Throwing Caution to the Wind: the growing threat of Industrial Wind Energy Development in Pennsylvania to Wildlife, Habitat and Public Lands

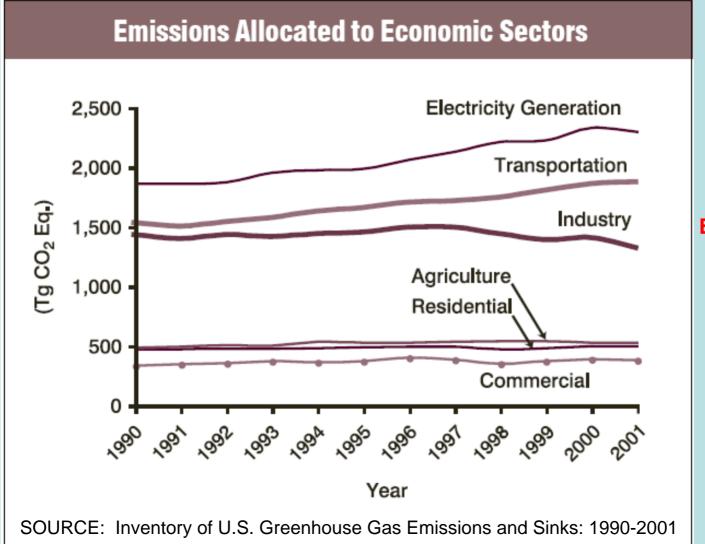
Dan Boone
Consulting Conservation Biologist

Presented at the public meeting held by Save Our Allegheny Ridges

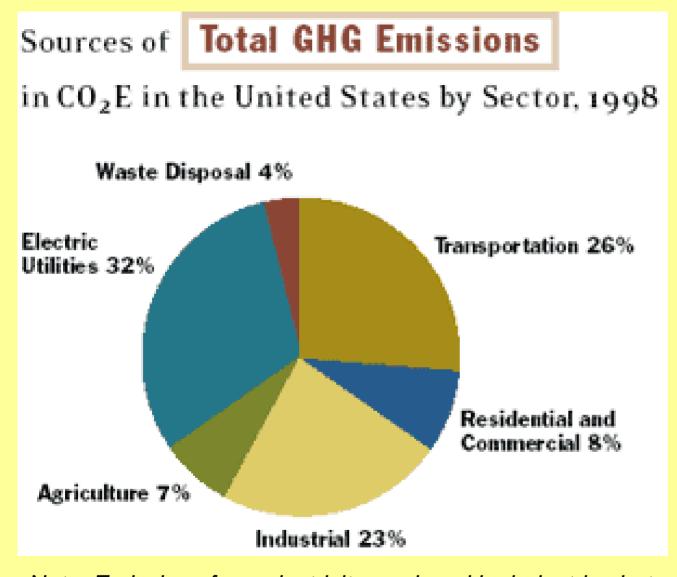
Bedford, PA

September 18, 2006

ELECTRICITY IS THE MAJOR SOURCE OF "ENERGY" RELIED ON BY THE U.S., BUT THE FOSSIL FUELS USED FOR OTHER FORMS OF ENERGY CONTRIBUTE MORE TO CLIMATE CHANGE.

