



Do Wind Facilities Affect Local Property Values?

Preliminary Results From A Multi-Site Analysis



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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

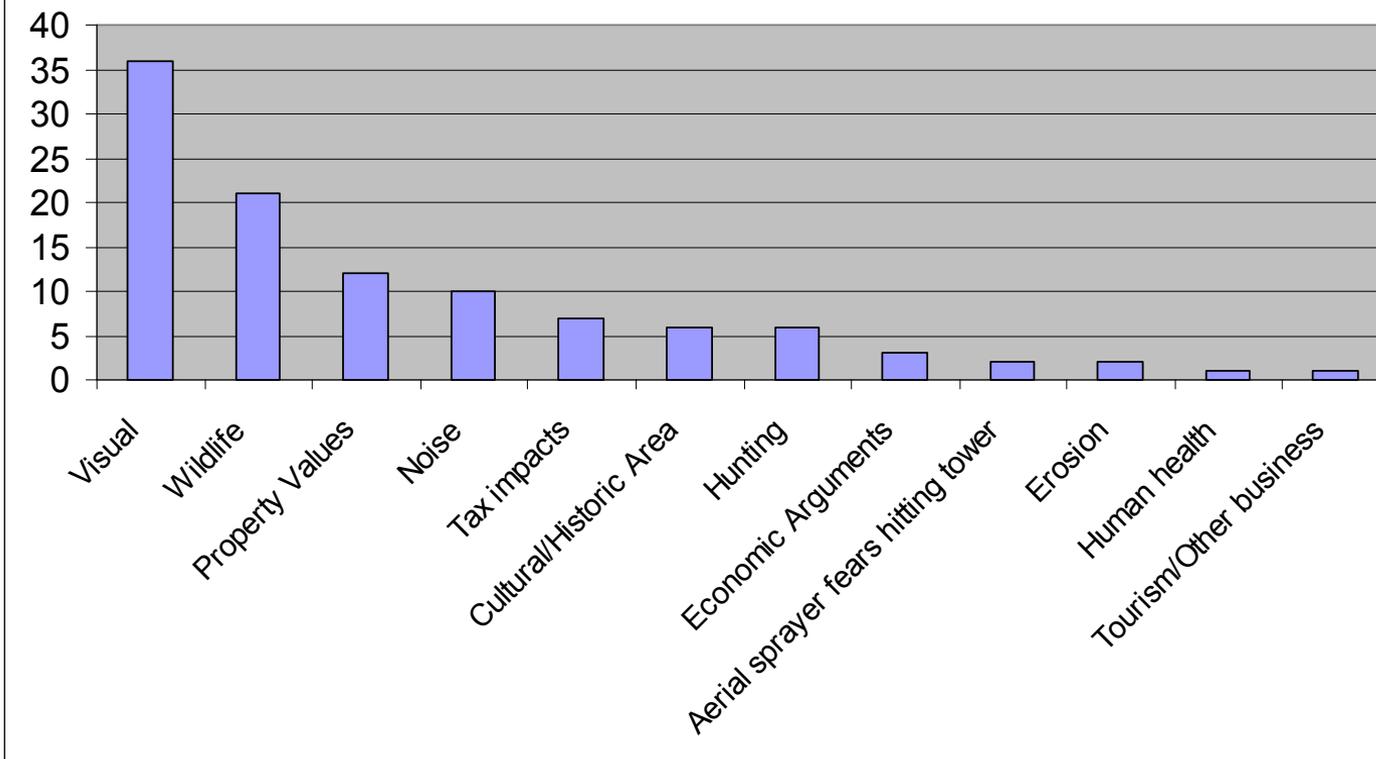
- 30 to 50% of contract failures are attributed to siting and permitting (CEC, 2006; BWEA, 2003 cited by Loring, 2006)

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

OPPOSITION ISSUES



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 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	↓ \$
Hoen (2006)	New York	Hedonic	Area Stigma/ Scenic Vista Stigma	nc nc

Overview

- Most tested for just 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
- Transaction values (not assessed values)
- Field visits to each home
- Test for all 3 effects: area stigma, scenic vista stigma, and nuisance effects
- Sample sizes over 350 for each site
- Hedonic Pricing Model – Used to isolate effects

