

Do Wind Facilities Affect Local Property Values?

Preliminary Results From A Multi-Site Analysis



Ben Hoen & Ryan Wisler
Lawrence Berkeley National Laboratory
benhoen2@earthlink.net, rhwisler@lbl.gov

WINDPOWER 2007
Los Angeles, CA
June 5, 2007

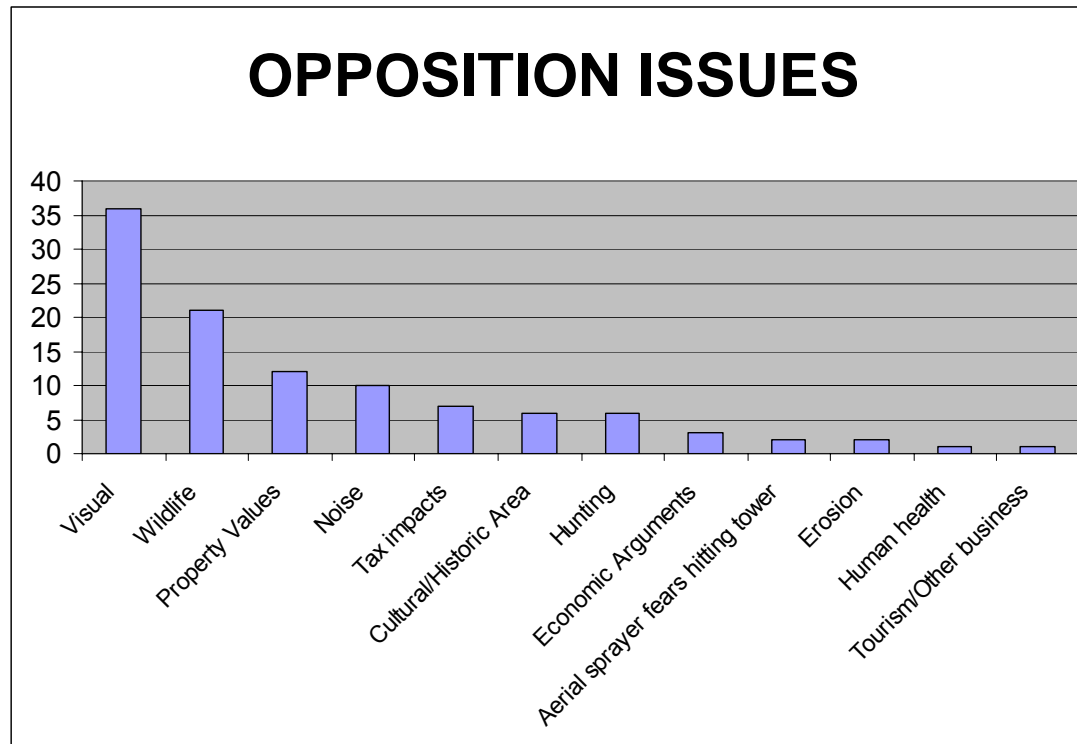
Why Is This Important?

Increasing Siting Success Rate is Crucial!

- As wind development accelerates easing siting and permitting barriers will be crucial
 - An average of 140 new sites per year will be needed to reach 20% by 2030 ¹
- Siting and permitting challenges are a key reason for project delay or failure
 - 30 to 50% of contract failures are attributed to siting and permitting (CEC, 2006; BWEA, 2003 cited by Loring, 2006)
- Strength of the network of those opposed to development is more influential on project success than that of supporters (Loring, 2006)

¹ Using 330,000 MW at 100 MW per site

Aesthetics & Property Values Rank At The Top Of Concerns



US developers rank aesthetics & property values as the #1 and # 3 concerns of those in opposition to wind development (Paul, 2006)

Aesthetics & Property Values Are Strongly Linked



This linkage is well studied

Property Value Concerns For Wind Energy Fall Into 3 Categories

1. **Area Stigma:** Concerns over “industrialization” of area leading to decreases in tourism and second home desirability

No one will move here!

