



Wind Power Siting Issues Overview

**National Association of Attorney Generals
Wind Energy Facility Siting Issue Panel
Center of New Hampshire Radisson Hotel
Manchester, NH**

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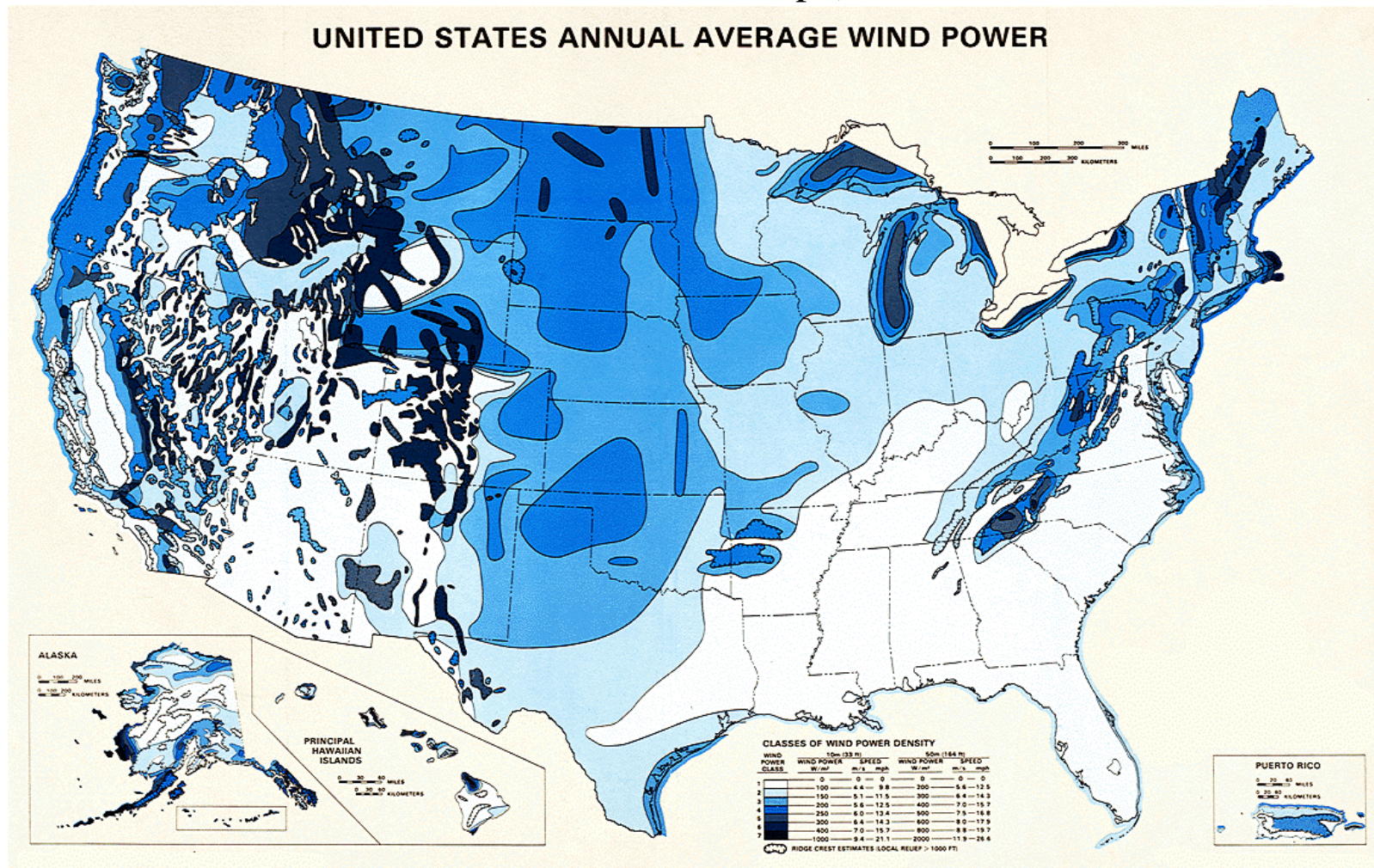
Wind Project Siting Issues

- Need high quality wind resources
- Large footprint, small power output
- Wind power- Green but high cost alternative
- Tall Structures- Highly Visible
- Impact on local property values
- No air/water emissions but may pose other environmental health & safety challenges
- Wind generation environmental/economic benefits



US Wind Resources-

The higher the wind class, the lower the projected production cost
DOE's NEMS Model considers Class 4 or higher winds needed (average winds
>7 m/s or 15.5 mph)



Wind Project Development Issues



- **Large footprint, small power output**
 - Industry rule of thumb has been that a conventional 1.5 MW turbine design needs turbine spacing of roughly 40 acres of cleared land/turbine to avoid wind turbulence interference. AWEA believes 75 acres/turbine required for larger new turbine designs. To displace energy from New England's smallest coal unit (Somerset) would require 167 turbines covering 22 miles of mountain ridge line.
 - As turbines have gotten larger (up to 3.6 MW offered), minimum spacing requirements have also increased. Need spacing of roughly 8-10 blade lengths (4-5 rotor diameters) between turbines. Newer larger model designs may require spacing equivalent to 75-100 acres/turbine.



