Inconvenient Truths About Wind Energy

Do the Pro's outweigh the Con's?

Let's start by looking at how much electricity wind farms can generate . . .

Gary A. Abraham, Esq., public interest environmental law
www.garyabraham.com

U.S. Department of Energy, National Renewable Energy Laboratory, *Wind Resource Assessment Handbook* (April 1997), p. 3-2:

Grid cells designated as Class 4 or greater are generally considered to be suitable for most wind turbine applications. Class 3 areas are suitable for wind energy development using tall (e.g., 50 m hub height) turbines. Class 2 areas are marginal and Class 1 areas are unsuitable for wind energy development. The gridded wind resource estimates were not meant to address the variability in mean wind speed on a local scale but to indicate broad areas where a high wind resource is possible. Therefore, in approaching an area designated as Class 2, for example, the analyst should not rule out the possibility that it may contain smaller-scale features possessing a more energetic (Class 3 or greater) wind resource.

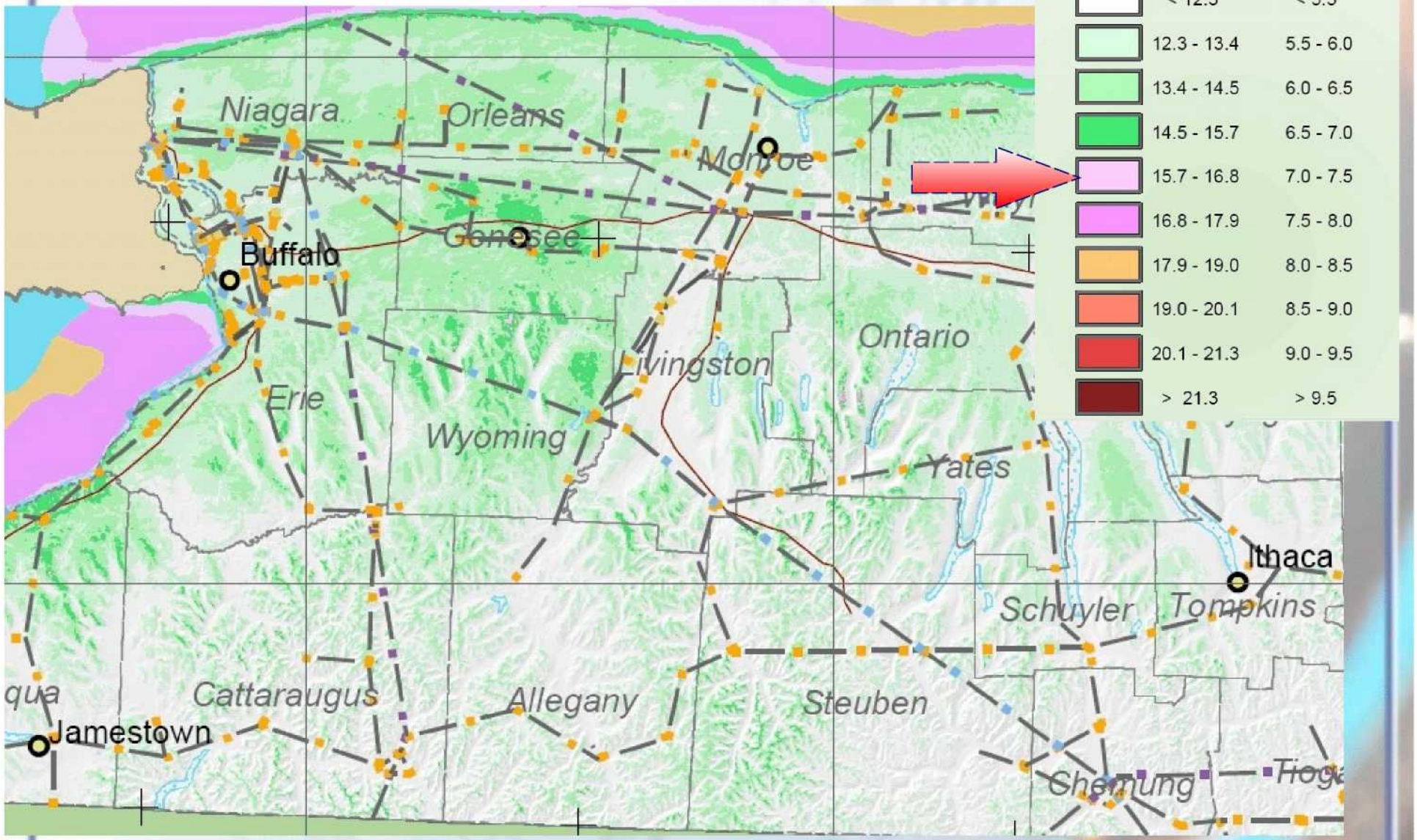
Table 3.1
Classes of Wind Power Density

	30 m (98 ft)		50 m (164 ft)	
Wind Power Class	**Wind Power Density (W/m^2)**	**Wind Speed m/s (mph)**	**Wind Power Density (W/m^2)**	**Wind Speed m/s (mph)**
1	≤160	≤5.1 (11.4)	≤200	≤5.6 (12.5)
2	≤240	≤5.9 (13.2)	≤300	≤6.4 (14.3)
3	≤320	≤6.5 (14.6)	≤400	≤7.0 (15.7)
4	≤400	≤7.0 (15.7)	≤500	≤7.5 (16.8)
5	≤480	≤7.4 (16.6)	≤600	≤8.0 (17.9)
6	≤640	≤8.2 (18.3)	≤800	≤8.8 (19.7)
7	≤1600	≤11.0 (24.7)	≤2000	≤11.9 (26.6)

Conclusion: a mean wind speed of 6.4-7.0 m/s, or nearly 16 mph at a 50 meter height will be required for a viable industrial wind project.

New York State Energy and Research Development Authority, http://www.windexplorer.com/NewYork/NewYork.htm

Where are the pink zones?



Wind speed doesn't matter

Where is the real benefit?