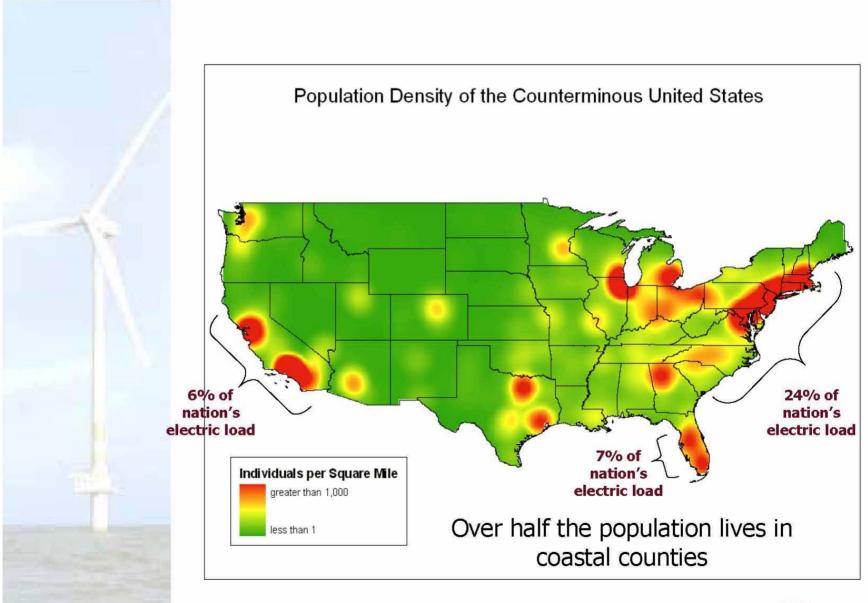


WIND
TURBINES
ONLY
GENERATE
ELECTRICITY
AND ARE
EXPECTED
TO SUPPLY
ONLY A
SMALL
FRACTION
OF FUTURE
ENERGY
NEEDS

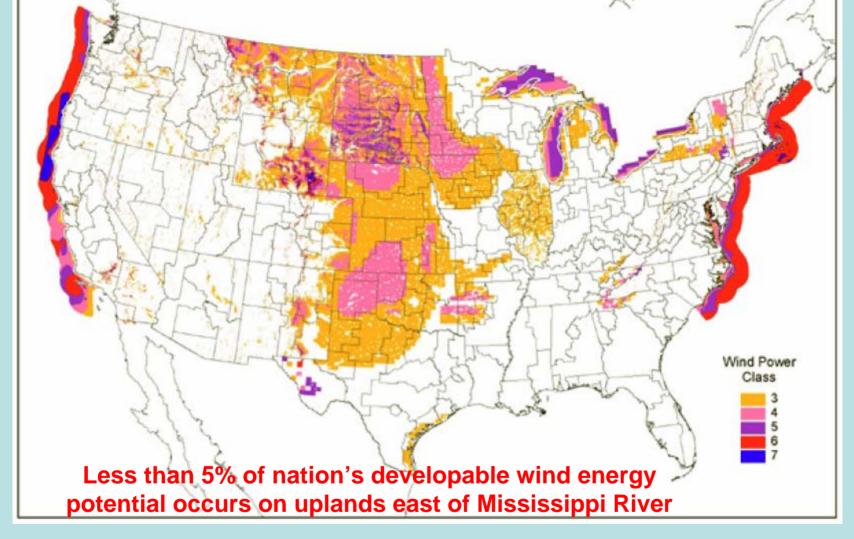


ONLY **1/3 OF THE U.S. TOTAL EMISSIONS** OF **GREEN HOUSE GAS** (GHG) IS DUE TO **POWER PLANTS**

Note: Emissions from electricity produced by industries but sold to the grid is included in the "Industrial" category. Excludes emissions from U.S. territories. Source: US EPA, 2001.