Wind Project Development Issues

- **Wind power- Green but high cost power alternative**
 - High capital cost
 - Low capacity utilization
 - Little capacity credit towards reserve margin requirements
 - Heavily dependent upon large ratepayer & taxpayer subsidies and mandates to compete against conventional electrical power generation sources



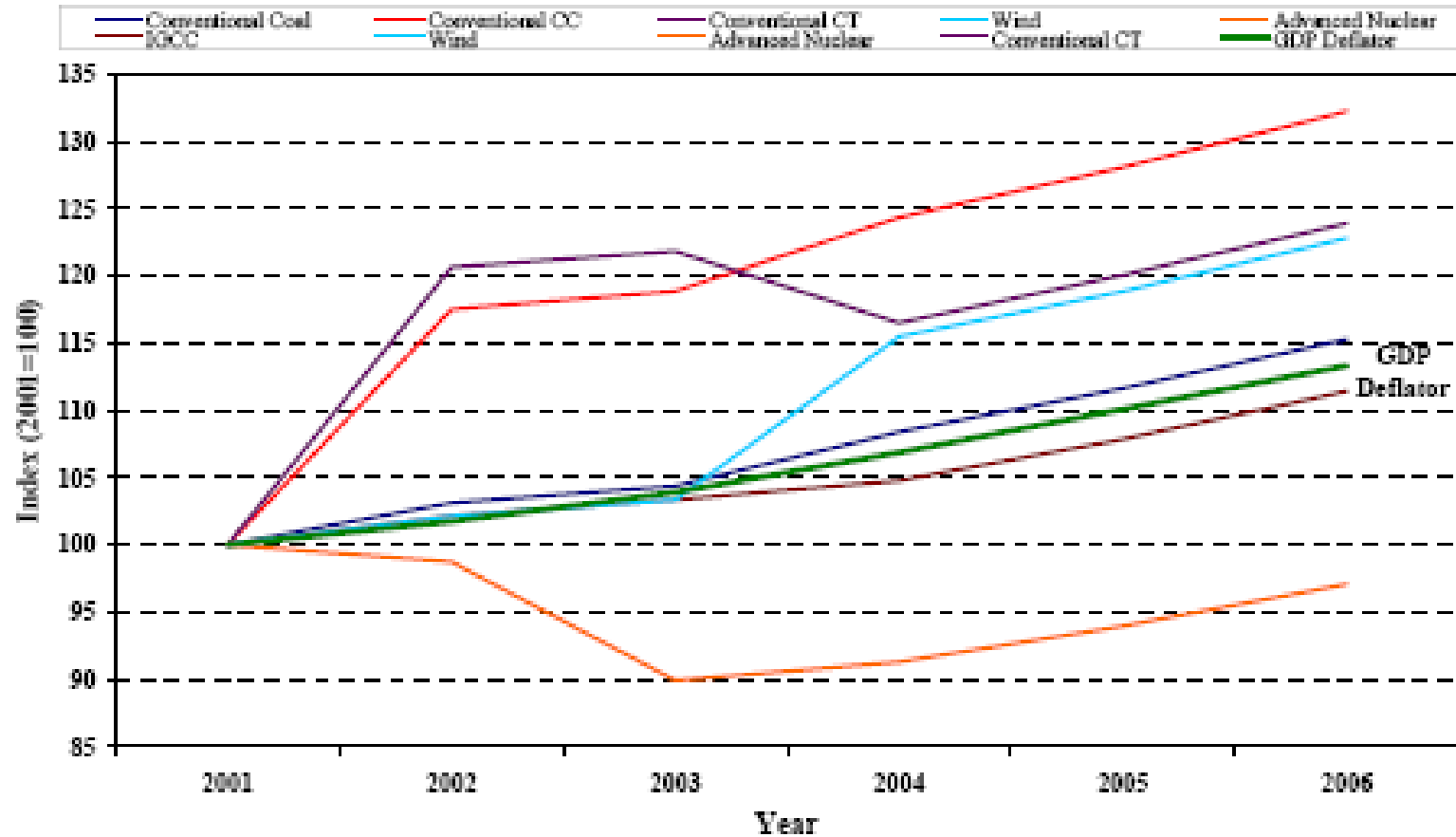
Wind- A High Cost Alternative



- **High Capital Cost**
 - Project capital costs have been rapidly escalating due to high turbine demand, weak dollar and rapid increases in labor, materials and supplies
 - Capital costs have escalated to \$2,100-2,400/kW
- **Poor Capacity Utilization**
 - 29% in 2005 average for 83 reporting projects
- **Low Assigned Capacity Value towards reserve margin requirements**
 - 5,000 MW of new wind project capacity required to offset need for one 500 MW fossil fired powerplant in New England



