impacts.

Strengths and Limitations

- Large repeat-sales dataset (~107,000 transactions) with strong spatial resolution near solar sites.
- Use of multiple identification strategies (with and without control group) provides a range of estimates and highlights sensitivity to assumptions.
- Study is limited to two dense New England states, which may not generalize to less dense regions.

Abashidze et al. (2023) – Utility-Scale Solar Farms and Agricultural Land Values (University of Wyoming)

Link to Report – Journal: Land Economics

Summary

This study examines how utility-scale solar farms affect nearby agricultural land values, focusing on rural markets in North Carolina. The analysis uses georeferenced agricultural land sales data from 2007–2019, covering 1,676 transactions within five miles of 299 solar farms (and broader datasets in sensitivity analyses). The study links transaction data with detailed spatial data on solar farm locations and transmission infrastructure to evaluate both direct spillover effects and indirect "option value" effects. The study measures changes in agricultural land prices per acre as a function of proximity to solar farms and transmission lines, using hedonic pricing models with fixed effects and causal identification strategies (e.g., before/after comparisons and spatial controls).

Key Findings

- No statistically significant effect (≈0% change) on agricultural land values within 5 miles of solar farms after construction.
- Distance effects are statistically insignificant across all distance bands tested (including parcels within 5 miles), with no consistent gradient closer to solar farms.
- Timing effects show no statistically significant differences before vs. after solar farm construction, indicating no detectable anticipation or post-construction impact.
- Pre-construction (baseline) results are statistically insignificant, suggesting no systematic differences in land values near sites selected for future solar development.

- Proximity to transmission lines shows negative or neutral effects before solar construction (statistically significant in some models), indicating potential disamenities or productivity constraints.
- After solar construction, proximity to transmission lines shows positive effects (e.g., ~4.1% increase, ≈$136/acre when moving 1 mile closer), with some estimates statistically significant.
- Results show heterogeneity across samples and specifications, but the core finding—no direct solar farm effect—is consistent across all models and robustness checks.

Strengths and Limitations

- Detailed geospatial dataset linking >1,600 agricultural land sales to 451 solar farms and transmission infrastructure.
- Clear separation of direct solar effects and indirect option-value effects using spatial and temporal variation.
- Focus on North Carolina limits generalizability to other regions with different land markets or siting patterns.

Report Summaries: Wind Energy

Hoen et al. (2025) – Uplifting winds: The surprisingly positive community-wide impact of wind energy installations on property values (Lawrence Berkeley National Laboratory)

Link to report – Journal: Energy Research & Social Science

Summary

This study examines how commercial wind energy projects affect property values at the community-wide scale (specifically, within school districts), rather than focusing only on homes very close to turbines. The authors link large national datasets on residential property values with the timing and location of U.S. wind energy installations between 2005 and 2021. Using statistical comparisons that mimic an experiment, the authors compare communities before and after wind development to similar communities without wind projects. The study evaluates whether wind energy is associated with broader changes in average property values and how those effects relate to local economic and fiscal conditions.

Key findings

- At the community level, wind energy installations are associated with statistically significant increases in average property values of ~2.7% to 2.9%.
- Event study results show increases of roughly ~3% to 5% in district-wide home values following project operation, though individual year estimates are less precise and have wider confidence intervals.
- Positive effects persist when excluding homes within 1–2 miles of turbines, indicating gains extend beyond the immediate vicinity of turbines.

- Wind development increases school district revenues by ~$800 per pupil and total expenditures by ~$700 per pupil on average, with larger increases (~$1,000–$2,000 per pupil) observed in event study estimates over time.
- Community-wide property value gains are concentrated in areas with higher installed capacity, with statistically significant increases primarily in districts above the median (~20 kW per pupil).
- Findings suggest that community-wide increases can offset localized proximity effects, which prior studies estimate at ~5–10% declines within ~1–2 miles of turbines.
- Results indicate that analyses focused only on homes near turbines miss broader positive capitalization effects occurring at the community scale.

Strengths and Limitations

- This study uniquely shifts the lens from parcel-level proximity effects to community-wide impacts, addressing an important gap in prior literature.
- The integration of property value analysis with per-pupil revenue and expenditure data provides a clear mechanism linking wind development to local fiscal conditions and housing markets.
- The analysis does not estimate distance-specific or visibility-based impacts on individual properties.
- Findings depend on how communities are defined geographically, which can influence estimated effects.