Tax Credits:

100%-- **5-year depreciation allowance (federal)**

30%-- **Production Tax Credit (federal)**

Production Tax Credit (NY)

Local Property Tax Exemption (NY)

Sales Tax Exemption (NY)

Total percentage of tax subsidies to wind farms has been estimated to be 164%

U.S. Dept. of Energy, Energy Information Administration (EIA), *Federal Financial Interventions and Subsidies in Energy Markets 2007* (April 2008), p. 18:

Table ES5. Subsidies and Support to Electricity Production: Alternative Measures

Fuel/End Use	FY 2007 Net Generation (billion kilowatthours)	Alternative Measures of Subsidy and Support	
		FY 2007 Subsidy and Support (million 2007 dollars)	Subsidy and Support per Unit of Production (dollars/megawatthour)
Coal	1,946	854	0.44
Refined Coal	72	2,156	29.81
Natural Gas and Petroleum Liquids	919	227	0.25
Nuclear	794	1,267	1.59
Biomass (and biofuels)	40	36	0.89
Geothermal	15	14	0.92
Hydroelectric	258	174	0.67
Solar	1	14	24.34
Wind	31	724	23.37
Landfill Gas	6	8	1.37
Municipal Solid Waste	9	1	0.13
Unallocated Renewables	NM	37	NM
Renewables (subtotal)	360	1,008	2.80
Transmission and Distribution	NM	1,235	NM
Total	4,091	6,747	1.65

NOTES: Unallocated renewables include projects funded under Clean Renewable Energy Bonds and the Renewable Energy Production Incentive.

NM=Not meaningful. Totals may not equal sum of components due to independent rounding.

Production Tax Credit by industry:

Table 9. Fuel Allocation for New Technology Credit Fiscal Year 2007 Estimated Expenditure

Renewable Technology	Estimated Qualified Capacity (Megawatts)	Estimated Eligible Generation (FY07 Megawatthours)	Average Capacity Factor (percent)	Value of Credit (cents per kilowatthour)	EIA Estimate Based on FY07 Generation (Thousand dollars)	Treasury's Estimated Credit Allowed (Thousand dollars)
Biomass (open loop)	188	351,139	21.3	0.95	3,336	4,223
Geothermal	68	346,945	58.7	1.90	6,592	8,345
Hydroelectric	44	85,318	22.3	0.95	811	1,026
Landfill Gas	193	705,341	41.7	0.95	6,701	8,482
Municipal Solid Waste	37	89,988	27.9	0.95	855	1,082
Solar	87	31,143	4.1	1.90	592	749
Wind	15,312	27,694,360	20.6	1.90	526,193	666,093
Total or Weighted Average	15,928	29,304,234	21.0	1.86	545,078	690,000

NOTE: Totals may not equal sum of components due to independent rounding.

Sources: Office of Management and Budget, *Analytical Perspectives of the United States Budget, Fiscal Year 2008,* Table 19-1. Energy Information Administration, "Power Plant Report," Form EIA-906, and "Combined Heat and Power Plant Report," Form EIA-920.

U.S. Dept. of Energy, Energy Information Administration (EIA), *Federal Financial Interventions and Subsidies in Energy Markets 2007* (April 2008), p. 34.

How much electricity do we get for our tax dollars?

The wind industry's own assessment:

7.4 Summary

Capacity factors of inland wind sites in New York are on the order of 30% of their rated capacity. Their effective capacities, however, are about 10%, due to both the seasonal and daily patterns of the wind generation being largely "out of phase" with the NYISO load patterns.

GE Energy, *The Effects of Integrating Wind Power on Transmission System Planning, Reliability, and Operations (Report on Phase 2)*, prepared for The New York State Energy Research and Development Authority (NYSERDA) (March 4, 2005), p. 7.16.

Can we *rely* on wind power for our electricity needs?

(1) No electricity is provided to the host community

(2) Wind generates electricity only when the wind blows

(3) baseload and dispatchable power plants must be available for almost 100% of all wind power capacity

What is the *purpose* of wind energy?

1. To reduce our dependence on foreign oil.

2. To reduce greenhouse gases and slow the rate of climate change.

#1: Oil is burned for only 1% of electricity generated in the United States (3% in NY)

#2: The best estimates say that wind power cannot meaningfully reduce emissions from conventional power plants (coal & natural gas)

#2: *How much* can wind power reduce emissions from conventional power plants?

European grid operator (and wind farm developer) E.On Netz:

> In order to also guarantee reliable electricity supplies when wind farms produce little or no power, e.g. during periods of calm or storm-related shutdowns, traditional power station capacities must be available as a reserve. . . . In concrete terms, this means that in 2020, with a forecast wind power capacity of over 48,000MW (Source: dena grid study), 2,000MW of traditional power production can be replaced by these wind farms.

In other words, wind farms can only replace about ***four percent*** of traditional power station capacities.

E.ON Netz GmbH, *Wind Report 2005*, p. 10, <http://www.eon-netz.com/pages/ene_en/ EEG__KWK-G/Renewable_Energy_Sources_Act_/EEG_plants/Facts_and_figures_relating_to_wind_power/>.

#2: *How much* can wind power reduce emissions from conventional power plants?

The National Academy of Sciences estimates that wind-generated energy can:

- displace about ***8%*** of the capacity of more polluting sources;
- displace no more than ***2.25%*** of U.S. anthropogenic CO_2 emissions at full build-out by 2020; and
- increases rather than decreases the need for reserve power, further reducing wind power's net displacement of CO_2

Conclusion: ***emissions displacement by wind farms is unlikely to be significant in the foreseeable future.***

National Academy of Sciences, *Environmental Impacts of Wind-Energy Projects: Impacts on Human Health and Well-Being* (2007), pp. 35, 52, 63-64, <http://www.nap.edu/openbook.php?isbn=0309108349>

Wind Turbine Noise: *What the Science Says*

- in areas a mile or more from heavy traffic or industrial uses, ambient (background) sound levels in rural communities are about 25 dBA, especially at night
- many towns adopt wind industry recommended sound limits of 50 dBA (also NYSERDA, NYS Assn. of Towns
- wind turbine noise includes a significant low-frequency component, sounds below 500 Hz, including inaudible infrasound (0–20 Hz), measured as dB**C** (vibrations)
- low-frequency sound is often felt rather than heard
- low-frequency sound is "louder" than A-weighted sound, and passes through walls
- chronic exposure to low-frequency sound is linked to growth of collagen and elastin in the blood vessels, cardiac structures, trachea, lungs, and kidneys of humans and animals