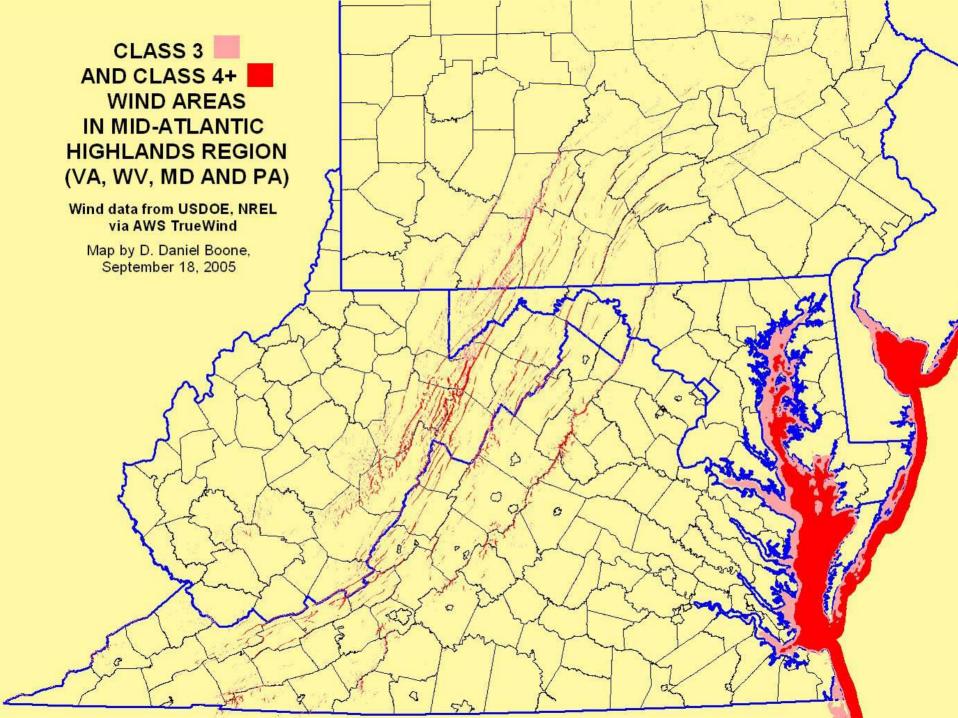






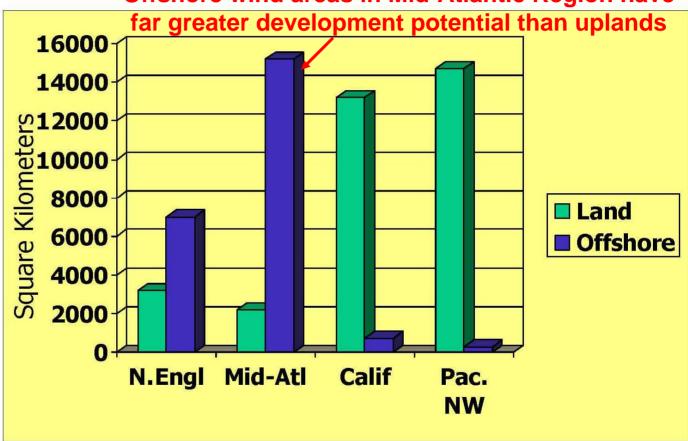
Wind energy potential in the United States. Areas with Wind Power Class 3 and above are considered economical to develop. Most of the inland wind potential is in the Midwest. In Pennsylvania most of the wind potential is on ridgetops and along shoreline and in Lake Erie. Areas with high wind potential on the mountain ridges are narrow lines that don't show up well at this map scale.

(From National Renewable Energy Laboratory, DOE: http://www.nrel.gov/analysis/winds)



Available Windy Area

Offshore wind areas in Mid-Atlantic Region have



*Class 4+ on Land; Class 5+ Offshore and Water Depths <70 ft; No land use exclusions



BALANCE?

The Upside

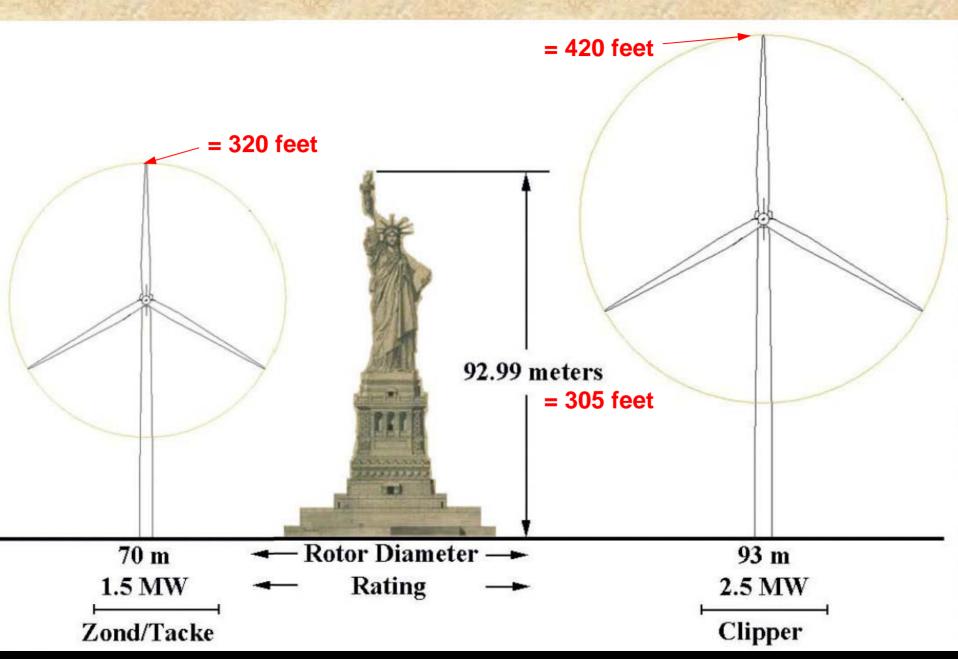
- non-polluting fuel source
- no fuel waste to dispose
- landowner lease income
- substation upgrades for utilities?
- taxes for local communities?