Figure ES-2 EIA Generation Construction Cost Estimates



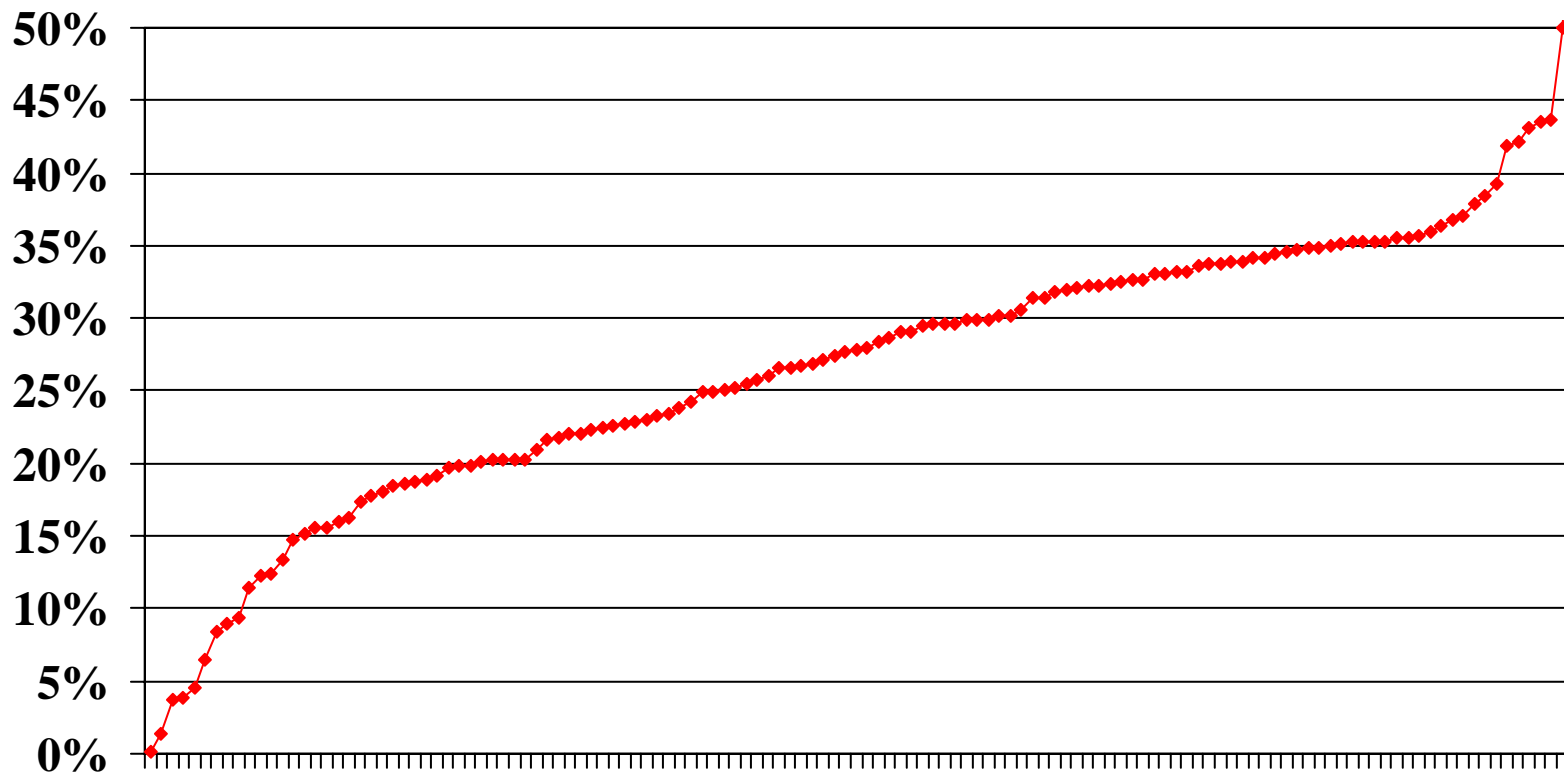
Sources: Data collected from the U.S. Energy Information Administration, *Assumptions to the Annual Energy Outlook 2002 to 2007* and from the U.S. Bureau of Economic Analysis.