Wind Turbine Noise: *What the Science Says*

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- wind turbine noise includes a significant low-frequency component, often felt rather than heard, measured as dBC (vibrations)
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- chronic exposure to low-frequency sound is linked to growth of collagen and elastin in the blood vessels, cardiac structures, trachea, lungs, and kidneys of humans and animals
- both the audible and less-audible or inaudible components of wind turbine noise can result in serious adverse health effects
- chronic sleeplessness leads to cardiac arrhythmia, vasoconstriction, increased fatigue, depressed mood or well-being, and decreased performance according the World Health Organization

Distinctive fluctuating sound of wind turbines

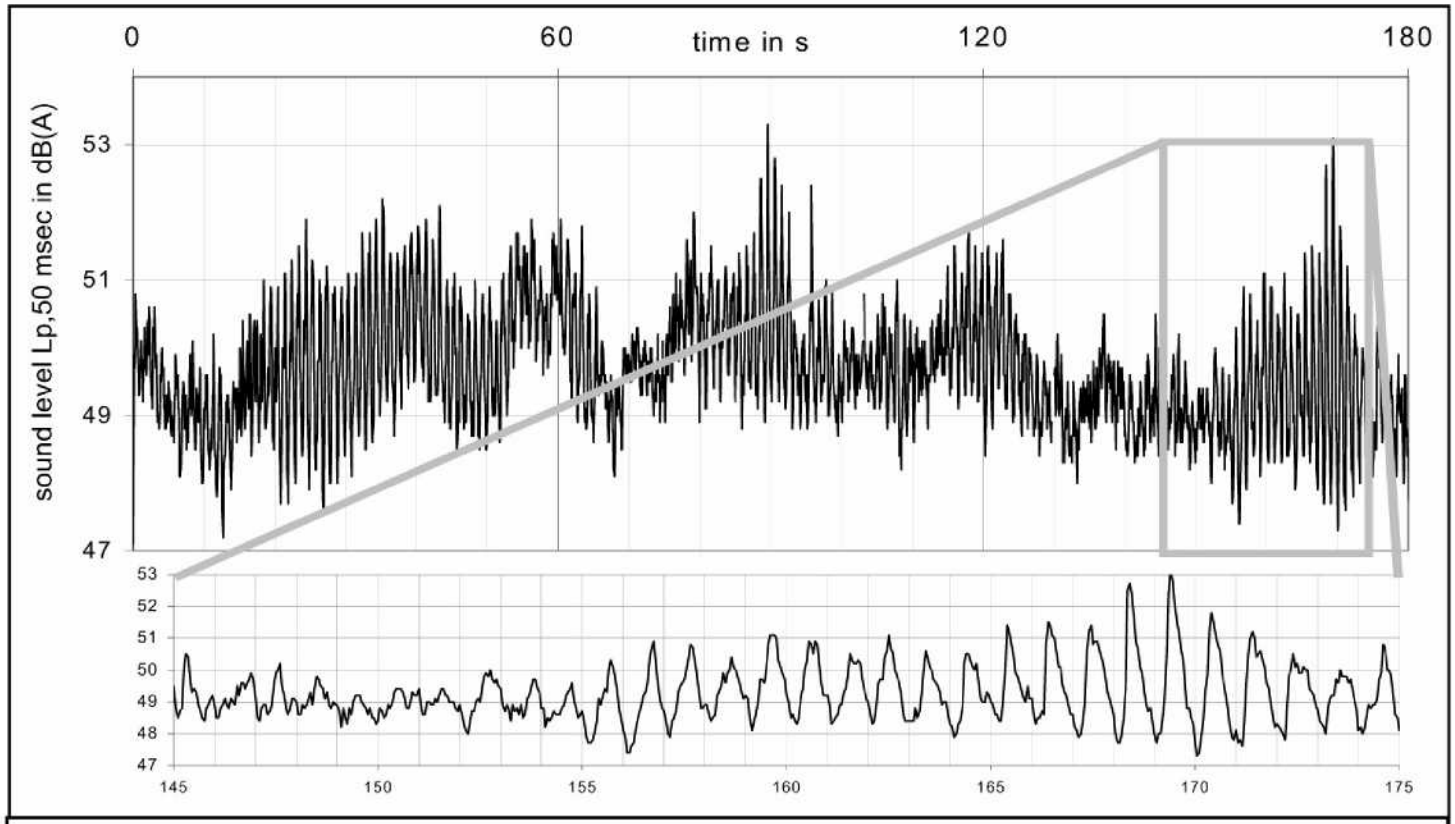
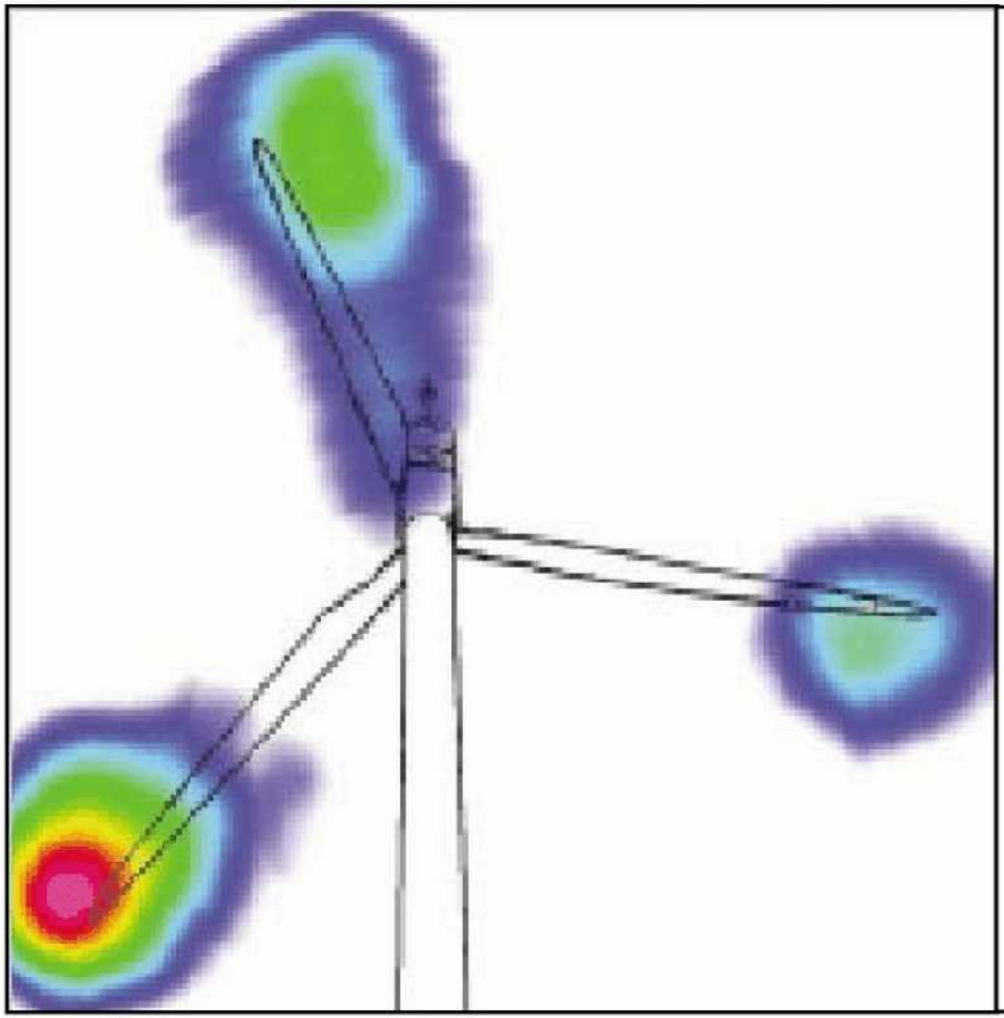