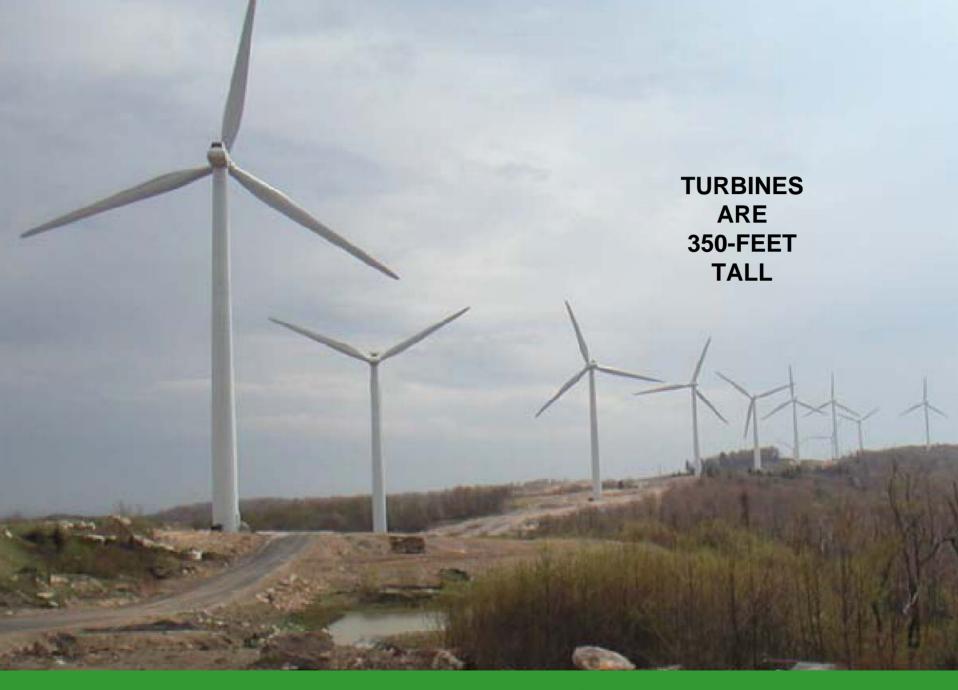
The Downside

- aesthetics & health (noise, etc.)
- few local, state or federal guidelines
- wildlife & habitat impacts (especially cumulative)
- decreased property values
- tourism impacts