2004 US Wind Project Capacity Factors

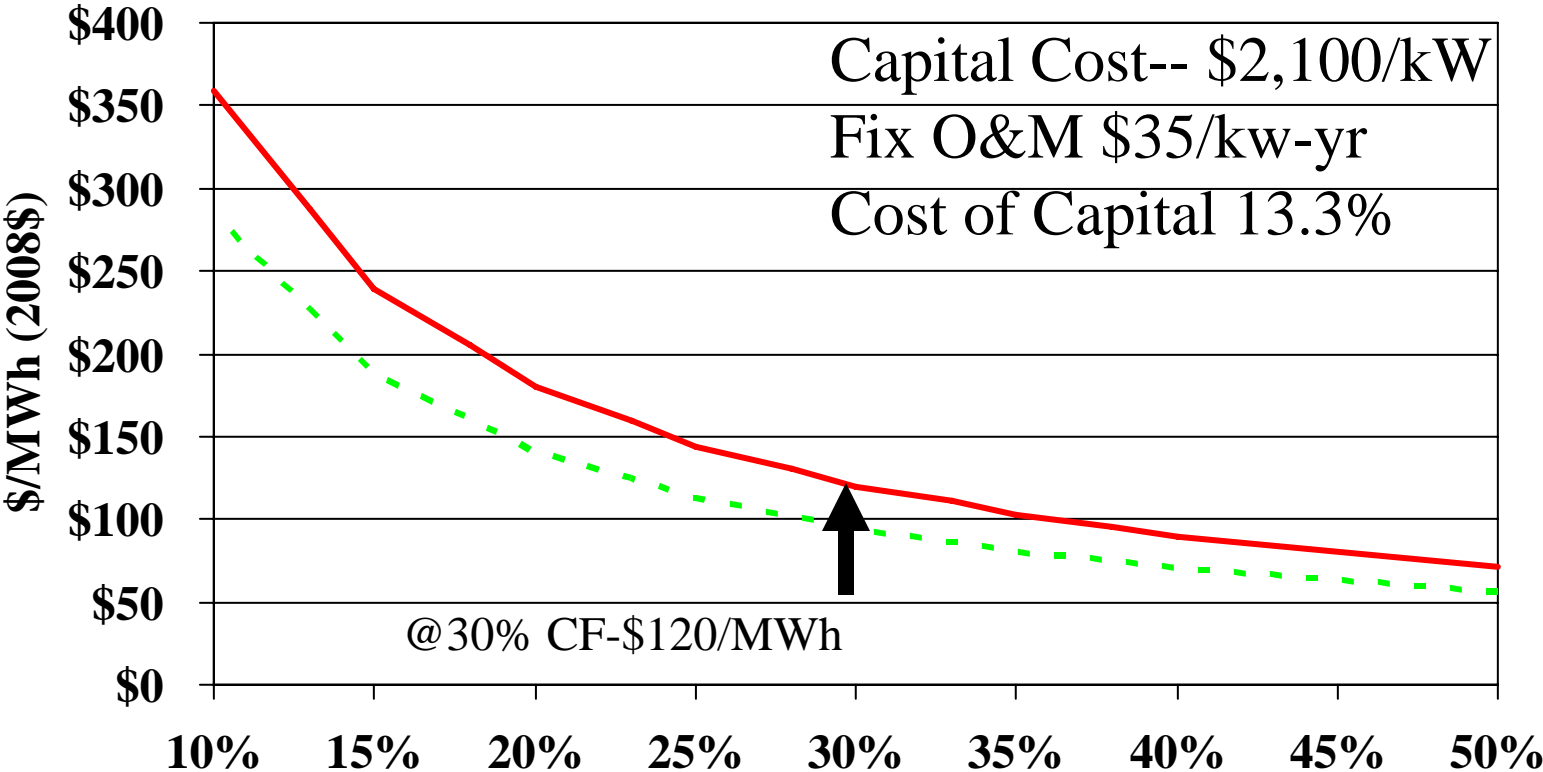


Source: US DOE Form 906 Data



Wind Production Cost Before Federal/State Incentives

Production Costs are highly sensitive to projected project output performance



Renewable Energy Subsidies

Federal

- Federal Production Tax Credit- \$20/MWh for 2007 (10 years-must be online by 12/31/07).
- Accelerated 5 year depreciation (Federal)