2. **Scenic Vista Stigma:** Concerns for decreases in quality of scenic vistas from homes

It will ruin my view!

3. **Nuisance & Health Effects:** Potential health/well being concerns of nearby residents

I won't be able to live in my home!

Each of these effects could impact property values

Very Few Quality Wind & Property Studies

A List Of The Most Publicized

<u>Author (Year)</u>	<u>Location</u>	<u>Method</u>	<u>Test</u>	<u>Result</u>
Jordal-Jorgensen (1996)	Denmark	Hedonic	Area Stigma	↓ \$
Sterzinger et. al. (2003)	10 US sites	Simple	Area Stigma	↑ \$
Poletti (2005)	Wisconsin	Simple	Area Stigma	nc
Delacy (2005)	Washington	Paired Sales	Area Stigma	nc
Sims & Dent (2006)	UK	Hedonic	Area Stigma	↓ \$ / nc
Hoen (2006)	New York	Hedonic	Area Stigma/ Scenic Vista Stigma	nc nc

Overview

- Most tested for area stigma
- None of the studies, except Hoen (2006), visited homes
- None have been peer reviewed & published
- Sample size is problematic in many of the studies
- Statistical analysis is sometimes not rigorous

LBNL Study Methods

- US focused
- Multiple sites – 4 now, eventually 10 sites
- Field visits to each home
- Transaction values (not assessed values)
- Sample sizes over 350 for each site
- Hedonic Pricing Model – Used to isolate effects
- Test for all 3 effects: area stigma, scenic vista stigma, and nuisance effects