Brunner et al. (2024) – Commercial wind turbines and residential home values (University of Connecticut)

Link to report – Journal: Energy Policy

Summary

This study estimates how residential property values change over time near wind turbines across the United States. The authors link nationwide home sale transactions with the full U.S. wind turbine database from 2005–2020. Using difference-in-differences and event-study methods, they compare price changes for homes at different distances from wind projects before announcement, during construction, and after operation. The goal is to measure the timing, magnitude, and persistence of wind turbine impacts on nearby home values.

Key findings

- Homes within 1 mile of a wind project experience an average price decline of about 11% following project announcement.
- Price declines are largest during the announcement and construction period, before turbines become operational.
- Property values recover over time, with estimated effects shrinking to about 2% and becoming statistically insignificant several years after operation begins.
- Homes located 1–2 miles away show much smaller and often statistically insignificant effects.

- Estimated impacts are driven mainly by projects in urban counties (population greater than 250,000), with little evidence of effects in rural areas.

Strengths and Limitations

- Announcement dates are imputed for about 40% of projects, introducing potential timing error.
- Analysis includes only homes that sold, not unsold properties.
- Findings represent average effects across hundreds of projects throughout the country, not individual outcomes.

Guo et al. (2024) – The visual effect of wind turbines on property values is small and diminishing in space and time (European Institute on Economics and the Environment)

Link to Report – Journal: Proceedings of the National Academies of Sciences

Summary

This study examines how the visibility of wind turbines affects residential property values across the United States. It uses nationwide data from 1997 to 2020, including more than 180 million housing transactions and detailed geospatial data on over 60,000 turbines, making it one of the largest analyses of this question to date. The study measures whether turbines are visible from each property using high-resolution viewshed modeling that accounts for terrain, rather than relying only on distance. The authors estimate impacts using a spatial difference-in-differences framework that compares price changes for homes that gain visibility to turbines when they become operational relative to nearby homes without visibility. This approach isolates the causal effect of visibility rather than proximity alone. All heterogeneity analyses (e.g., urban vs. rural, income, and political characteristics) are conducted at the county level, meaning these results reflect broader regional context rather than property-level conditions.

Key Findings

- Homes within 10 km (~6 miles) with at least one visible turbine experience ~1.1% decline in sales price on average, and this effect is statistically significant.
- Homes very close to turbines (within ~1.5 km / 1 mile) experience larger declines of up to ~8%, but these estimates are not consistently statistically significant reflecting a small sample and substantial uncertainty.
- Effects decline with distance and are statistically indistinguishable from zero beyond ~8 km (~5 miles).
- Property values decline more with greater visibility intensity, with each additional 10 turbines reducing values by ~0.2% and large wind farms (>20 turbines) associated with ~2.5% declines.
- Effects emerge immediately after installation, peak at more than 3% decline within ~3 years, and dissipate within ~7 years, suggesting adaptation over time.
- Effects are heterogeneous, with stronger and more consistent impacts in urban areas (defined at the county level), high-income areas, and non-mountainous regions, and weaker effects in rural areas.

Strengths and Limitations

- The study is distinct in its national scale and its explicit modeling of visibility, allowing it to assess how effects vary across distance, time, turbine density, and local context.
- Visibility modeling does not account for built obstructions (e.g., buildings), which may affect real-world exposure.

Dong et al. (2023) – Property Value Impacts of Onshore Wind Energy in New England: The Importance of Spatial Heterogeneity and Temporal Dynamics (University of Rhode Island)

Link to Report – Journal: Energy Policy

Summary

This study examines how proximity to onshore wind turbines affects residential property values in Massachusetts and Rhode Island, using transaction data from 2000 to 2019. The dataset includes ~369,000 housing transactions located within 10 km (~6.2 miles) of 119 turbines, enabling analysis in relatively dense housing markets with many proximate homes. The study measures changes in home sale prices as a function of distance to turbines and timing relative to project development, using a difference-in-differences framework that distinguishes pre-announcement, post-announcement/pre-construction, and post-construction periods. The analysis emphasizes spatial and temporal heterogeneity, estimating effects separately across regions and over time since construction.

Key Findings

- Homes within 1 km (~0.62 miles) experience an approximate 2.5% to 4.6% decline post-construction (relative to homes within 3–10 km; ~1.9—6.2 miles), though only some estimates are statistically significant depending on model specification, indicating modest but somewhat sensitive evidence of localized price impacts.
- No statistically significant effects beyond 1 km (~0.62 miles), indicating highly localized impacts.
- Short-term impacts decrease over time: prices within 1 km (~0.62 miles) decline ~7.7% in the first 3 years post-construction, then decrease to ~5.7% in years 3–6; effects beyond 6 years are small and statistically insignificant.
    - This is informally described as temporal dynamics following a "U-shaped" pattern where prices begin declining pre-construction, reach maximum decline shortly after construction, then partially or fully rebound.
- Substantial regional heterogeneity: aggregate negative effects are driven almost entirely by one region (Cape Cod and Nantucket Island), indicating that average estimates do not generalize across contexts.
    - Cape Cod and Nantucket: ~7.0% to 10.8% decline within 1 km (~0.62 miles), consistently statistically significant
    - Western MA: negative (~3.7% to 5.6%) but mostly statistically insignificant
    - Eastern MA (excluding Cape Cod): effects near zero and statistically insignificant