Hedonic Regression Model

COMBINED MODEL						
	Coeff.	Std. Error	t	Sig.	90% Cnfdnc Intrv	
				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 Tract_256	-0.23	0.09	-2.51	0.01	-0.38	-0.08
NYMCDC Tract_257	-0.14	0.10	-1.40	0.16	-0.30	0.02
NYMCDC Tract_309	0.16	0.13	1.28	0.20	-0.05	0.38
NYMCDC Tract_311	-0.46	0.13	-3.47	0.00	-0.67	-0.24
PASC Tract_208	-0.11	0.10	-1.16	0.25	-0.27	0.05
PASC Tract_209	-0.25	0.05	-5.38	0.00	-0.33	-0.18
PASC Tract_210	-0.29	0.07	-4.43	0.00	-0.40	-0.18
PASC Tract_211	-0.28	0.05	-5.80	0.00	-0.36	-0.20
PASC Tract_213	-0.27	0.14	-1.91	0.06	-0.51	-0.04
PASC Tract_214	-0.09	0.06	-1.46	0.14	-0.18	0.01
PASC Tract_215	-0.40	0.05	-7.67	0.00	-0.49	-0.32
PASC Tract_216	-0.41	0.04	-9.24	0.00	-0.48	-0.33
PASC Tract_217	-0.29	0.05	-5.36	0.00	-0.38	-0.20
PAWC Tract_9602	0.12	0.07	1.68	0.09	0.00	0.24
PAWC Tract_9603	-0.05	0.04	-1.10	0.27	-0.12	0.02
PAWC Tract_9604	-0.12	0.11	-1.11	0.27	-0.30	0.06
PAWC Tract_9608	-0.03	0.12	-0.23	0.82	-0.22	0.16
PAWC Tract_9610	0.00	0.06	0.05	0.96	-0.10	0.10
NYMC Tract_30200	0.17	0.09	1.88	0.06	0.02	0.31
NYMC Tract_30300	0.06	0.04	1.39	0.16	-0.01	0.13
NYMC Tract_30402	-0.03	0.09	-0.35	0.73	-0.18	0.12
NYMC Tract_30501	0.30	0.05	6.46	0.00	0.22	0.38
NYMC Tract_30502	0.22	0.05	4.66	0.00	0.14	0.30
NYMC Tract_30700	0.12	0.05	2.44	0.01	0.04	0.20

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



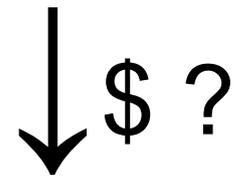
To Test for Scenic Vista Stigma Scenic Vista Itself Needs to be Controlled For

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

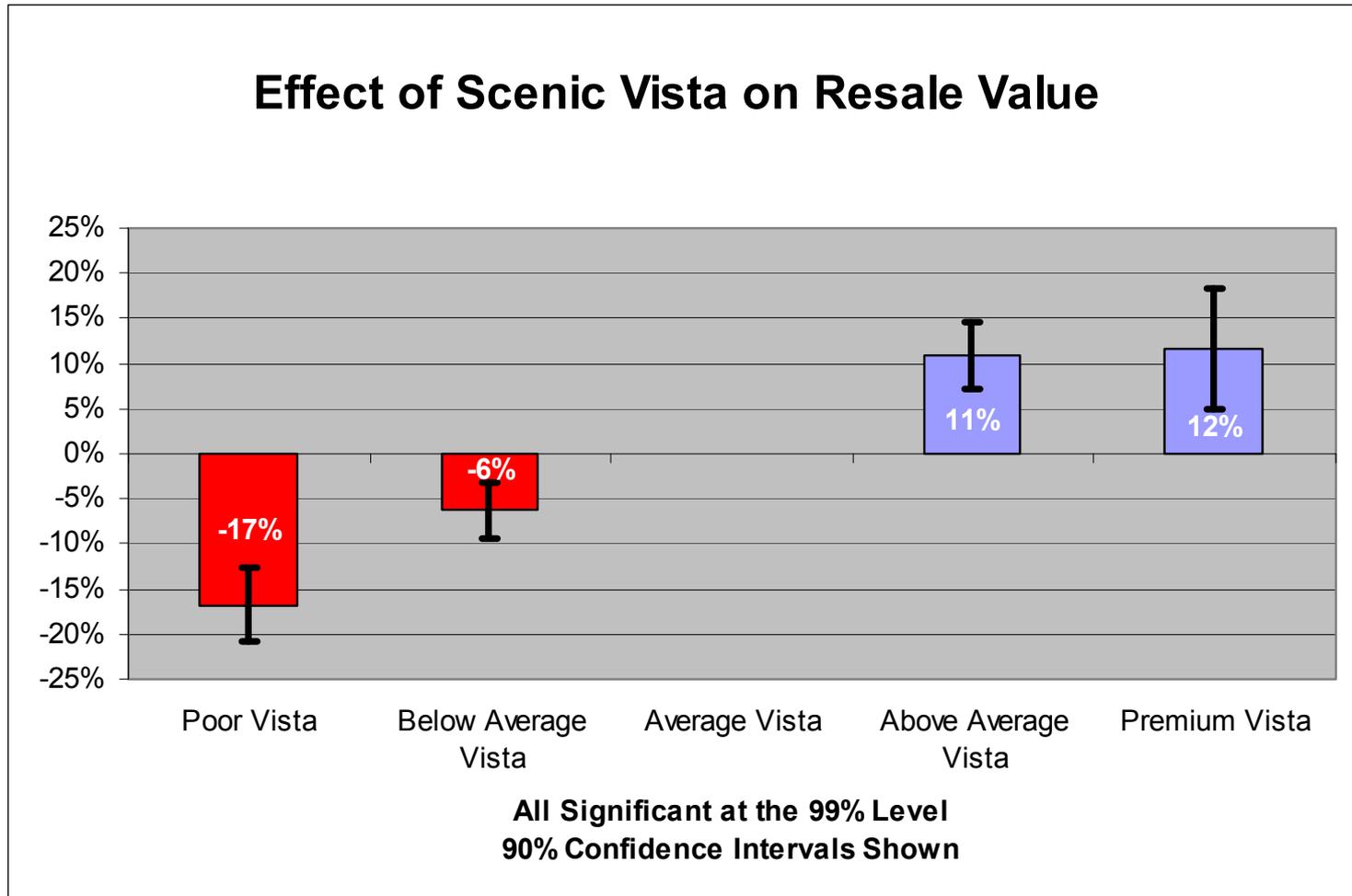
And quantitative measurements such as numbers of turbines and distance were also collected