State

- Renewable Portfolio Standards--Renewable energy credit market developed to implement standard. In one project analysis, these credits may exceed more than 25% of the project capital cost.
- State tax incentives
- Green power purchase programs
- Public Benefit funding for qualifying projects

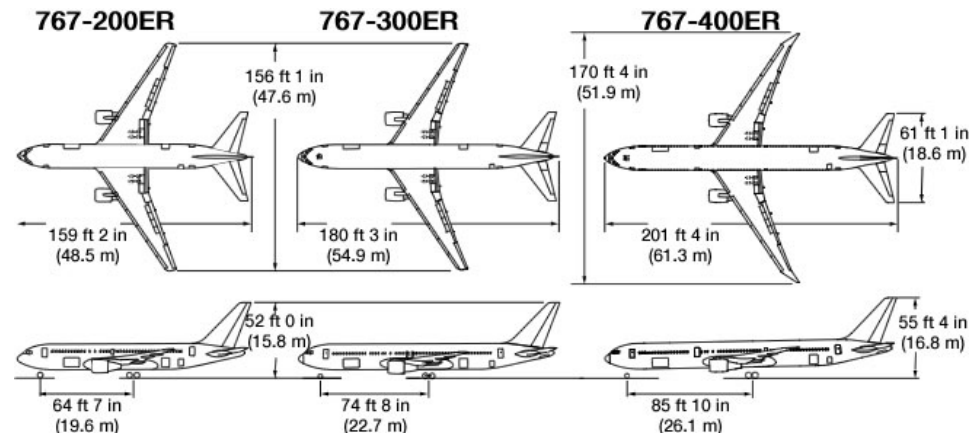


Wind Project Issues



- **Tall Structures--Highly Visible**

- Wind turbines can range from 320-510 high
 - Taller than Statue of Liberty (305 feet high—112 feet without base)
 - Turbine towers can range from 200-350 feet high
 - Turbine rotor can range from 250-340 feet in diameter
- Night lights on structures for safety reasons



Wind Project Development Issues



- **Small contribution to county property taxes**
 - In some states, energy producing equipment exempt from property taxes, taxable items may be limited to foundation and tower structure
 - Some developers also apply for additional local tax relief.
- **Impact on local property values**
 - 7 Studies: Wind farms may have adverse property value impacts
 - 4 Studies: No adverse property value impacts



Effects on Local Property Values– Few studies exist, some methodology flaws



Several factors drive local property values– interest rates, local economic activity, supply/demand for area properties, recreational activities, etc. It is difficult to isolate market impact from wind turbines without conducting a large, long term assessment. Does it affect property demand ?

Studies Concluding Wind Turbines Devalue Local Property Values

- 2001-02 Lincoln Township WI study comparing property sales prices to assessed values before and after wind farm construction. Assessor reported that property sales (vs. 2001 assessed values) declined by 26% within 1 mile and by 18 % > 1 mile of its wind farm project. However, study includes related party transactions. Moratorium Committee survey of County residents reported 74% of respondents would not build/buy within ¼ mile, 61% within ½ mile and 59% within 2 miles of wind farm.
- May 2000 County Guardian article *Case Against Windfarms*– Observations of English surveyors concluding wind turbines significantly decrease property values by as much as 30%. Simple survey, no transaction data provided.
- 1996 Danish report *Social Assessment of Wind Power-Visual Effect and Noise from Windmills-Quantifying and Valuation* contained survey of 342 people living close to wind mills. Survey found 13% of people surveyed considered wind mills a nuisance and would be willing to pay 982 DKK per year to have them leave. Survey of house sale prices showed 16,200 DKK lower price near single windmills and 94,000 DKK lower price near wind farms versus similar houses located in other areas.
- Assessed values declined significantly for property adjoining Mackinaw City WTG after it started operation.



Effects on Local Property Values– Few studies exist, some methodology flaws



Studies Concluding Wind Turbines Devalue Local Property Values

- *Impact of wind farms on the value of residential property and agricultural land: An RICS survey* (November 2004) Khatri, 2004 Survey by Royal Institution of Chartered Surveyors found 60% of respondents thought a wind farm would decrease value of residential properties within its view. Only 28% of the respondents thought a wind farm would decrease the value of surrounding agricultural land while 9% thought there would be a positive agricultural land value impact. Provided no analysis of value change or supporting transaction data.
- *Economic Analysis of a Wind Farm in Nantucket Sound* (May 2004) Haughton, Survey of land owners from 6 towns on Cape Cod. *On average, home owners believe that the windmill project will reduce property values by 4.0%. Households with waterfront property believe that it will lose 10.9% of its value. Applying these survey results, the study estimated the total loss in property values resulting from the construction of an offshore wind farm to be over \$1.3 billion, a sum that is substantially larger than the approximately \$800 million cost of the wind farm itself.* Provided no supporting transaction data
- *Appraisal Consulting Report- Forward Wind Project- Dodge County WI* (May 2005) Zarem Appraisal report examining paired sales of electric transmission line in Wisconsin concluded that a wind farm would cause an estimated 17-20% lot value loss within view shed.