Hedonic Regression Model

COMBINED MODEL						
	Coeff.	Std. Error	t	Sig.	Lower	Upper
Intercept	10.85	0.07	160.89	0.00	10.74	10.96
Age_at_Sale	-0.01	0.00	-10.24	0.00	-0.01	0.00
Age_at_Sale_Sqrd	0.00	0.00	7.73	0.00	0.00	0.00
Sqft_1000	0.21	0.01	14.47	0.00	0.19	0.23
Acres	0.02	0.00	8.87	0.00	0.02	0.02
Baths	0.07	0.01	5.79	0.00	0.05	0.09
Finished Basement	0.07	0.02	3.87	0.00	0.04	0.10
Stone Exterior	0.18	0.03	6.41	0.00	0.13	0.23
Central AC	0.10	0.03	2.99	0.00	0.05	0.16
Fireplaces	0.10	0.01	7.37	0.00	0.08	0.12
CUL_DE_SAC	0.12	0.02	5.80	0.00	0.09	0.16
Poor Condition	-0.50	0.05	-9.03	0.00	-0.59	-0.41
Below Average Conditio	-0.25	0.02	-11.37	0.00	-0.29	-0.21
Above Average Conditio	0.11	0.02	5.58	0.00	0.08	0.14
High Condition	0.24	0.06	4.14	0.00	0.14	0.34
Year_1997	-0.03	0.06	-0.47	0.64	-0.13	0.07
Year_1998	-0.08	0.06	-1.45	0.15	-0.17	0.01
Year_1999	-0.01	0.06	-0.26	0.80	-0.11	0.08
Year_2000	-0.01	0.06	-0.14	0.89	-0.10	0.08
Year_2001	-0.02	0.06	-0.37	0.71	-0.11	0.07
Year_2002	-0.02	0.06	-0.27	0.79	-0.11	0.08
Year_2003	0.00	0.06	-0.01	0.99	-0.09	0.09
Year_2004	0.01	0.06	0.24	0.81	-0.08	0.10
Year_2005	0.03	0.05	0.59	0.55	-0.06	0.12
Year_2006	0.05	0.06	0.83	0.41	-0.05	0.14
Year_2007	-0.18	0.13	-1.43	0.15	-0.40	0.03
SD_NYMCDC_BRKFD	0.00	0.14	-0.03	0.98	-0.24	0.23
SD_NYMC_STK_VLY	-0.10	0.10	-1.05	0.29	-0.26	0.06
SD_NYMC_ONDA_CITY	-0.07	0.09	-0.82	0.41	-0.22	0.07
SD_NYMC_CHTNGO	0.02	0.08	0.21	0.84	-0.12	0.15
SD_NYMC_MRL ETN	-0.12	0.05	-2.48	0.01	-0.20	-0.04
SD_NYMCDC_MDSN	-0.19	0.05	-4.00	0.00	-0.26	-0.11
SD_PAWC_WYN_HGL	0.14	0.10	1.36	0.17	-0.03	0.31
SD_PAWC_FRST_CTY	-0.11	0.06	-1.64	0.10	-0.21	0.00
SD_NYMCDC_HMTN	0.11	0.04	2.88	0.00	0.05	0.18
SD_NYMCDC_WTRV	-0.03	0.10	-0.29	0.77	-0.19	0.14
SD_NYMC_CANST	-0.01	0.05	-0.13	0.89	-0.08	0.07
SD_PAWC_W_WYN	0.05	0.04	1.43	0.15	-0.01	0.12
NYMCDC_Traet_256	-0.23	0.09	-2.51	0.01	-0.38	-0.08
NYMCDC_Traet_257	-0.14	0.10	-1.40	0.16	-0.30	0.02
NYMCDC_Traet_309	0.16	0.13	1.28	0.20	-0.05	0.38
NYMCDC_Traet_311	-0.46	0.13	-3.47	0.00	-0.67	-0.24
PASC_Traet_208	-0.11	0.10	-1.16	0.25	-0.27	0.05
PASC_Traet_209	-0.25	0.05	-5.38	0.00	-0.33	-0.18
PASC_Traet_210	-0.29	0.07	-4.43	0.00	-0.40	-0.18
PASC_Traet_211	-0.28	0.05	-5.80	0.00	-0.36	-0.20
PASC_Traet_213	-0.27	0.14	-1.91	0.06	-0.51	-0.04
PASC_Traet_214	-0.09	0.06	-1.46	0.14	-0.18	0.01
PASC_Traet_215	-0.40	0.05	-7.67	0.00	-0.49	-0.32
PASC_Traet_216	-0.41	0.04	-9.24	0.00	-0.48	-0.33
PASC_Traet_217	-0.29	0.05	-5.36	0.00	-0.38	-0.20
PAWC_Traet_9602	0.12	0.07	1.68	0.09	0.00	0.24
PAWC_Traet_9603	-0.05	0.04	-1.10	0.27	-0.12	0.02
PAWC_Traet_9604	-0.12	0.11	-1.11	0.27	-0.30	0.06
PAWC_Traet_9608	-0.03	0.12	-0.23	0.82	-0.22	0.16
PAWC_Traet_9610	0.00	0.06	0.05	0.96	-0.10	0.10
NYMC_Traet_30200	0.17	0.09	1.88	0.06	0.02	0.31
NYMC_Traet_30300	0.06	0.04	1.39	0.16	-0.01	0.13
NYMC_Traet_30402	-0.03	0.09	-0.35	0.73	-0.18	0.12
NYMC_Traet_30501	0.30	0.05	6.46	0.00	0.22	0.38
NYMC_Traet_30502	0.22	0.05	4.66	0.00	0.14	0.30
NYMC_Traet_30700	0.12	0.05	2.44	0.01	0.04	0.20

Dependent Variable: LN_SalePrice96

Controlling Variables:

Number of Bedrooms, Number of Bathrooms, Square Feet, Acres, Finished Basement, Age of the Home, Condition of the Home, School District, Census Tract, Scenic Vista, etc.