Note of Caution

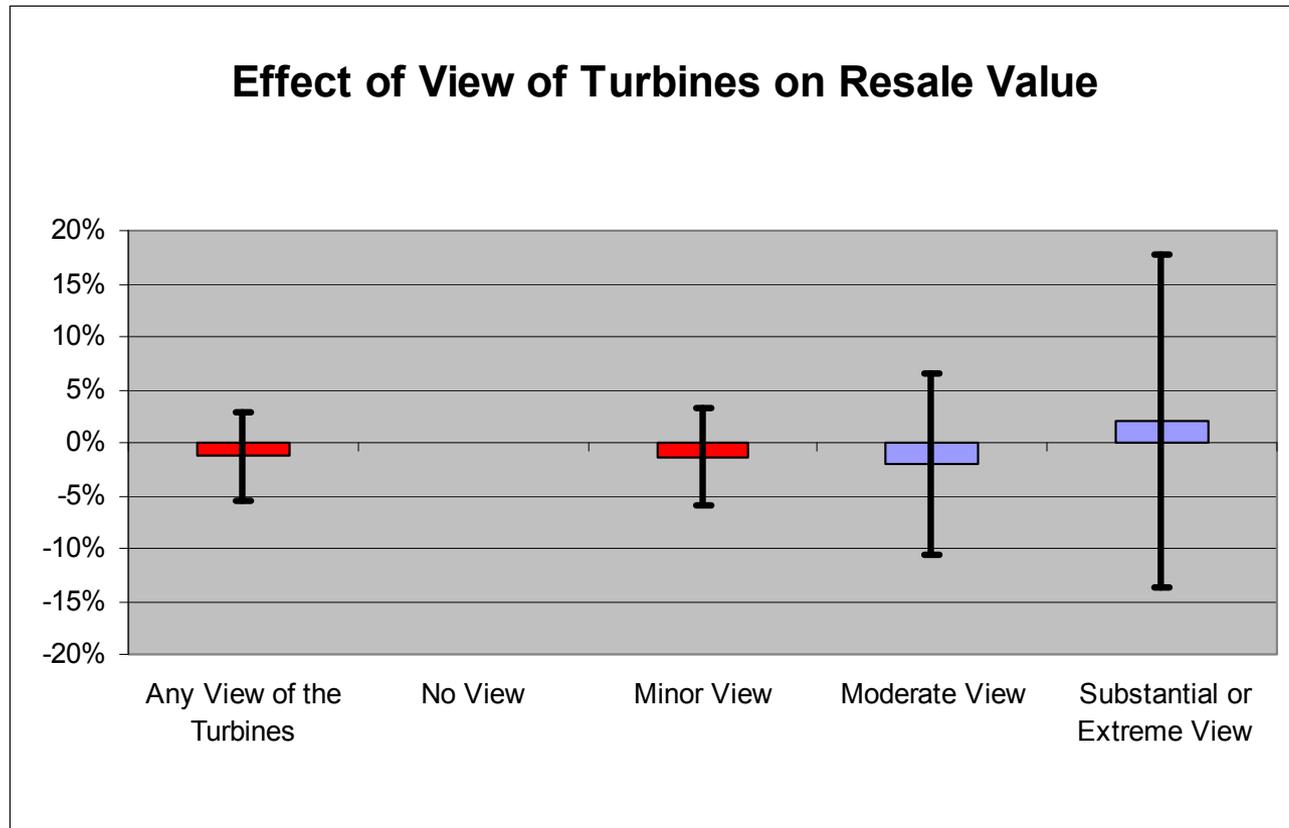
The following graphs, tables, and findings are **PRELIMINARY**, so conclusions based on these results should be considered preliminary as well