Figure V.4: fluctuations in broad band A-weighted sound immission level at façade of dwelling P; the lower panel is an expansion of the part within the grey rectangle

Van den Berg, Sounds of High Winds (2006)

The source of wind turbine noise



'acoustic photograph' showing the high speed tips of a wind turbine radiate most sound; colors from centre to outside contour indicate an decreasing sound level (photo: Acoustic Camera, GFaI, Berlin)

Van den Berg, Sounds of High Wind (2006)

20-30 decibel difference in sound fluctuations

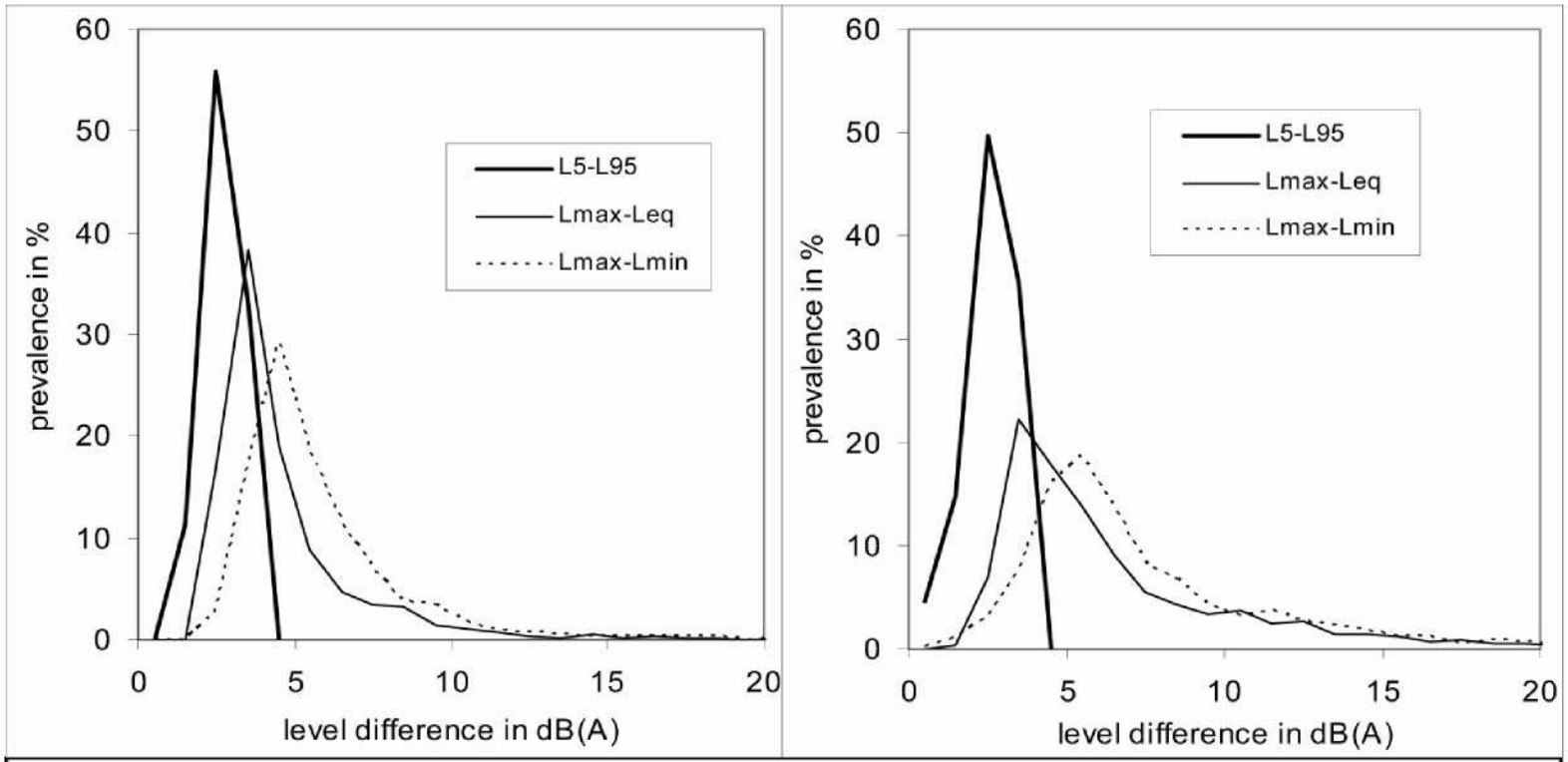


Figure V.7: statistical distribution of level differences (in 1 dB-classes) between high and low sound levels within 5 minute periods at 400 m (left) and 1500 m (right) from the nearest wind turbine

400 meters = 1,312 feet
1500 meters = 4,921 feet

Van den Berg, Sound of High Winds (2006)