- Rhode Island: mixed results (-5.8% to +0.6%), generally not robust across specifications

Strengths and Limitations

- Explicit treatment of both spatial and temporal heterogeneity, which are rarely examined together.
- Limited to two states in New England; generalizability to other regions is uncertain.
- Timing of announcement and construction is inferred rather than directly observed.

Brunner & Schwegman (2022) – Commercial wind energy installations and local economic development (University of Connecticut)

Link to Report – Journal: Energy Policy

Summary

This study evaluates how commercial wind energy development affects local economic outcomes, including housing values, at the county level. The authors combine county-level economic indicators, housing data, and wind project information between 1995 and 2018. Using before-and-after comparisons between counties with wind development and similar counties without projects, the study assesses whether wind energy contributes to broader local economic development rather than focusing on parcel-level proximity effects.

Key findings

- Wind energy development modestly increases local incomes (~3–6%) but does not increase total employment, instead shifting jobs toward construction and manufacturing sectors
- County GDP per capita increases by ~6–8.5% on average (~2% during construction, ~7% during operation), indicating broad economic gains tied to project scale.
- Counties hosting wind projects experience higher local tax revenues following development.
- Median home values increase by ~2.6% in binary models and up to ~7% when scaled to average installed capacity, with effects occurring primarily after projects become operational.
- Total employment shows no statistically significant change, but employment composition shifts, with manufacturing and construction shares increasing and farm employment declining.
- Economic impacts are strongest in higher-capacity counties (e.g., GDP increases ~1.8% at median capacity vs. ~7.2% at the 75th percentile), indicating benefits scale with project size.

Strengths and Limitations

- The study addresses a different and important question than proximity-based analyses by focusing on county-wide economic outcomes.
- County-level analysis captures fiscal and employment effects that parcel-level studies cannot.
- County-level averages may mask neighborhood-scale or near-project impacts.
- The study does not isolate close-proximity housing effects.

Sampson et al. (2020) – The On-Farm and Near-Farm Effects of Wind Turbines on Agricultural Land Values (Kansas State University)

Link to Report – Journal: Journal of Agricultural and Resource Economics

Summary

This study examines how wind turbines affect agricultural land values using parcel-level sales data in Kansas from 2001–2017. The analysis uses a large dataset of farmland transactions (over 12,000 observations) and estimates how sale prices per acre vary with proximity to turbines. The authors apply hedonic regression models with spatial and fixed effects controls to isolate the relationship between turbine proximity and land values. The study measures changes in land values as a function of distance to the nearest turbine and whether a turbine is located on the parcel. It is focused on agricultural land (rather than residential properties) and uses both pooled cross-sectional and repeat-sales approaches. The analysis also explores variation over time and across turbine characteristics.

Key Findings

- A 10% increase in proximity to a turbine (i.e., being closer) is associated with a ~0.26% to 0.65% increase in land value.
- Near turbines (0–2 and 2–4 km; i.e., 0–1.2 and 1.2–2.5 miles) price increase effects are detected, but statistically insignificant across specifications.
- At mid-range distances (4–6; i.e., ~2.5–3.7), some models show small negative effects that are occasionally statistically significant, but these effects become statistically insignificant when additional spatial controls are applied.
- Comparing the same properties over time, estimates are negative across distance bands but statistically insignificant, indicating no consistent evidence that proximity to turbines affects land values.
- Over time, positive effects associated with proximity to turbines decline by approximately 0.6 percentage points per year, while distance-based treatment effects remain statistically insignificant across all periods.
- There is no evidence that larger turbines have greater effects on land values.
- The results suggest that localized positive and negative effects may offset one another, resulting in near-zero average impacts across distance bands.

Strengths and Limitations

- Large dataset of agricultural land transactions over a long time period (2001–2017).
- Multiple model specifications, including spatial controls and repeat-sales analysis.
- Geographic scope limited to Kansas, which may affect generalizability.
- Limited number of repeat sales and on-parcel observations reduces precision in some models.

Hoen et al. (2014) - Spatial Hedonic Analysis of the Effects of U.S. Wind Energy Facilities on Surrounding Property Values (Lawrence Berkeley National Laboratory et al.)