Buyers & Sellers Care about Scenic Vista



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

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

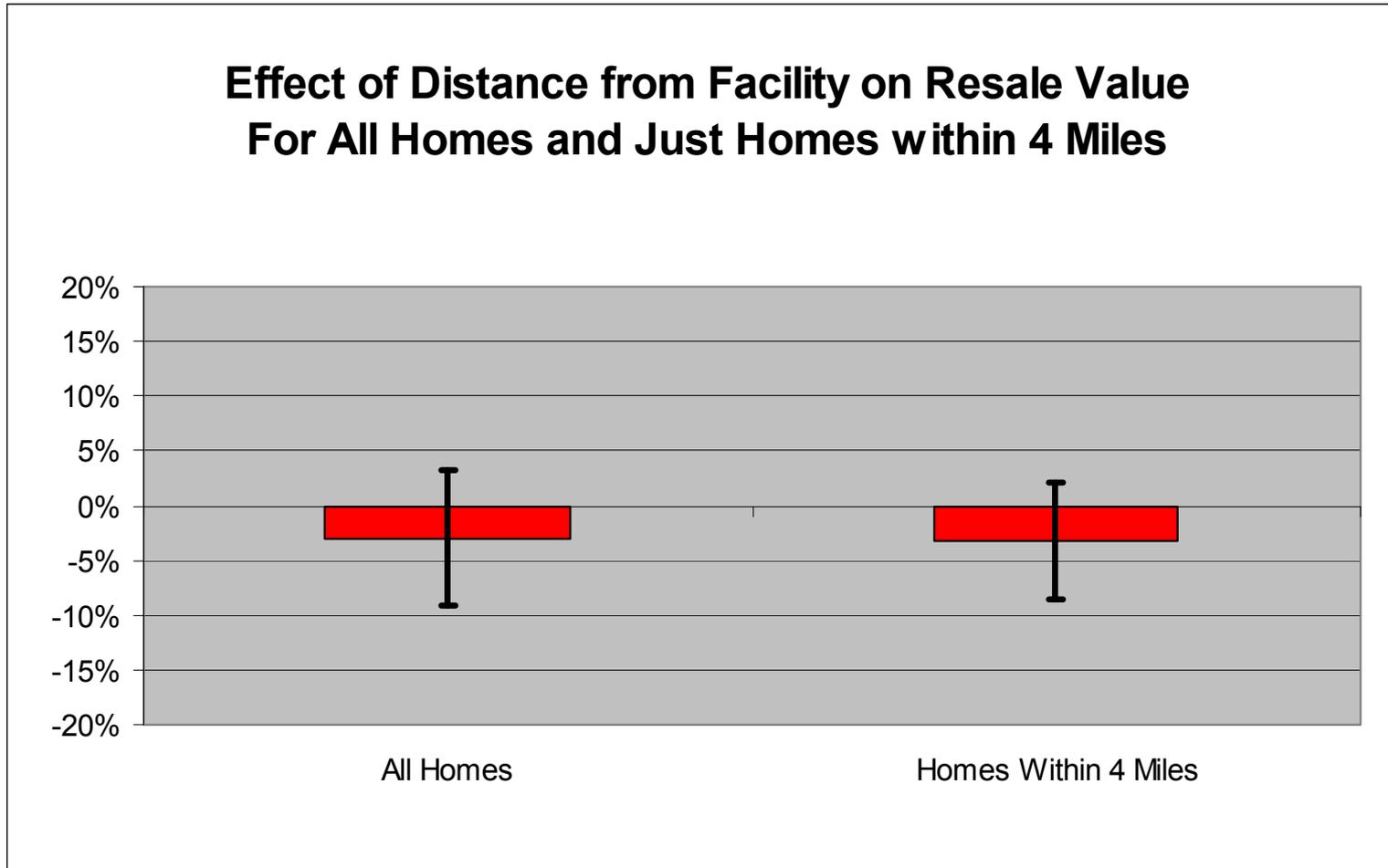


Model Statistics: $n = 2195$, Adjusted $R^2: 0.72$, f Stat.: 84, Overall Sig.: 0.000

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 Conclusions Can Be Drawn From These Preliminary 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

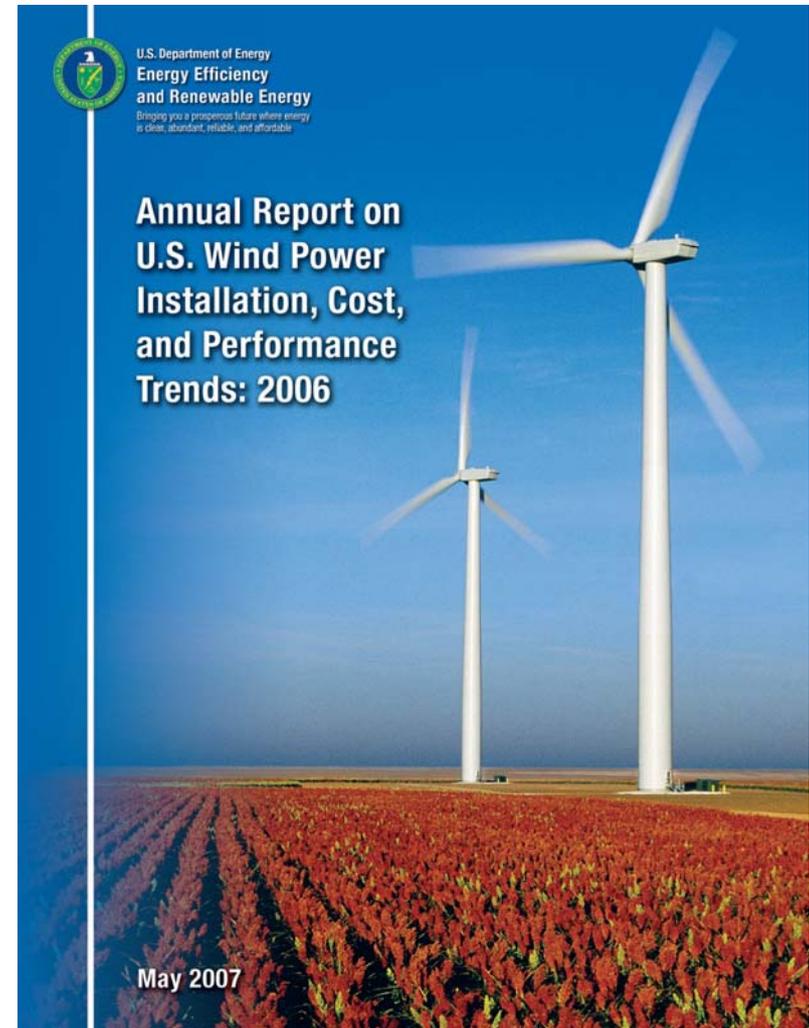
With more data to be collected over the coming months at a wider variety of sites, we'll have more to report