Wind turbine noise is more annoying than sources that are louder

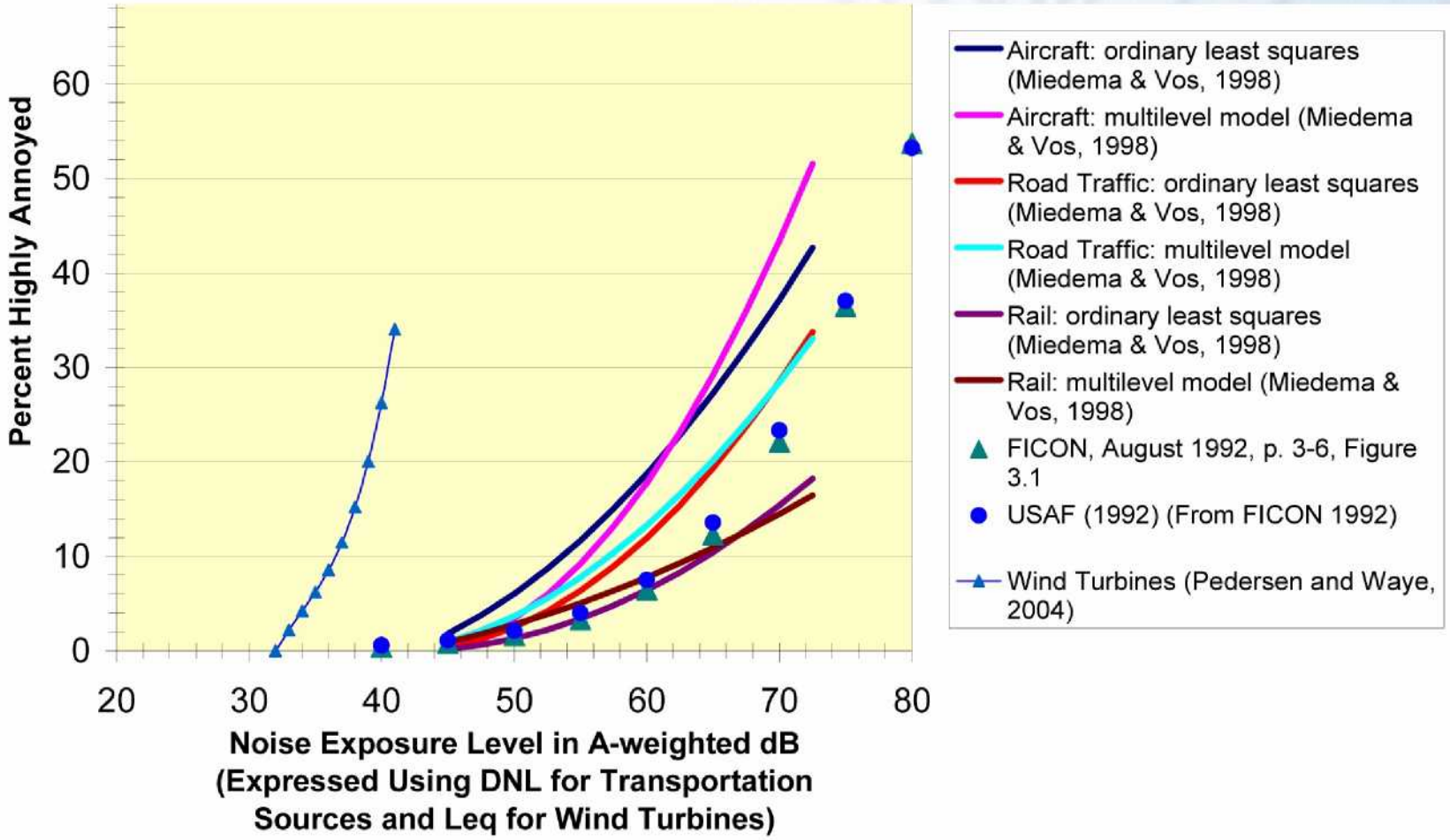


Figure 1: Dose-response relationships for transportation sources and wind turbines

C.J. Bajdek, Communicating the Noise Effects of Wind Farms to Stakeholders (2007)

What's the *ambient* (background) sound level in a rural residential community?

E-Coustic Solutions

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P.O Box 1129, Okemos, MI, 48805
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Richard R. James
Principal
Tel: 517-507-5067
Fax: (866) 461-4103

2006 Baseline Noise Study
For
Residents for Sound Economics and Planning
Ubly, Michigan
January 22, 2007

Table 2-Study Findings for Test Sites and Calculated Ldn for each Site

Site	Description	dB(A) Ambient (Huron County*)			Baseline L_{dn} (1)
		L(day)	L(evening)	L(night)	
Site 1	Farm-North Edge of Ubly	33	33	29	36.3
Site 2	Residential-Sub-Division	32	31	27	34.6
Site 3	Farm-Rural	32	24	23	32.4

*Data in this chart is based upon reviewed and selected field data. Final values are the ambient sound levels for day, evening, and night periods calculated as defined ANSI S12.9 and ISO 1996. Data that was excluded was: (1) collected for a different purpose; (2) contained artifacts created by people or activities in the vicinity of the data collection instruments; or (3) contained data caused by non-typical events including vehicle and airplane pass-bys.

night time background sound level here is 23-29 dBA

distances from nearest turbine
Site 1 = 4,000 ft.
Site 3 = 1,529 ft.

wind speeds = 3-10 mph

adding penalities for espcially quiet areas, a wind farm is expected to increase perceive sound level by 26.5-32.2 dBA

ANSI S12.9 Adjustments for Community Characteristics and Predicted Sound Levels of Wind Turbines

Site	Description	Baseline L_{dn} (1)	Predicted Turbine Noise (Noble Data) (6)	ANSI S12.9 Correction Factors (2)		L_{dn} with Turbines at Predicted Sound Level (5)		Perceived Change dBA
				Unfamilar Sound Correction Factor (3)	Rural Correction Factor (4)			
Site 1	Farm-North Edge of Ubly	36.3	41.3	5	10	**62.7**	L_{dn}	**26.5**
Site 2	Residential-Sub-Division	34.6	No Data	5	10	No Data		No Data
Site 3	Farm-Rural	32.4	43.2	5	10	**64.6**	L_{dn}	**32.2**

R. James, Sound Study for Ubly, Michigan, con't

Assessing and Mitigating Noise Impacts

(February 2, 2001)

New York State
Department of Environmental Conservation

HUMAN REACTION TO INCREASES IN SOUND PRESSURE LEVEL

Increase in Sound Pressure (dB)	Human Reaction
Under 5	Unnoticed to tolerable
5 - 10	Intrusive
10 - 15	Very noticeable
15 - 20	Objectionable
Over 20	Very objectionable to intolerable