jobs? Construction vs. Permanent

1999 2004

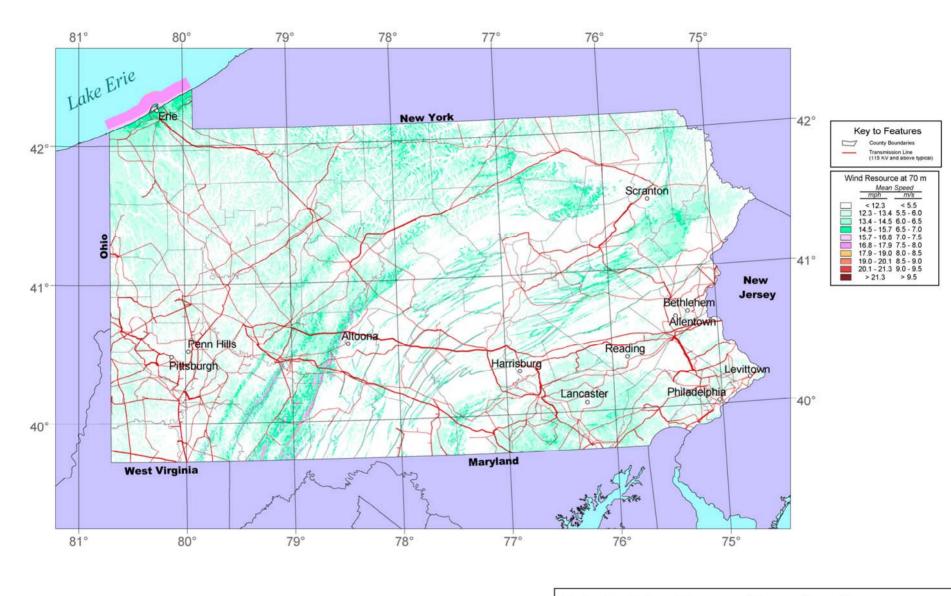




Mountaineer Wind Energy Center, WV



Wind Speed Map of Pennsylvania at 70 m



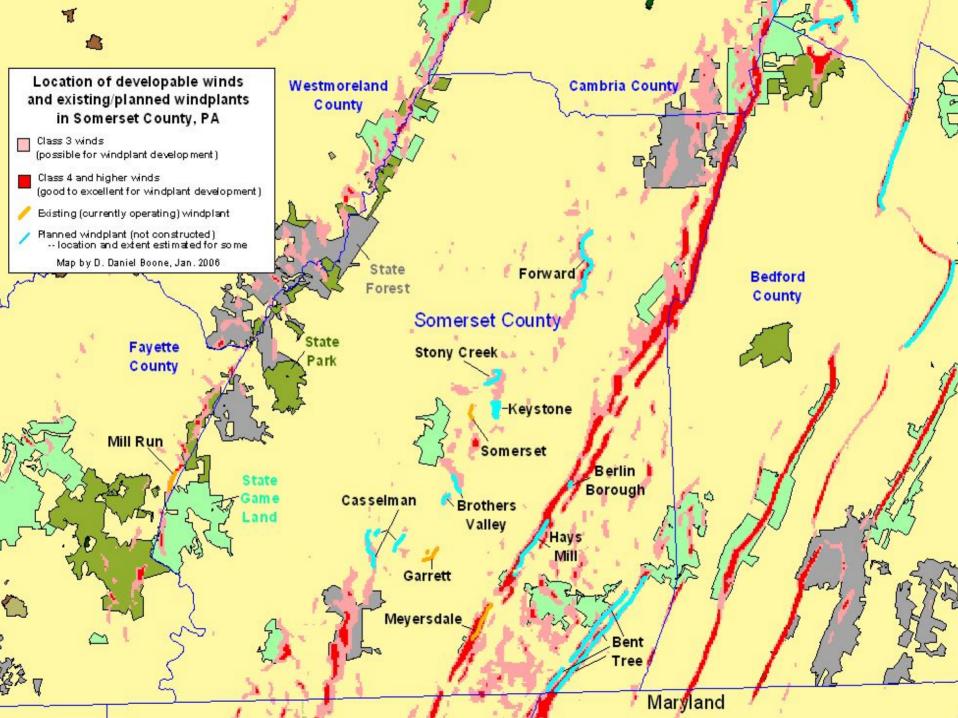
0 30 60 90 Miles

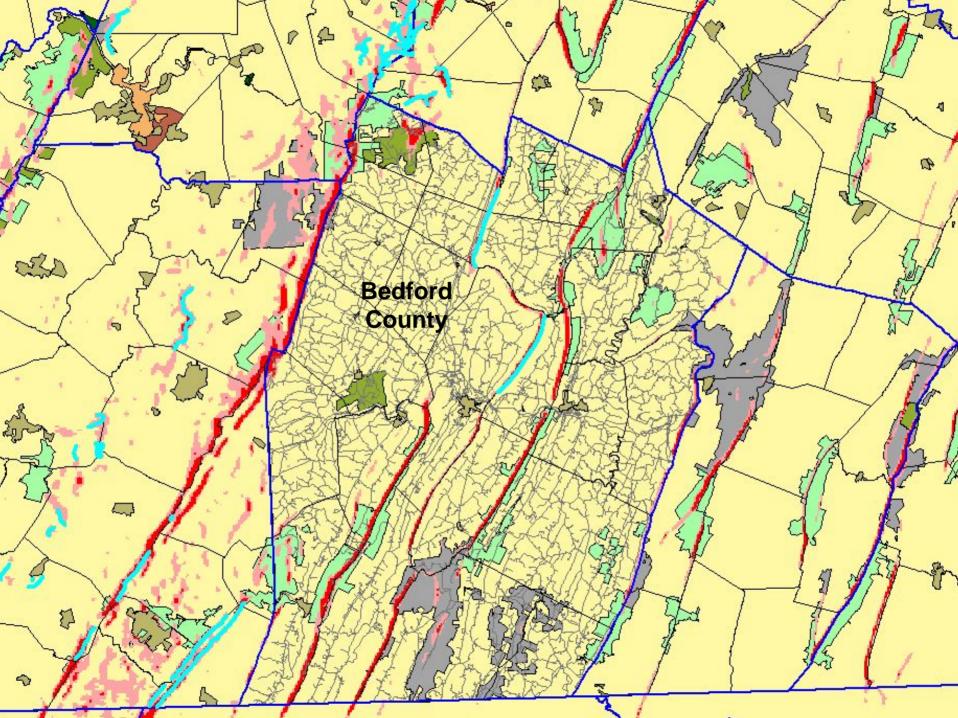
Projection: Universal Transverse Mercator (Zone 17) Spatial Resolution of Wind Resource Data: 200 m