Variables of Interest:

View of Turbines, Distance From Turbines, Number of Turbines Visible

Tests For 3 Effects: Area Stigma, Scenic Vista Stigma & Nuisance

1. Area Stigma: Test if distance from the facility has any effect alone after the facility was constructed
2. Scenic Vista Stigma:

Qualitatively: Using an on-site rating, compare sales of homes with views with those without

Quantitatively: Using distance and number of turbines visible, compare sales of homes with views with those without
3. Nuisance & Health: Compare sales inside of 2500 ft with and without a view to all others

4 Preliminary Sites – All in Northeast

Madison & Oneida Counties, NY: Madison Wind Farm

- 7 Turbines – 11.5 MW, rolling farmland
- Construction began June 2000
- 464 sales within 7 miles

Madison County, NY: Fenner Wind Farm

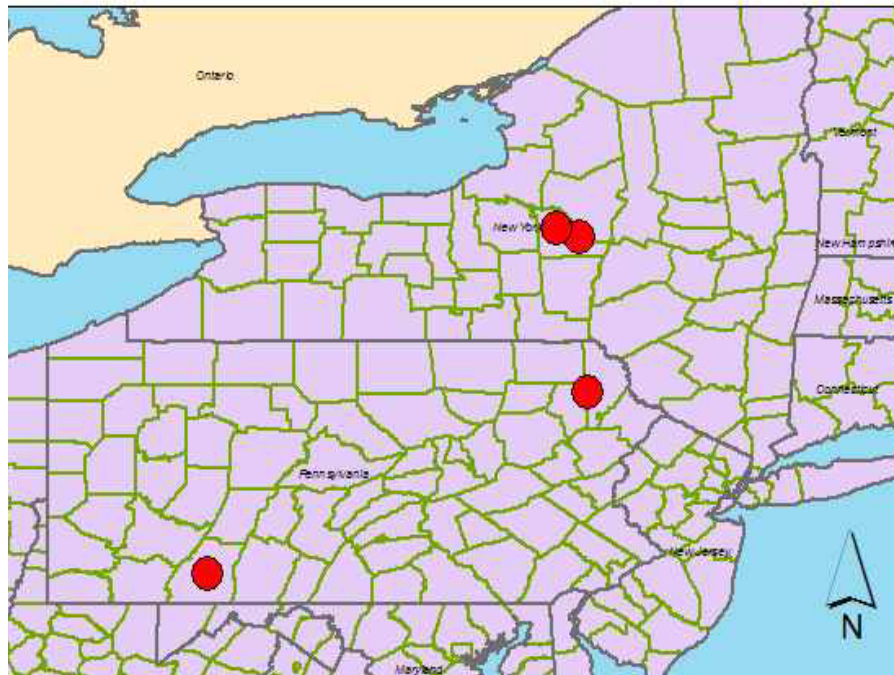
- 20 Turbines - 30 MW, rolling farmland
- Construction began Spring 2001
- 694 sales within 5 miles

Wayne County, PA: Waymart Wind Facility

- 43 Turbines – 64.5 MW, ridgeline
- Construction began June 2003
- 553 sales within 7 miles

Somerset County, PA: Multiple Sites

- 34 Turbines – 49.4 MW, rolling farmland & ridgeline
- Construction began December 1999 – August 2003
- 489 sales within 4 miles



To Test for Scenic Vista Stigma Scenic Vista Itself Needs to be Controlled For

They might pull in two directions



↑ \$ Without separating out scenic vista,
measurements of the effects
of the turbines might be artificially inflated

↓ \$?

