# Local Costs and Benefits of Power Installations
## Hedonic Evidence from Germany

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# Background and Surrounding Literature

- Germany's energy system is undergoing a massive transformation
  - The last nuclear plants went off-line in 2023
  - Coal is slated for nixing by 2038
  - Renewable capacities have increased 10-fold over the last two decades

- Literature using hedonic price methods considers the impact of power generation plants and RES installations on surrounding house values
  [Davis, 2011, Dröes and Koster, 2016, Frondel et al., 2019, Brinkley and Leach, 2019].

# Contribution

- With few exceptions (e.g. [Eichholtz et al., 2021]), most papers focus on a single installation type.

- The present paper develops a unified framework to investigate the openings and closing of several types of facilities: nuclear, wind, coal and solar.

- We compare the overall costs of co-existing policy decisions on the local housing markets with a back-of-the-envelope estimation.
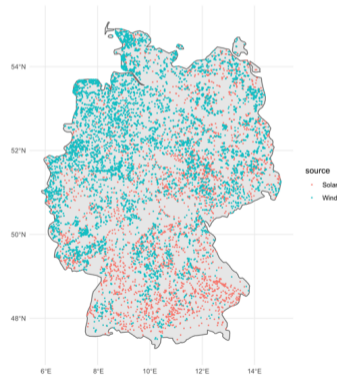
# Pooled Data, 2008 - 2019

2.4 Million postings on ImmobilienScout24 are merged with georeferenced plant data.



Conventional power plants

Wind and solar parks

# Treatment

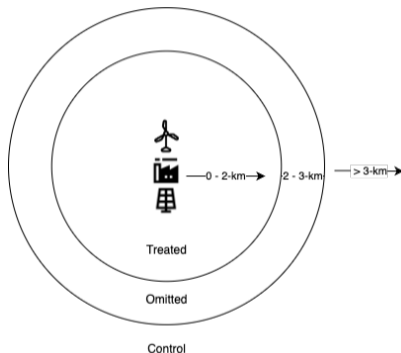Treated houses are those with a plant located within in a 2km radius.



Figure: Treatment and Control Group Definition.

# Empirical Identification Strategy

- Employ a spatial difference-in-differences (DID) approach, to address endogeneity.
- Unified modeling framework.
- In preferred specification we include postcode and county-year fixed effects.

$$\ln P_{it} \;=\; \beta_0 + \beta_{\mathbf{x}}^T \mathbf{x}_i +$$

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$$+$$

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& + \lambda_j + \eta_{ct} + \epsilon_{cijt}
\end{aligned}
\tag{1}
$$

- $\beta_{POPk}$ and $\beta_{PCLk}$, capture the average difference in the change of asking prices.

# Results

Table: Spatial DiD Estimation Results on the Asking Prices of Houses.

|  | Year FE | | County-Year FE | |
| --- | --- | --- | --- | --- |
| **Openings:** | | | | |
| Wind Turbine $<$ 2 km | -0.067*** | (0.011) | -0.018* | (0.008) |
| Solar Park $<$ 2 km | 0.013 | (0.010) | 0.009 | (0.006) |
| Coal Power Plant $<$ 2 km | -0.126* | (0.052) | -0.135** | (0.049) |
| Gas Power Plant $<$ 2 km | 0.027 | (0.033) | 0.003 | (0.018) |
| **Closings:** | | | | |
| Coal Power Plant $<$ 2 km | -0.175*** | (0.035) | -0.081** | (0.031) |
| Gas Power Plant $<$ 2 km | 0.085 | (0.055) | -0.033 | (0.036) |
| Nuclear Power Plant $<$ 2 km | 0.001 | (0.094) | -0.052 | (0.103) |
| Fixed Effects | post code + year | | post code + county-year | |
| adjusted $R^2$ | 0.712 | | 0.727 | |
| # Observations | 2399949 | | 2399949 | |

Notes: *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$. SE, in parentheses, clustered at the county-level.

Table: Spatial DiD Estimation Results on the Asking Prices of Houses.

|  | Year FE | | County-Year FE | |
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| **Openings:** | | | | |
| Wind Turbine < 2 km | -0.067*** | (0.011) | -0.018* | (0.008) |
| Solar Park < 2 km | 0.013 | (0.010) | 0.009 | (0.006) |
| Coal Power Plant < 2 km | -0.126* | (0.052) | -0.135** | (0.049) |
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# Robustness

- Parallel trends ✓

- Anticipation effects ✓

- Different buffer sizes ✓

# Accounting for staggered treatment

- The data straddles a turbulent period in Germany's real estate market.
  - Global financial crisis in 2008, followed by
  - Rock bottom interest rates, followed by
  - Exploding house prices
- This turbulence, coupled with the staggered nature of the treatment, may call for an estimator that accounts for heterogeneous treatment effects such as the Group-Time Estimator of [Callaway and Sant'Anna, 2021].