Thank You

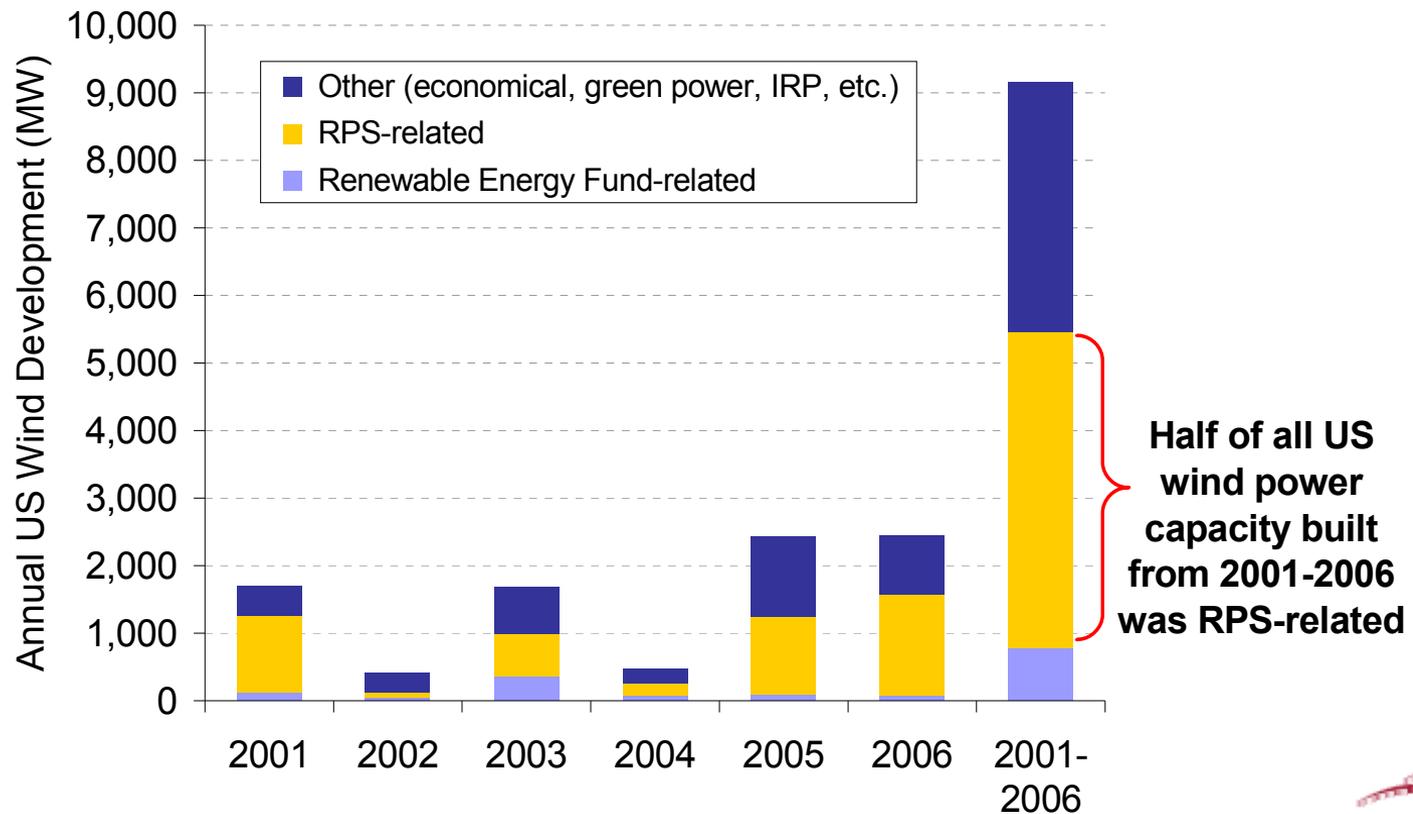
Annual Report on U.S. Wind Power Installation, Cost, and Performance trends: Inaugural Issue

- Wind installation trends
- Wind industry trends
- Evolution of wind pricing
- Installed wind project costs
- Wind turbine transaction prices
- Wind project performance
- O&M cost trends
- Integration/transmission/policy
- Coming up in 2007