5 Rankings for Scenic Vista

Each home was given a scenic vista rating



Poor



Average



Premium

Below
Average

Above
Average

4 Qualitative Ratings for View of Turbines dominance

Each home was given a view of turbines dominance rating



Minor



Moderate



Extreme

Substantial

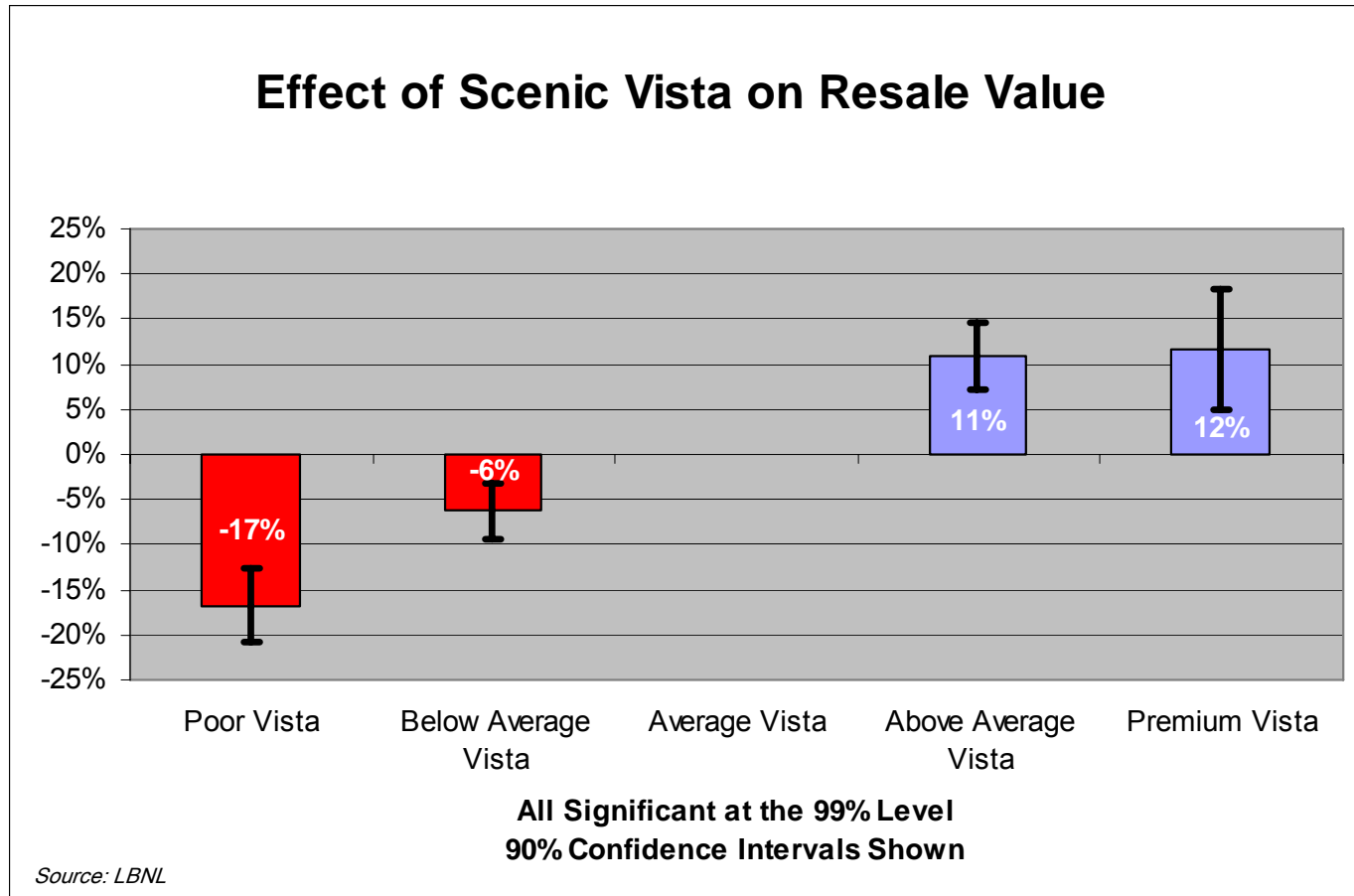


And quantitative measurements such as numbers of turbines and distance were also collected