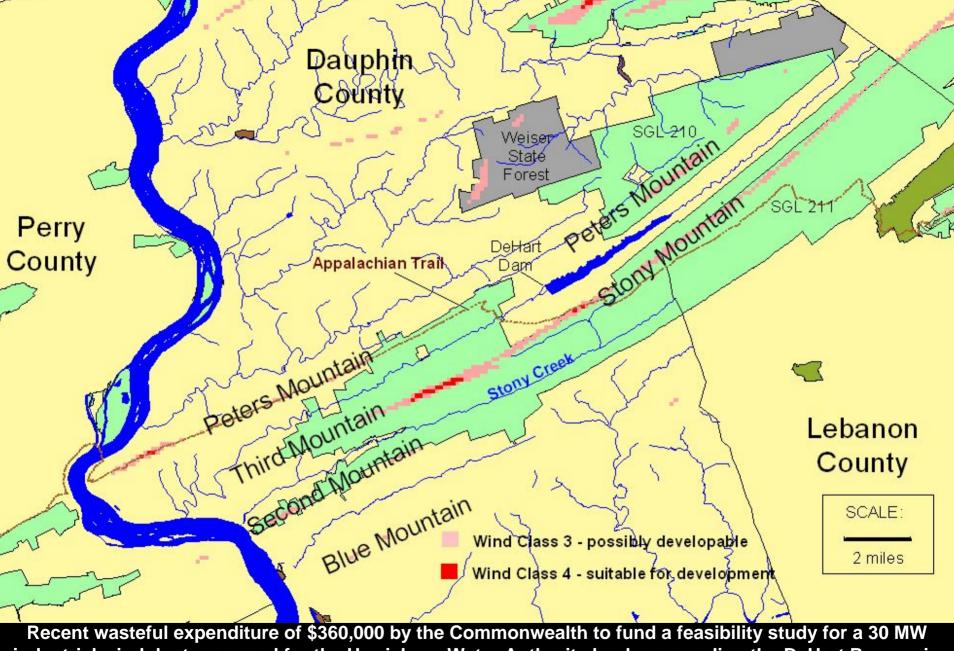
This map was created by TrueWind Solutions using the Mesomap syst

Wind Projects Connected To or Proposed For Interconnection With Wind Projects overview PJM as of Feb. 10, 2006 Legend Queues Status Code In Service In Service, No NOTE: As of July 31, 2006, there Capacity Requested are 4 additional wind projects proposed for WV - totaling 375 MW, and 17 additional wind projects Under proposed for PA - totaling 1,655 MW Construction (see: http://www.pjm.com/planning/ project-queues/queue-q.jsp). ACTIVE **Under Study** SOURCE: http://www.pjm.com/committees/teac/downloads/20060301-presentation.pdf

©2006 PJM



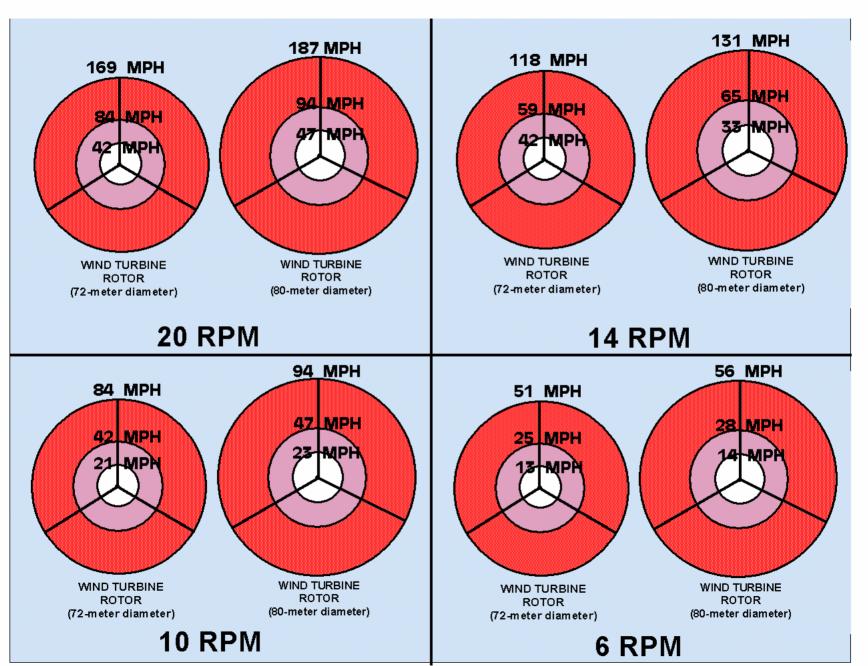




industrial windplant proposed for the Harrisburg Water Authority land surrounding the DeHart Reservoir.