(Down and Stocks - 1978)

"If the goal is not to raise the future noise levels the new facility would have to operate at 10 dB(A) or more ***lower than the ambient****."*

wind industry trick #1

take town officials to hear the noise of wind turbines here, where sound levels are minimal

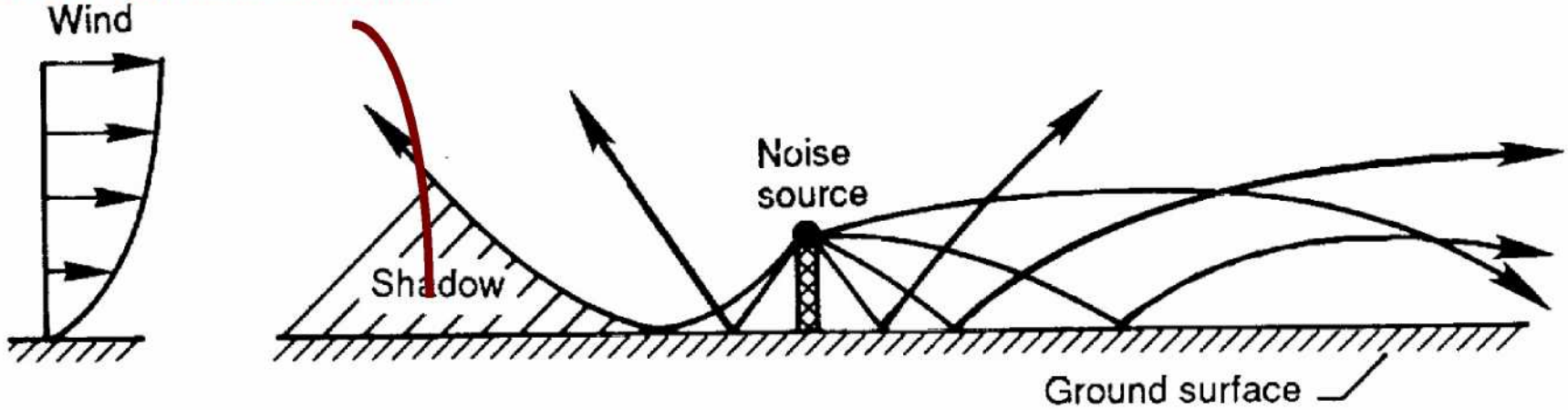
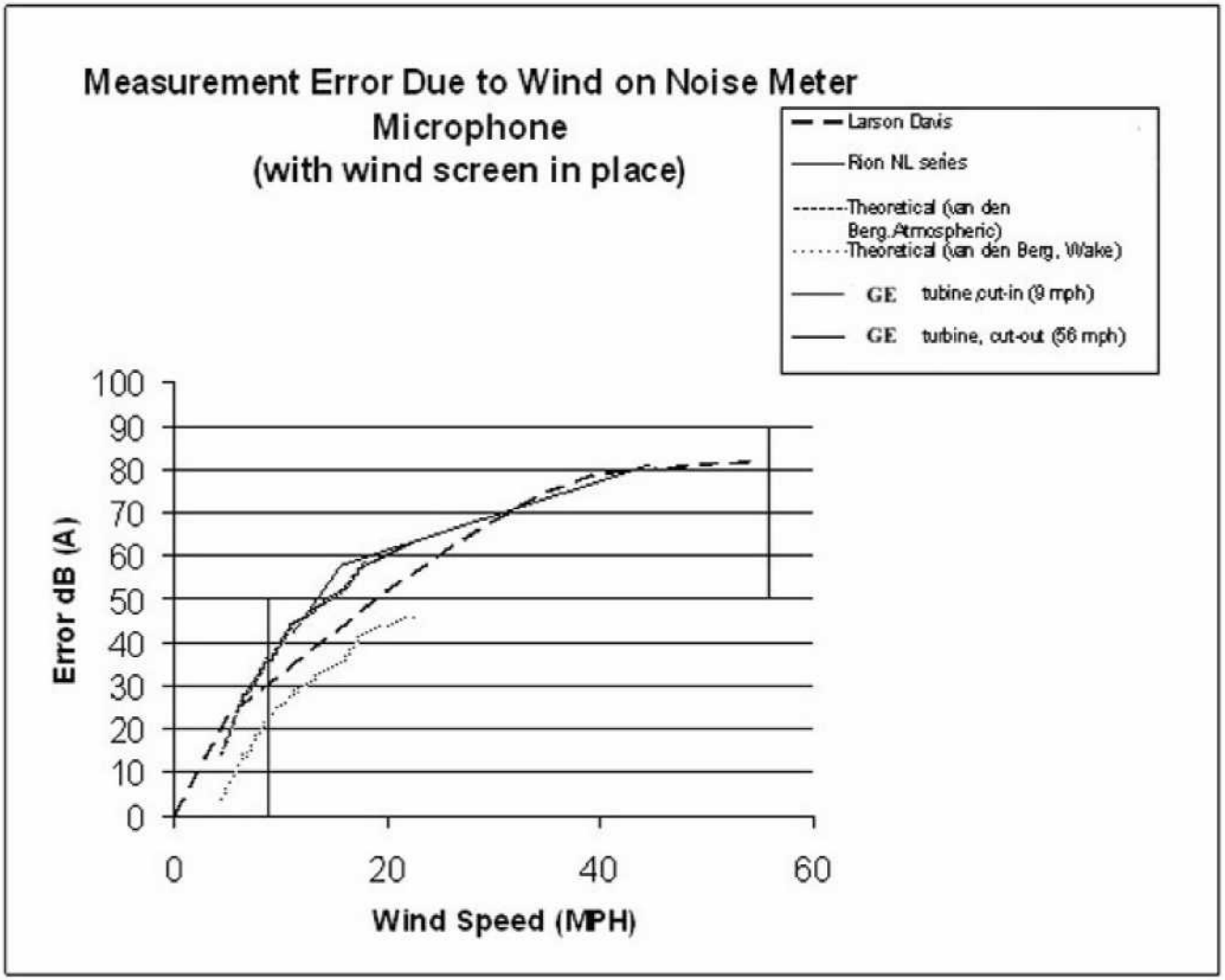