Effects on Local Property Values– Few studies exist, some methodology flaws



Studies Concluding Wind Turbines Do Not Devalue Local Property Values

- *Economic Impacts of Wind Power in Kittitas County* (2002) ECONorthwest– Telephone survey of tax assessors views of 2 proposed Washington projects. Concluded no adverse property impacts. No supporting transaction data provided.
- *Effect of Wind Development on Local Property Values* (May 2003) Renewable Energy Policy Report examines property values in areas within 5 miles of surrounding 9 large wind farms. Concludes “presence of commercial scale wind turbines does not appear to harm property values.” Did not attempt to look at property values from within 1 mile due to limited data. Could not compare “like” properties. Roughly 70% of data was related party transactions and 72% of the data did not have actual views of the turbines.
- *A Real Estate Study of the Proposed Forward Wind Energy Center Dodge & Fond du Lac Counties WI* (May 2005) Poletti & Associates, Examined property sales records in Kewanee County Wisconsin and Lee County Illinois, had discussions with two town assessors, reviewed the two prior wind property studies above and reviewed property value impact studies of sanitary landfills. Concludes that the “*Forward Wind Energy Center is so located as to minimize the effect on the value of the surrounding property .*”
- *Impacts of Windmill Visibility on Property Values in Madison County New York* (April 2006) Hoen reviewed 280 homes sales within 5 miles of an operating wind farm and concluded that view of wind turbines in this county did not affect real estate values. Hoen cautions about applying conclusions to other non-similar settings.



Wind Project Development Issues



- **No air emissions but may pose other environmental health & safety challenges**
 - Wildlife: Has caused bird and bat deaths if poorly located. Concerns raised when endangered species are in area
 - Shadow Flicker: Strobe like effect caused by shadows of moving blades
 - Noise: Noise at turbine hub can range from 100-105 dBA. Can be noticeable for long distances in more remote areas with existing low ambient levels (Humans can differentiate sounds up to 3 dBA above background levels)



European Studies on Bird Fatalities

Plaats	Aantal turbines	Aantal vogels / turbine / jaar	Studieperiode	Referentie	
Place	Number of turbines	#birds/turbine/year	Study period	Reference	
Belgium	Schelle	3	18	1 year	This article
	Oostdam, Zeebrugge	23	24	2 years	" & Everaert et al.2002
	Boudewijnkan.Brugge	14	35	1 year	"
Spain, Navarra	Salajones	33	35	1 year	Lekuona 2001
	Izco	75	26	1 year	"
	Alaiz	75	4	1 year	"
	Guerinda	145	8	1 year	"
	El Perdón	40	64	1 year	"
Spain	Basque Country	40	5-7	3 years	Onrubia et al. 2002
Spain	Pesur, Tarifa	190	0,45 ⁽¹⁾	1 year	SEO/Birdlife 1995
	E3, Tarifa	66	0,05 ⁽¹⁾	1 year	"
UK	Blyth	9	1,34	2 years	Still et al. 1996
Netherlands	Zeeland	5	2-7	1 year	Musters et al. 1996
	Oosterbierum	18	22-33 ⁽²⁾	1 year	Winkelman 1995
	Urk	25	15-18 ⁽²⁾	1 year	"

Table 4. Mean avian mortality rates from collision at some wind farms in Europe. These studies used correction factors (predator removal and search efficiency rates) to adjust the figures. ⁽¹⁾ This is only the number of large sized birds. Small sized birds are not included because they weren't surveyed. ⁽²⁾ These rates were calculated mainly from several days in spring and autumn, originally expressed as birds per turbine per day; the rates over a year long period can be lower.