Note of Caution

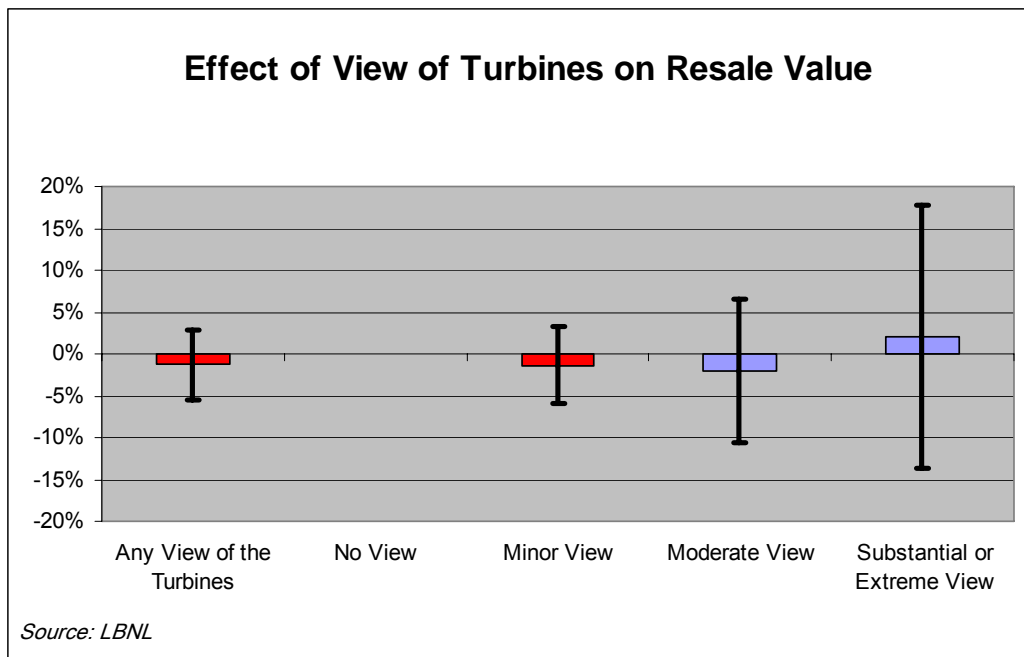
The following graphs, tables, and findings are **PRELIMINARY**, so conclusions based on these results should be considered preliminary as well

Buyers & Sellers Care about Scenic Vista...



Model Statistics: $n = 2195$, Adjusted $R^2: 0.72$, f Stat.: 84, Overall Sig.: 0.000