Figure 7-20. Effects of wind-induced refraction on acoustic rays radiating from an elevated point source [Shepherd and Hubbard 1985]

Fig. 6: Sound Refraction Effect (NASA, Fig 7-20)

R. Bolton, Assessment of the Sound Level Study for the Mars Hill Wind Farm (2007)



Measurement Error Due to Wind on Noise Meter

R. Bolton, Assessment of the Sound Level Study for the Mars Hill Wind Farm (2007)

wind industry trick #2

fail to remove the sound of the microphone wind screen from ambient (background) sound measurements

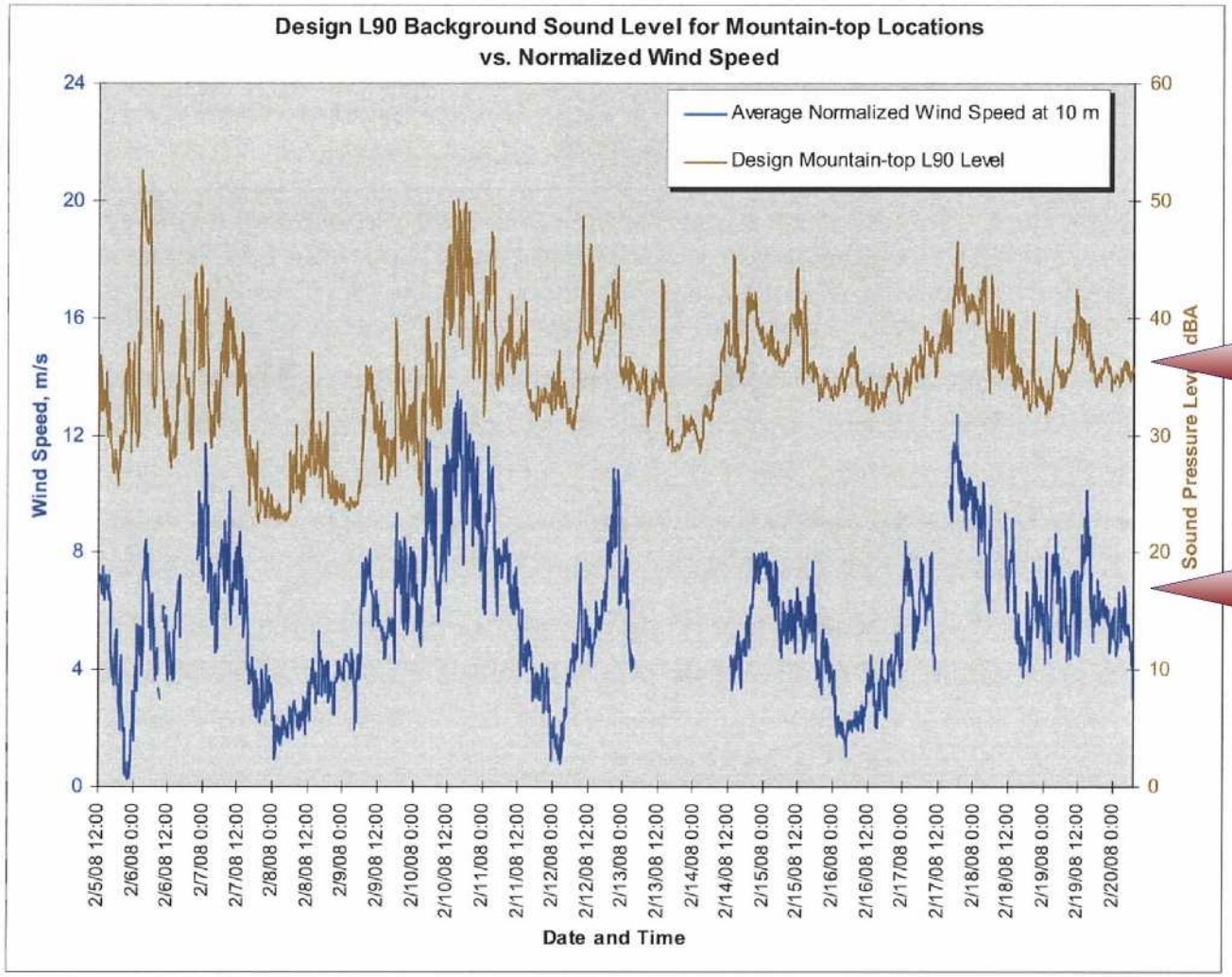


Figure 2.5.7 *Design Mountain-top Sound Level Compared to Wind Speed*

Both of these plots show that the typical sound level in both settings is related to wind speed; or, more specifically, to wind-induced sounds. The sound levels generally peak during periods of high winds and diminish during relatively calm periods.

Hessler Assocs., Noise Impact Assessment, Allegany Wind Farm Project (Everpower), December 19, 2008

argue that background sound levels go up with wind speed, so wind noise will mask the noise from turbines

wind industry trick #3

why trick #3 is so unprofessional:

- it is common for calm air to prevail at ground level while at turbine hub height winds are sufficient to sustain turbine operations
- this phenomenon is known as “wind shear” coupled with near-ground level “atmospheric stability”
- Van den Berg measured sound near a wind farm for one full year, every half-hour, concluding: “A high wind shear at night is very common and must be regarded a standard feature of the night time atmosphere in the temperate zone and over land.”
- Van den Berg found high wind shear 47% of the time over the course a year on average, and most often at night
- Richard James found studies estimating this occurs 60% of the time during summer evenings in New York

Opportunities for Public Participation

Town local law

Adoption of local wind law

- follows one year after developer purchases easements from local property owners (farmers, non-residents)
- modeled on guidelines provided to state and federal agencies by wind industry
- often drafted or modified for town by developer

State & federal agencies

NYS Department of Environmental Conservation

- jurisdiction limited to wetlands & streams
- will not be "lead agency"

U.S Army Corps of Engineers

- same
- same

Opportunities for Public Participation

State & federal agencies (continued)

U.S. Fish & Wildlife Service

Bald and Golden Eagle Protection Act

Endangered Species Act

jurisdiction and interests limited to rare and threatened plant and animal species

Federal Aviation Administration

- requires blinking red lights on up to half the turbines in a wind farm

jurisdiction and interests limited to aviation safety & radar interference

Opportunities for Public Participation

State & federal agencies (continued)