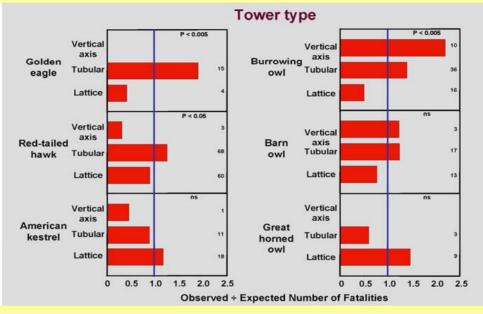
The PA Energy Development Authority via DEP awarded these funds in 2005 while dispersing \$8.5 million to support 25 Clean Energy Projects.

BLADE SPEED AT TIP, MIDPOINT and 1/4 LENGTH





"Monopole" Wind Turbine Towers Are No Safer for Birds Than Older Lattice Towers



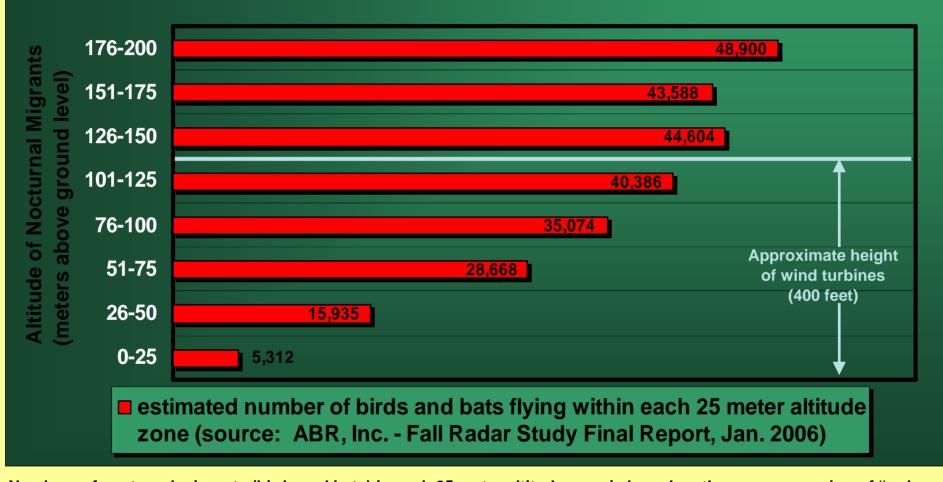


The claim is often made that monopole turbine towers (see above left) are safer for birds than the older lattice tower design (see above right) because they lack perching places for raptors and other birds, and therefore are less likely to cause collision mortality. This plausible speculation was widely promoted, and the monopole turbine bases were heralded as significant design improvements to safeguard birds from collision with turbines. However, the latest scientific research indicates that turbines with the tubular monopole tower are just as deadly, if not more so, for Golden Eagles, Burrowing Owls and other raptors than turbines with the older lattice tower base (see graph above; from a presentation by Shawn Smallwood entitled "Raptor Mortality at the Altamont Pass Wind Resource Area" - see Slide #42 in:

http://www.nationalwind.org/events/wildlife/2003-2/presentations/Smallwood.pdf.

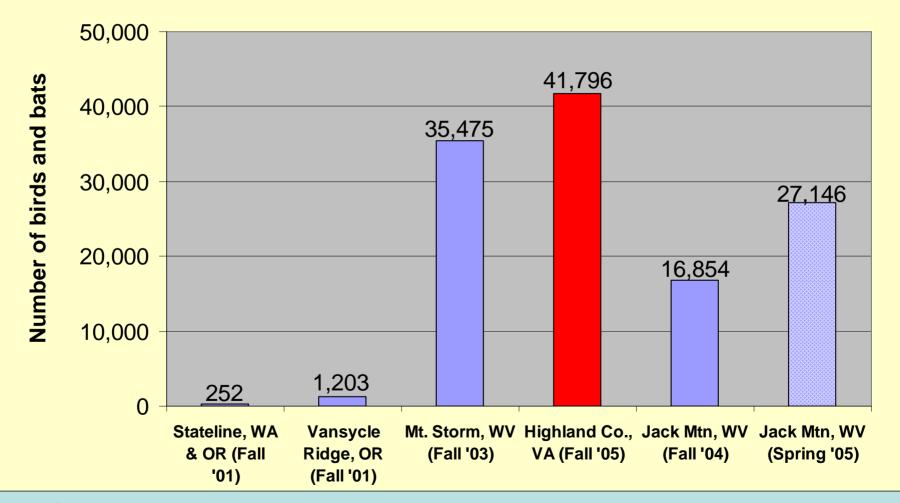


Numbers of nocturnal migrants determined via radar to fly below 200 meters over proposed Highland County, VA windplant - by 25 meter altitude zones (Fall 2005)



Numbers of nocturnal migrants (birds and bats) in each 25-meter altitude zone is based on the average number of "radar targets" determined to fly per nighttime hour per kilometer of linear transect (oriented perpendicular to the predominant direction of migration, or running roughly east to west) multiplied by the 3 kilometer east-to-west span of the proposed windplant located in western Highland County, VA times the average of 10 hours of darkness per night times 92 nights from August through October times the % of radar targets detected within each 25-meter altitude zone. Over a million nocturnal migrants were estimated by this radar study to pass directly over the area proposed for Highland Co. windplant during Fall 2005, and about 125,000 (11.8%) flew below the height of its planned wind turbines (i.e., under 120 meters).