WIND TURBINES AND BIRDS IN FLANDERS: PRELIMINARY STUDY RESULTS AND RECOMMENDATIONS

JORIS EVERAERT

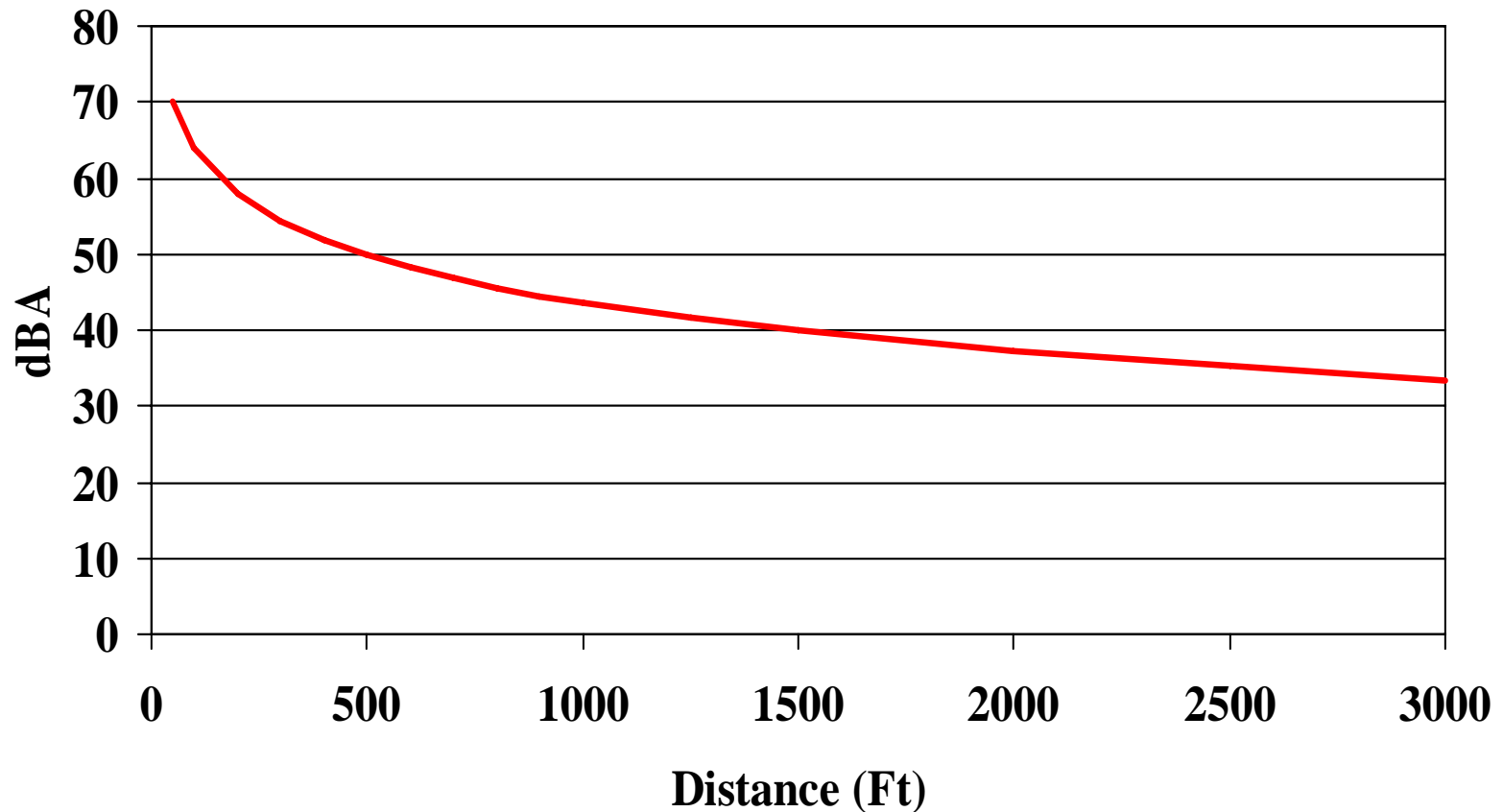
English text (without photo's) from Dutch article, published in the magazine
Natuur.Oriolus 69(4): 145-155



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Single Wind Turbine Noise Level

Model: NM-82 WTG



Wind Speed- 8m/s, relative humidity 80%, 50 degrees F, no attenuation from trees, terrain or barriers



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Wind Project Development Issues



- **No air emissions but may pose other environmental health & safety challenges**
 - Aviation hazard: May cause radar interference. FAA can deny permits if turbine heights pose airport safety risk. Illinois Agricultural Aviation Association has adopted a resolution not to serve areas inside or immediately adjacent to wind turbine groupings
 - Ice Throw: Turbines can throw ice accumulating on blades. Risk increases with decreasing distance.



Wind Siting Issues- Environmental Health & Safety



- Local ordinances for wind power development needed to protect public health & safety, minimize adverse environmental impacts and achieve land use plan
 - **Setback provisions**
 - **Noise**
 - **Visibility**– Address through limiting allowable sites and setting minimum project setbacks and height restrictions.
 - **Shadow Flicker**– Address through minimum setbacks and/or WTG location
 - **Safety** (blade throw, ice throw, structural failure, ground clearance)– Use Setback & minimum clearance requirements.