N.Y.S. Historic Preservation Office

- *reviews database of properties listed and eligible for the National Register of Historic Places*
- *see SHPO's Guidelines for Wind Farm Development, Cultural Resources Survey Work*

Seneca Nation of Indians

- *may* review excavation plans (turbine sites & transmission lines)

Opportunities for Public Participation

State & federal agencies (continued)

N.Y.S. Department of Public Services (DPS, PSC)

- *wind project application for DPS approval will be filed on PSC's "interconnection queue" **before** any local approval*
- *commits developer to time frame that pressures local government to accommodate project plans*
- *concerned citizens should get on "service list" for all communications, and may intervene as a party, commenting on any request for DPS approval*

Opportunities for Public Participation

. . . bottom line:

- ***There is no comprehensive state or federal regulation of wind farms***
- ***The burden of land use regulation falls almost entirely on local towns (look for local law, zoning, SEQR . . .)***
- ***Wind developers approach town planning and governing boards early with offers to money equivalent to all town property taxes***
- ***Local Industrial Development Agency will "sponsor" the project, eliminating all sales and property taxes***
- ***Town will be left with small portion of "payment in lieu of taxes" (PILOT); county gets some, school districts get most***

Opportunities for Public Participation

State Environmental Quality Review (SEQR)

Unresolved issues:

- Who will be the "lead agency"?
- Conclusions of lead agency are binding on all other "involved agencies"
    - IDA gets about $400,000 in fees from each wind project
    - Town may want host benefit agreement in addition to PILOT payments

Opportunities for Public Participation, con't

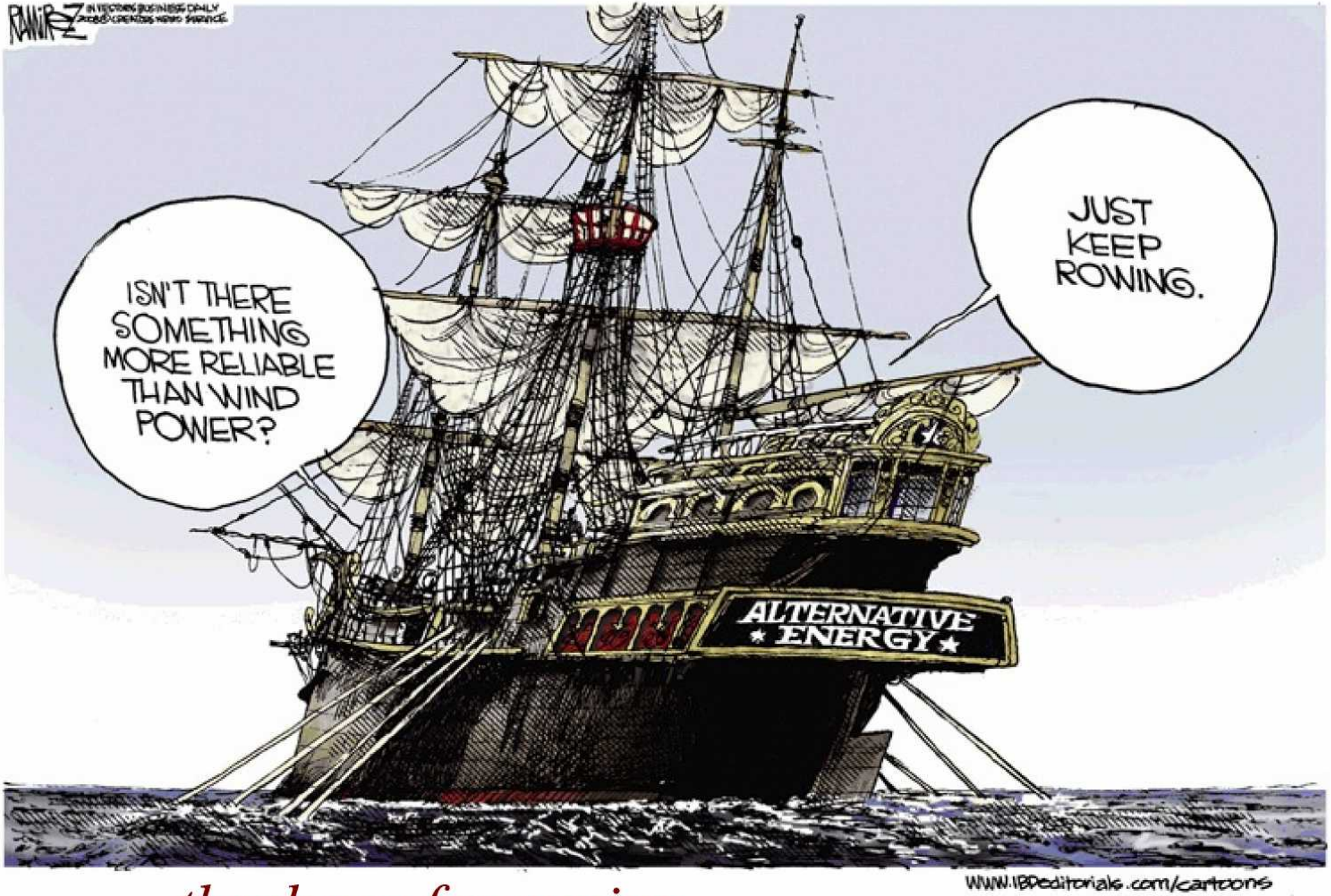
SEQR: the basics

- a ***hard look*** at the potential for adverse impacts is required "at the earliest possible time" in the development of a project
- government actions subject to the hard look requirement include the adoption of a local law and rezoning
- if approval of standards for wind turbines "may affect the environment and commit the agency to a definite course of future decisions," agency must look at future impacts
- a local land use law is a "Type I action"
- Type I actions ***should*** require an environmental impact study, prepared by the developer, adopted by the lead agency after public comments

Opportunities for Public Participation

SEQR: the basics

- if one or more impacts identified during the town's initial review of the proposed action *may be* "significant," an EIS is ***required***
- look at town's Environmental Assessment Form
- look at agency correspondence with town and developer
- look at town board or planning board minutes
- talk to local ecologists, birders, agency officials
- urge town to measure existing background sound levels
- identify all potential impacts
- begin drafting public comments on each impact
- be ready for public comment period – *it may be only 30 days*



thank you for coming . . .