Table: Group-Time Aggregated ATT for Wind Openings and Coal Closures

|  | Wind Opening | Coal Closure |
|---|---|---|
| ATT < 2 km | -0.09** (0.038) | -0.13 (0.17) |
| Fixed Effects | postal code + county-year | |

# Back-of-the-envelope Cost Estimates

Table: Back-of-the-envelope Estimates of the Costs related to Future Coal Power Plant Closures and Wind Turbine Openings

|  | Point Estimate | # Affected Houses | Average Price in € | Per-property Cost in € | Total Cost in Billion € |
|---|---|---|---|---|---|
| Coal Power Plant Closure | -0.081 | 80465 | 463064 | -37508 | -3.0 |
| Wind Turbine Installations | -0.018 | 1020600 | 290369 | -5227 | -5.3 |

# Summary and Conclusions

- Wind and coal openings are associated with reductions in the value of surrounding houses:

- Coal closures also associated with depressed prices, likely owing to employment effects and regional economic spillovers.

- Magnitude of the costs amount to about €8.3 Billion in back-of-the-envelope calculation for future wind installations and coal plant closures.

- Policy action:
  - Individual compensation?
  - Regional investment in coal-closure areas?

# Parallel Trends Check

Test individual-treatment models with leads 2 years before the treatment, 3 years, and 4 or more.
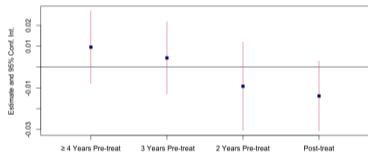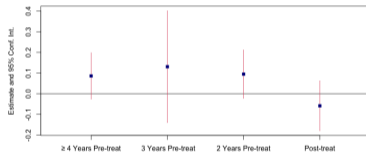


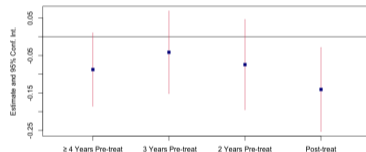Figure: Wind Opening.



Figure: Coal Opening.



Figure: Coal Closure.

# Different buffers

Table: Spatial DiD Estimations Results for Equation 1 under various Distance Definitions.

|  | 2-km radius | | 3-km radius | | 4-km radius | |
|---|---|---|---|---|---|---|
| **Openings:** | | | | | | |
| Wind Turbine < 2 km | -0.018* | (0.008) | -0.018** | (0.006) | -0.016** | (0.006) |
| Solar Park < 2 km | 0.009 | (0.006) | 0.007 | (0.005) | 0.006 | (0.004) |
| Coal Power Plant < 2 km | -0.135** | (0.049) | -0.019 | (0.083) | -0.044 | (0.041) |
| Gas Power Plant < 2 km | 0.003 | (0.018) | 0.018 | (0.016) | 0.025 | (0.020) |
| **Closings:** | | | | | | |
| Coal Power Plant < 2 km | -0.081** | (0.031) | -0.043 | (0.045) | -0.017 | (0.021) |
| Gas Power Plant < 2 km | -0.033 | (0.036) | -0.016 | (0.032) | -0.020 | (0.021) |
| Nuclear Power Plant < 2 km | -0.052 | (0.103) | -0.045 | (0.075) | -0.044 | (0.064) |
| Fixed Effects | postal code + county-year | | | | | |
| adjusted $R^2$ | 0.727 | | 0.729 | | 0.730 | |
| # Observations | 2399949 | | 2072471 | | 1806583 | |

Notes: *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$. Standard errors, reported in parentheses, are clustered at the county-level.

# Anticipation results

Table: Spatial DiD Estimation Results of Equation 1 when Ruling-out Anticipation Effects.

|  | Baseline Results | Ruling-out anticipation |
|---|---|---|
| **Openings:** | | |
| Wind Turbine <2 km | -0.018* (0.008) | -0.023* (0.010) |
| Solar Park <2 km | 0.009 (0.006) | 0.012 (0.007) |
| Coal Power Plant <2 km | -0.135** (0.049) | -0.235*** (0.069) |
| Gas Power Plant <2 km | 0.003 (0.018) | 0.019 (0.021) |
| **Closings:** | | |
| Coal Power Plant <2 km | -0.081** (0.031) | -0.099*** (0.027) |
| Gas Power Plant <2 km | -0.033 (0.036) | -0.055 (0.057) |
| Nuclear Power Plant <2 km | -0.052 (0.103) | 0.025 (0.133) |
| Fixed Effects | postal code + county-year | |
| adjusted $R^2$ | 0.727 | 0.728 |
| # Observations | 2399949 | 2279865 |

Note: *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$. Standard errors, reported in parentheses, are clustered at the county-level.

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# Thank you for your attention!
# Any questions / feedback?

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