Link to Report – Journal: The Journal of Real Estate Finance and Economics

Summary
This study examines whether wind energy facilities affect nearby home values using a large, multi-state dataset of residential transactions in the United States. The analysis covers 27 counties across 9 states (WA, MN, IA, IL, OK, OH, PA, NY, and NJ) and includes over 50,000 home sales from 1996–2011, including more than 1,100 sales within 1 mile of turbines. The dataset spans the following periods: pre-announcement, post-announcement but before construction, and post-construction. The study measures changes in home sale prices as a function of proximity to wind turbines, using hedonic pricing models with difference-in-differences and spatial controls to isolate turbine-related effects from broader housing market trends and pre-existing site conditions.

Key Findings

- No statistically significant effect on home values within 1 mile or ½ mile of turbines in either post-announcement or post-construction periods.
- Homes within 1 mile show estimated effects ranging roughly from −1% to +4%, but all results are statistically insignificant.
- Homes within ½ mile show estimated effects roughly between −8% and +6%, depending on model and period, but all results are statistically insignificant.
- Distance effects are not statistically distinguishable, with no consistent pattern of declining values closer to turbines once controls are applied.
- Timing effects show slightly more negative (but insignificant) estimates in the post-announcement/pre-construction period compared to post-construction, suggesting a possible but unconfirmed “anticipation” effect.
- Pre-announcement (baseline) results show no statistically significant differences for homes near future turbine sites, indicating no detectable pre-existing price differences.

Strengths and Limitations

- Very large dataset (>50,000 transactions), including substantial sample within 1 mile—much larger than prior studies.
- Explicit treatment of timing (pre-announcement, post-announcement, post-construction).
- Across geographies (27 counties), results are pooled and do not isolate local variation; any localized effects may be masked by averaging across markets.
- These findings are over a decade old, potentially limiting their relevance to present-day contexts.

Key Terms and Definitions

Core causal and economic concepts

- **Difference-in-differences (DiD):** A method that compares how prices change over time in areas affected by a project versus similar areas not affected.
- **Event study:** A method that tracks changes in prices year-by-year before and after a specific event, such as a project announcement or construction.

- **Counterfactual:** An estimate of what property values would have been if the energy project had not occurred.
- **Causal effect:** A change that can be attributed to the project itself, not to broader market trends or unrelated factors.
- **Amenities:** Features or changes associated with a renewable energy project that make a place more desirable to live or own property and therefore can increase or support property values. These could include local economic benefits, road improvements, stable land income, and more.
- **Disamenities:** Features or changes associated with a renewable energy project that reduce how desirable a property feels to buyers, potentially lowering property values. These could include visual impacts, noise, perceived risk, and more.
- **Parallel trends assumption:** The idea that treated and comparison areas would have followed similar price trends if the project had not happened.
- **Treatment group:** Properties located close enough to a project to potentially be affected.
- **Control group:** Similar properties located far enough away that they are assumed not to be affected.
- **Treatment timing:** The point at which a project is assumed to begin affecting property values, such as announcement, construction, or operation.
- **Heterogeneous effects:** Findings vary by place, distance, timing, or local conditions rather than being uniform.

Property value and housing market concepts

- **Hedonic pricing model:** A method that estimates how individual property features (size, age, location) contribute to sale price.
- **Price capitalization:** The extent to which perceived benefits or harms are reflected (or capitalized) in property sale prices.
- **Transaction data:** Records of actual property sales, including price, date, and property characteristics.
- **Observed sales:** Properties that sold during the study period; unsold properties are not directly observed.
- **Distance bands:** Defined distance ranges (for example, 0–0.5 miles, 0.5–1 mile) used to measure proximity effects.
- **Spatial decay:** The pattern where impacts weaken as distance from a project increases.
- **Viewshed:** Areas from which a project is visible; sometimes used instead of distance alone.
- **Property value index (Zillow Zestimate / Case-Shiller index):** Modeled or aggregated estimates of home values rather than observed transaction prices. Zillow Zestimates provide continuous value estimates, while the Case-Shiller index tracks repeat sales to measure market trends over time.
- **Repeat-sales model:** A method that compares the same property's sale price across multiple transactions to isolate price changes over time, reducing bias from differences in property characteristics.

- **Market indicators (price per square foot, sale-to-list ratio, days on market):** Metrics used to assess overall housing market performance rather than individual property price effects.