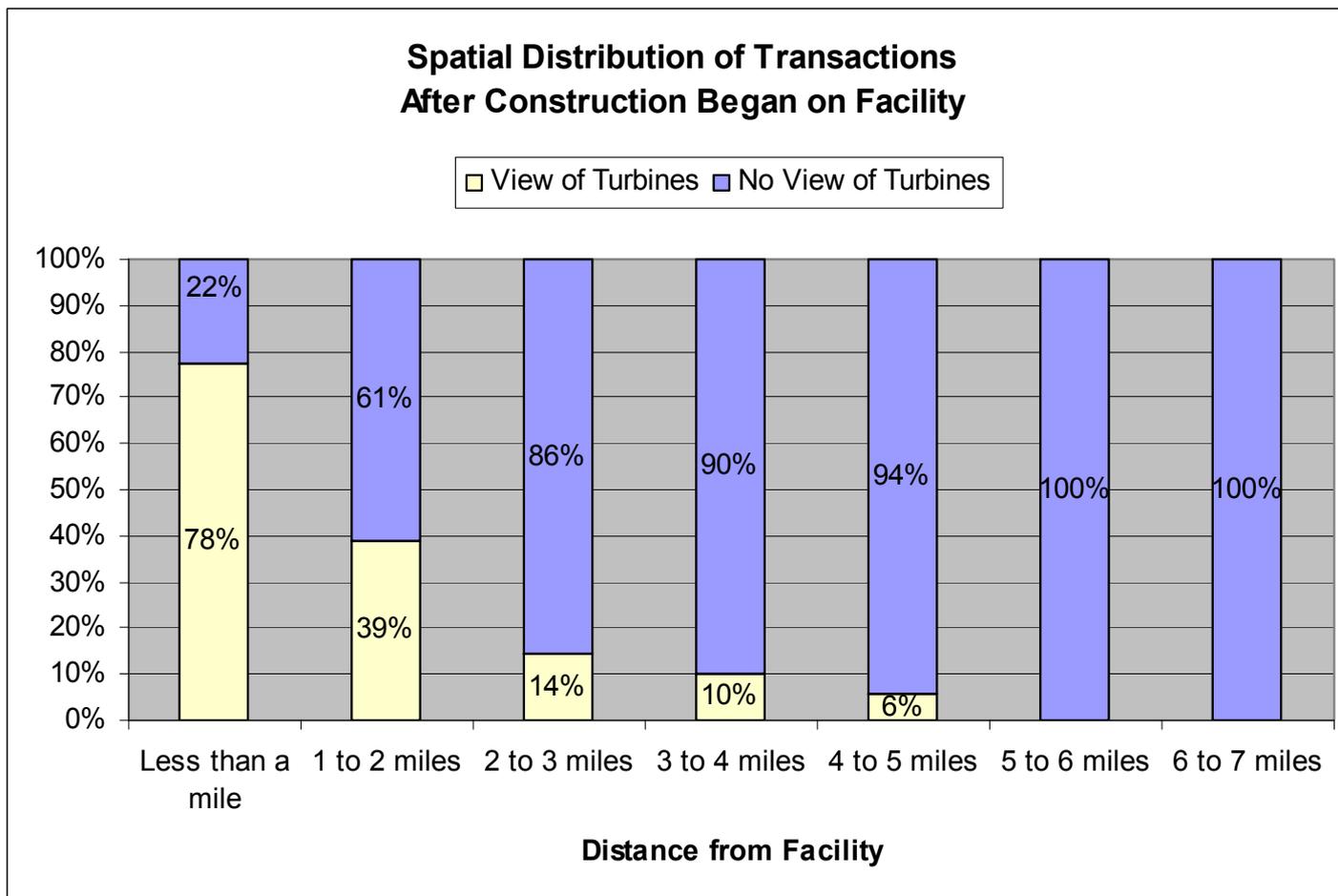
State RPS Activity Continues to Grow; Consideration At Federal Level Increases

- 23 states and D.C.
- New since beginning of 2006: WA, NH, OR
- Revisions to existing policies: NJ, WI, HI, CA, AZ, CT, MN, NM, CO, MD, TX