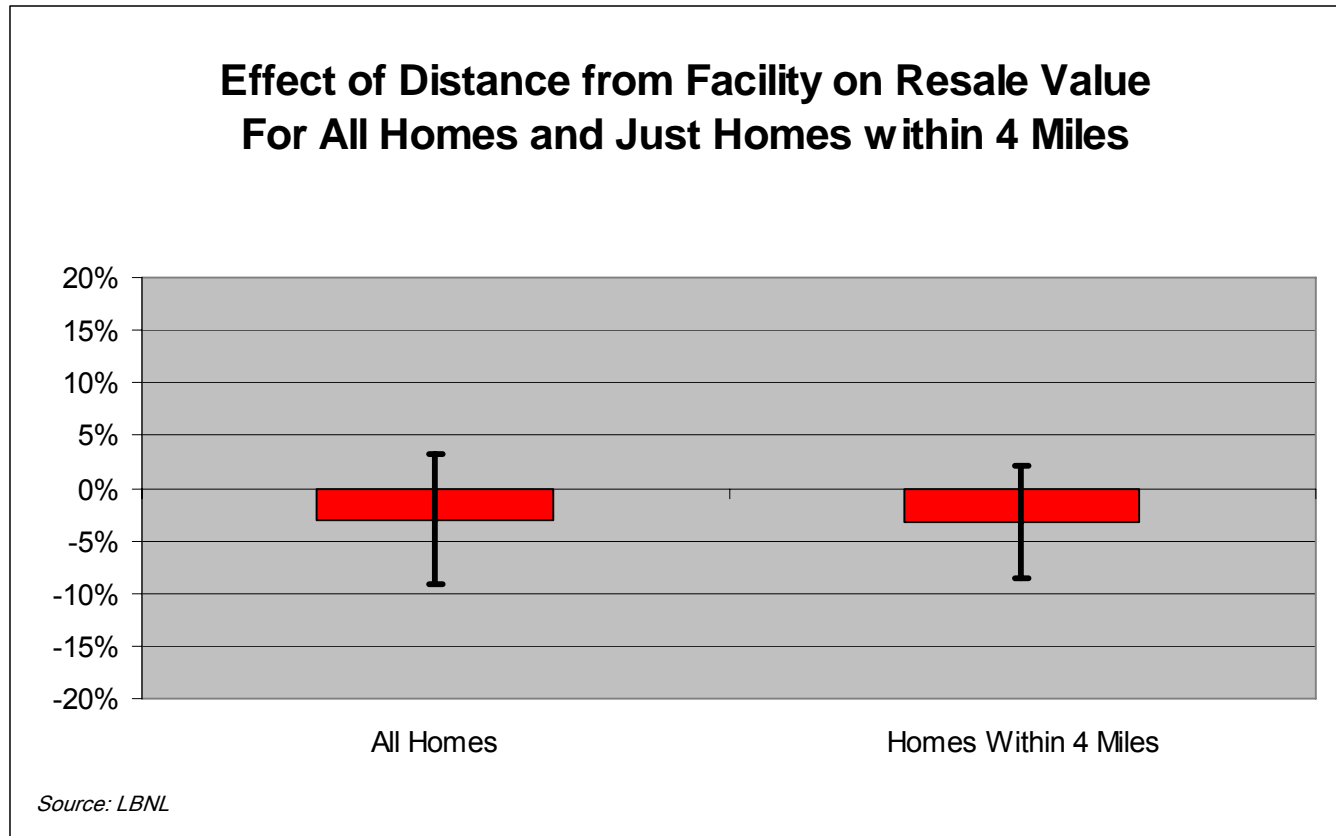
...but There Is No Statistically Significant Evidence They Care About Views of Turbines



Model Statistics: $n = 2195$, Adjusted $R^2: 0.72$, f Stat.: 84, Overall Sig.: 0.000

and this result holds using
quantitative or qualitative
measurements

There Is No Statistically Significant Evidence That An Area Stigma Exists



Area Stigma Model Statistics: $n = 1339$, Adjusted $R^2: 0.74$, f Stat.: 60, Overall Sig.: 0.000

Result – No Effects Found

But More Data Needed to Increase Confidence

Effect		Full Sample	2 Years Post Contr	Luxury Homes	2 Mile Homes
Area Stigma:		None Found	None Found	None Found	None Found
Scenic Vista Stigma:					
Qualitatively:		None Found	None Found	None Found	None Found
Quantitatively::		None Found	None Found	None Found	None Found
Model Statistics:	<i>n</i>	2195	463	548	509
	R ²	0.72	0.73	0.57	0.66
	Sig.	0.00	0.00	0.00	0.00

What Preliminary Conclusions Can Be Drawn From These Results?

Given our sample of 2195 transactions...

- Area Stigma: There is no statistical evidence that homes within 4-7 miles of a facility are affected adversely based simply on proximity
- Scenic Vista Stigma: There is no statistical evidence that homes with a view of turbines have different values than homes without
- Nuisance: More data is needed to reliably test this claim but with the 6 more wind farm sites to be added this might change

Results Are Provisional

With more data to be collected over the coming months from 6 more sites, we'll have much more to report.



Thank You