Statistical and data concepts

- **Fixed effects:** Statistical controls that account for unobserved characteristics that do not change over time.
- **Project-specific trends:** Allowing each project area to have its own housing market trend.
- **Stacked DiD:** A design that treats each project as its own comparison, then combines them to avoid bias.
- **Statistical significance:** A test of whether an observed effect is likely due to chance.
- **Economic significance:** Whether the size of an effect is large enough to matter in real-world terms.
- **Robustness checks:** Additional tests used to confirm that results are not driven by modeling choices.

Description of Methods

Hedonic pricing models

Hedonic models estimate how different characteristics of a property contribute to its sale price. These characteristics include things like house size, age, number of bathrooms, neighborhood, and proximity to infrastructure. In these studies, distance to a wind or solar project is treated as one more characteristic. The model asks: holding everything else constant, do homes closer to energy projects sell for more or less than similar homes farther away?

- **Why it's useful:**
  It allows researchers to isolate the role of proximity while controlling for many other factors.
- **Main limitation:**
  If important factors are missing or poorly measured, results can be biased.

Difference-in-differences (DiD)

DiD compares changes over time between two groups: properties near a project and similar properties farther away. Instead of comparing prices at a single point in time, it compares how prices change before and after a project is announced or built. This helps control for broader housing market trends that affect everyone.

- **Why it's useful:**
  It helps isolate causal effects by focusing on changes, not levels.
- **Main limitation:**
  Assumes that without the project, both groups would have followed similar price trends.

Event study designs

Event studies extend DiD by estimating effects year-by-year relative to a key event, such as project announcement. This allows researchers to see when impacts begin, how large they become, and whether they fade or persist over time.

- **Why it's useful:**
  It reveals timing patterns, such as announcement effects, construction impacts, and recovery after operation.
- **Strength:**
  Clearly shows whether impacts are temporary or long-lasting.

Stacked DiD and project-specific comparisons

Some studies treat each wind or solar project as its own "mini experiment." Homes near a project are compared only to homes farther away from that same project. These individual comparisons are then combined ("stacked") across many projects.

- **Why it's useful:**
  It avoids bias that can arise when projects are built at different times in different markets.
- **Strength:**
  Strong control over local housing market conditions.

Fixed effects and localized controls

Fixed effects control for unobserved characteristics that don't change over time, such as neighborhood quality or long-standing zoning patterns. Project-specific and time-specific fixed effects allow each project area to have its own baseline and trend.

- **Why it's useful:**
  It reduces bias from unmeasured, stable differences between places.

Distance-based treatment definitions

Rather than treating all nearby homes the same, studies define multiple distance bands. This allows researchers to test whether impacts are strongest close to projects and weaken with distance.

- **Why it's useful:**
  It reflects how visual, noise, or perception effects actually operate in space.

Community-level and county-level analyses

Some studies shift the focus from individual homes to broader geographic areas. Instead of asking whether a nearby house loses value, they ask whether the average value across a community rises or falls.

- **Why it's useful:**
  It captures broader economic and fiscal effects, such as tax revenue and investment.

- **Main limitation:**
  It can hide impacts experienced by specific households.

Robustness and sensitivity testing

Authors often test alternative distance thresholds, control groups, timing assumptions, and statistical specifications to confirm that results are not driven by a single modeling choice.

- **Why it's useful:**
  It increases confidence that findings are not accidental or fragile.

Repeat-sales approaches

Some studies compare the same property across multiple sales to measure how its value changes over time. This helps control for differences in property characteristics that do not change between sales.

- **Why it's useful:**
  It isolates price changes for the same property, reducing bias from differences across homes.
- **Main limitation:**
  It requires multiple sales of the same property, which can reduce sample size and exclude many properties.

Use of modeled or index-based property values

Some studies use modeled estimates (such as Zillow Zestimates) or housing price indices (such as Case-Shiller) instead of observed sale prices. These approaches allow for continuous tracking of property values over time, even when transactions are infrequent.

- **Why it's useful:**
  It enables analysis at broader geographic scales and higher time frequency.
- **Main limitation:**
  These measures are estimates rather than observed sales and may introduce measurement error or reduce precision.

Market trends (appraisal-style comparative analysis)

Rather than estimating causal effects on individual property prices, some studies compare trends in market indicators (such as price per square foot or days on market) between areas near projects and similar areas farther away.

- **Why it's useful:**
  It reflects how local real estate markets are performing overall, which can be meaningful for practitioners.
- **Main limitation:**
  It does not isolate causal effects or identify distance-specific impacts on individual properties.

Spatial and temporal heterogeneity analysis

Some studies explicitly estimate how effects vary across locations and over time, rather than reporting a single average effect.

- **Why it's useful:**
  It helps explain why results differ across regions, project types, and time periods.
- **Strength:**
  Avoids masking meaningful variation across contexts behind average effects.