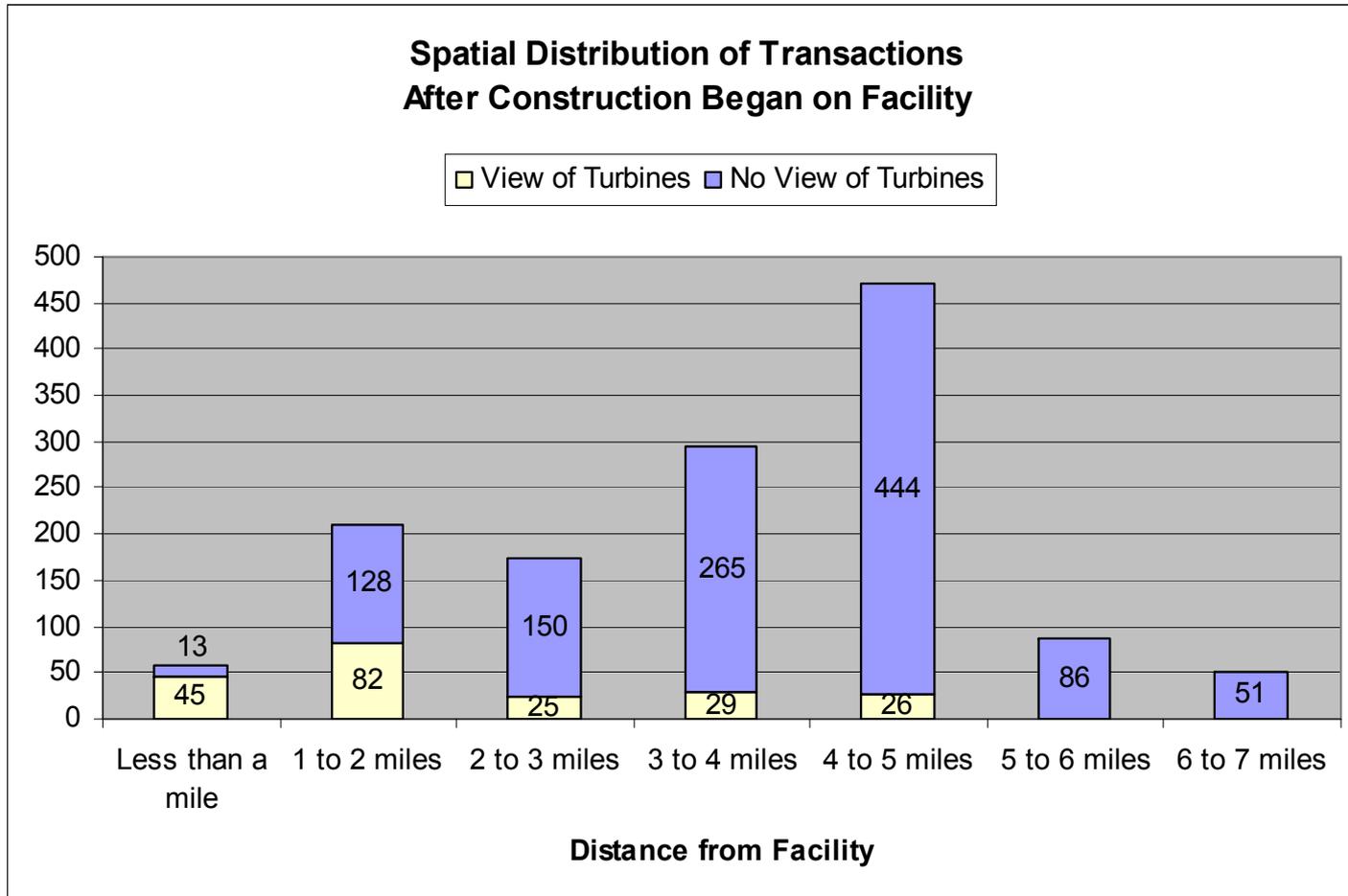




Spatial Distribution

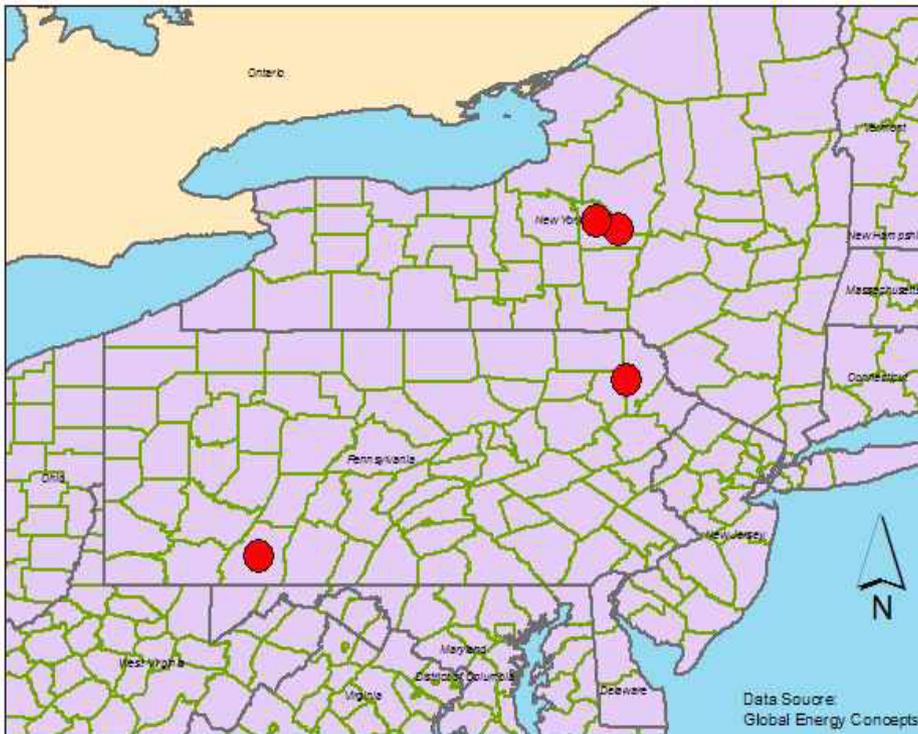


Spatial Distribution 2195 Transactions



Combined Model

We selected all Northeast sites and combined data while controlling for differences



Land Type: Ridgeline & Rolling Hills

Number of Transactions 2195

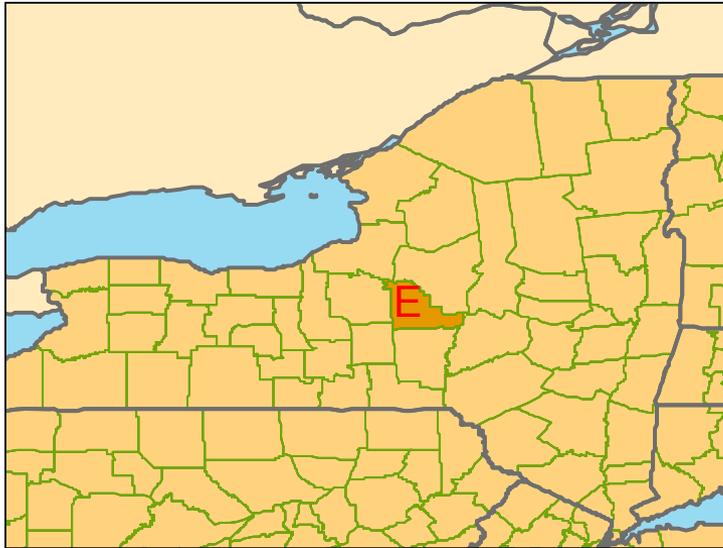
Minimum: \$12,000

Maximum: \$575,000

Sample Median: \$103,403

Fenner Wind Farm

Madison County, NY



Area Stigma Effects: None Found*

Scenic Vista Effects:

Qualitatively: None Found

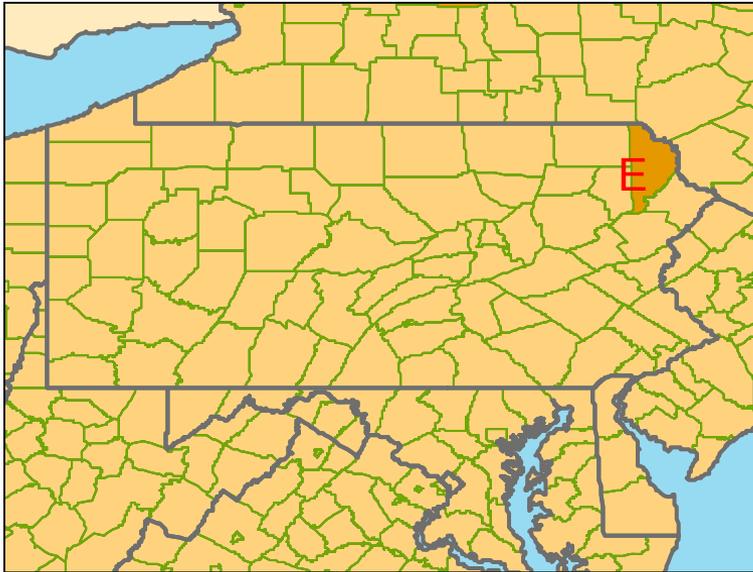
Quantitatively: None Found*

Land Type:	Rolling Farmland
Number of Transactions	695
Minimum:	\$26,000
Maximum:	\$575,000
Median Value:	\$124.697

	All Site	* Only Post Construction
Model Statistics: <i>n</i>	695	475
R^2	0.76	0.76
Sig.	0.00	0.00

Waymart Wind Facility

Wayne County, PA



Area Stigma Effects: None Found*

Scenic Vista Effects:

Qualitatively: None Found

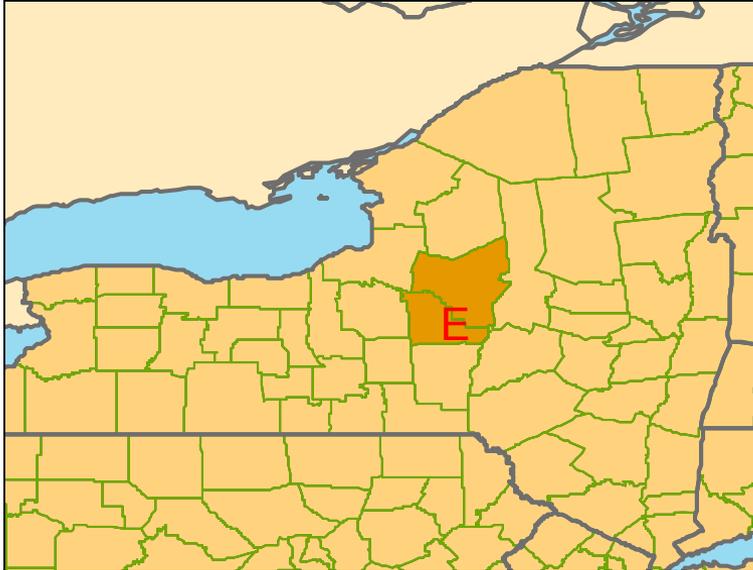
Quantitatively: None Found*

Land Type:	Ridgeline
Number of Transactions	554
Minimum:	\$20,000
Maximum:	\$444,500
Median Value:	\$111,681

	All Site	*Only Post Construction
Model Statistics: <i>n</i>	554	230
R^2	0.64	0.67
Sig.	0.00	0.00

Madison Wind Farm

Madison & Oneida Counties, NY



Area Stigma Effects: None Found*

Scenic Vista Effects:

Qualitatively: None Found

Quantitatively: None Found*

Land Type:	Rolling Farmland
Number of Transactions	465
Minimum:	\$13,500
Maximum:	\$380,000
Median Value:	\$99,430

	<u>All Site</u>	<u>* Only Post Construction</u>
Model Statistics: <i>n</i>	465	348
R^2	0.69	0.71
Sig.	0.00	0.00

Somerset, Green Mountain & Meyersdale Wind Facilities

Somerset County, PA



Area Stigma Effects: None Found*

Scenic Vista Effects:

Qualitatively: None Found

Quantitatively: None Found*

Land Type:	Rolling Farmland & Ridgeline
Number of Transactions	481
Minimum:	\$12,000
Maximum:	\$360,000
Median Value:	\$69.249

	All Site	* Only Post Construction
Model Statistics: <i>n</i>	481	283
<i>R</i> ²	0.57	0.57
Sig.	0.00	0.00