Setbacks can reach up to 2500 ft, Boone County– 2,000 feet setback provision, Bureau County– 750 minimum setback from any residence, Lee County– 1,400 feet from residences, 500 feet from roads; Pike County– minimum 3 times turbine+tower height from home

9-10 Rotors recommended

- **Height restrictions**
- **Exclude areas from development**



Wind Siting Issues- Environmental Health & Safety



- Local ordinances for wind power development needed to protect public health & safety, minimize adverse environmental impacts and achieve land use plan
 - **Unsafe & inoperable wind energy facilities**– Require bond to cover cost of removal & site restoration.
 - **Interference with navigational systems**– Location away from airport flight paths & locking mechanisms to limit airport radar interference
 - **Non-compliance penalties**– Must remove facility if out-of-compliance



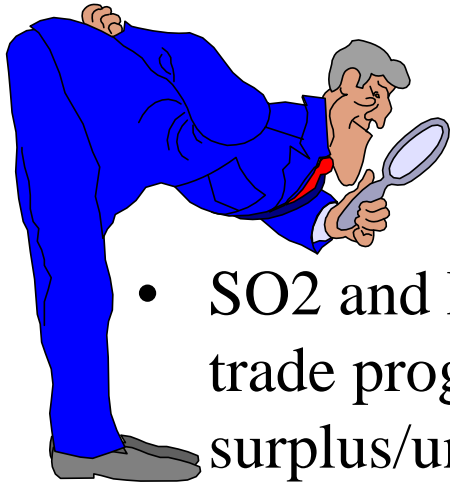
Claimed Wind Project Benefits



- **No air emissions**
 - SO₂/NO_x emissions maybe displaced **but are not avoided**. Displaced generation can sell/transfer their emission credit to other stations/units. As environmental limitations continue to tighten, the amount of displaced emissions will continue to decrease.
 - Projects will displace emissions of CO₂ emissions from generation sources on margin (usually natural gas fired power facilities). However, if region has cap & trade program emissions may be displaced and not avoided.
- **Reduced dependence on fossil fuel**
 - Wind/renewable projects displace generating units on the margin– in New England mostly gas-fired generation
 - Since wind power has no capacity value, power companies must still build new fossil fuel capacity to meet increase power demand
- **Lease payments to local property owners (>\$1,000/turbine/year)**
 - Property owners often lose ability to develop their property during lease period (up to 30 years). In some cases, WTGs have devalued local surrounding property values and Commissions have ordered developers to pay adjoining landowners.
- **Jobs**
 - Some temporary construction jobs created to erect wind turbines (0.7-2.6 jobs per turbine depending upon construction period).
 - Few maintenance jobs (usually <10 for large wind farms).

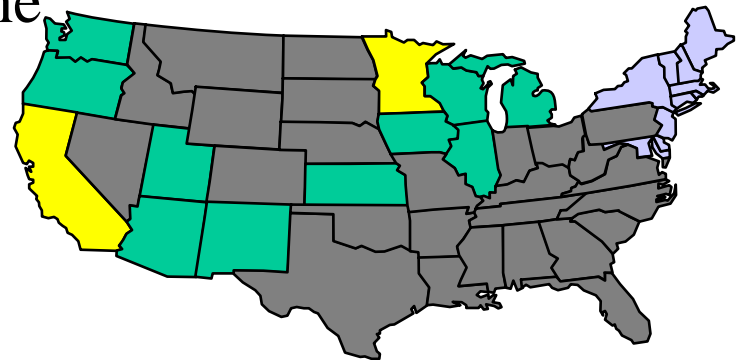
Some economic activity and jobs may be lost if higher power costs imposed onto local ratepayers through renewable portfolio standards.





Avoided Emission Claims- Fact of Fiction?

- SO₂ and NO_x powerplant emissions are subject to cap and trade programs. Owner of any displaced emissions can sell surplus/unused credits to another emitting source allowing it to emit at levels above their initial allocation. *Therefore, pollutants subject to cap & trade programs can be displaced but not avoided.*
- In 2009, CO₂ emissions from the power sector in 10 RGGI states will become subject to a cap & trade program. Two states have authorized CO₂ cap & trade programs. Ten more states committed to starting one.



Avoided Emission Claims- Fact of Fiction?

- For any individual power project, avoided emissions should be a comparison of total power sector emissions with and without the stated project. Since most wind projects are being built to meet a state RPS requirement, the “without the project case,” would likely be another renewable energy project that would be built to meet the special set-aside RPS demand. Therefore, the correct comparison for a given individual project would be a comparison of emissions from the proposed wind project vs. another qualifying renewable project.