COMPARISON OF NOCTURNAL MIGRANT NUMBERS ESTIMATED FROM RADAR TO FLY DIRECTLY OVER VARIOUS WINDPLANTS IN THE U.S. AT OR BELOW TURBINE HEIGHT (per kilometer of migration front per season)



Data Sources: Radar study reports prepared by ABR, Inc. and Woodlot Alternatives, Inc. to evaluate nocturnal migration over proposed industrial wind energy facilities in the U.S.

Myth – Wind energy will make US less dependent on oil

Amory Lovins wrote in 2003 that:

"Only 3% of all U.S. oil consumption makes electricity. Five-sixths of that usage is tarry residual oil or coal-like petroleum coke — both otherwise almost useless byproducts of refining. Only 0.4% of U.S. oil is distilled products made into electricity."

Source: page 3 in: http://www.rmi.org/images/other/EnergySecurity/S03-04_USESFtext.pdf

The US actually EXPORTS about twice as much oil each year as powerplants use annually to generate electricity. Consequently, the move to fund wind turbines by some energy monopolies like Shell is not going to cut into the demand for oil - which overwhelmingly is due to the transportation sector of our economy.

Exaggerated Benefits of Wind Energy Development

- •Wind energy will reduce our dependence on foreign oil
- Wind energy is a meaningful solution to air pollution problems such as ozone and mercury
- •Wind energy will reduce current rates of burning and mining of coal



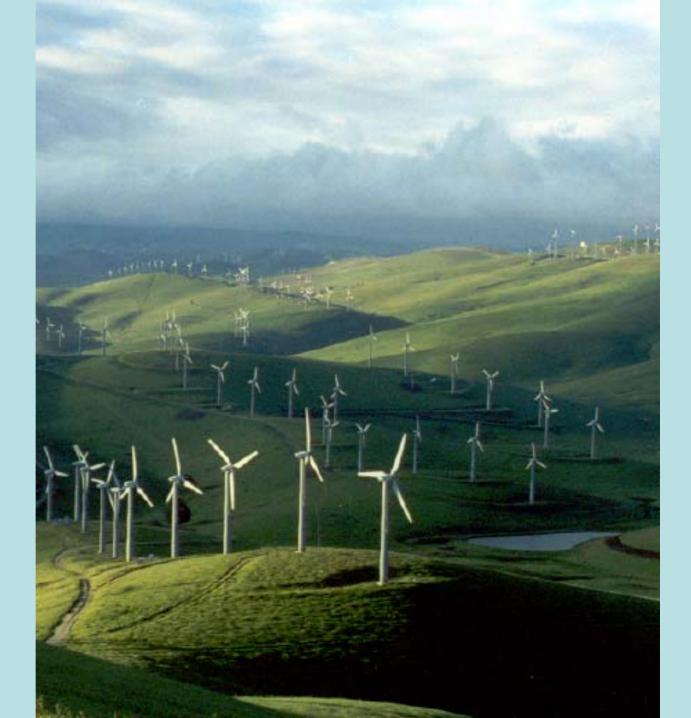
ALL OF THESE CLAIMS ARE FALSE
(ESPECIALLY FROM UPLANDS OF MID-ATLANTIC REGION)

Wildlife Impacts: Direct

- turbines may now exceed 450 feet; rotor sweeps measured in acres
- elevations at which migrants fly is not well known and evidently varies with terrain, height of cloud cover and other weather conditions, season, etc.
- north-south trending linear ridges that are preferred for wind project siting may occasionally channel and concentrate nocturnal migrants
- nearly all previous wildlife impact studies at wind plants have involved terrain not typical of this region (i.e., not on forested ridgetops), have been short term, have concerned small numbers of towers, have concerned relatively small towers, and have otherwise failed to adequately assess the issues
- project impacts let alone cumulative impacts of regional development - are not being evaluated via adequate pre-construction studies

WIND
TURBINES
AT
ALTAMONT,
CALIFORNIA

Turbines are less than 150 feet tall









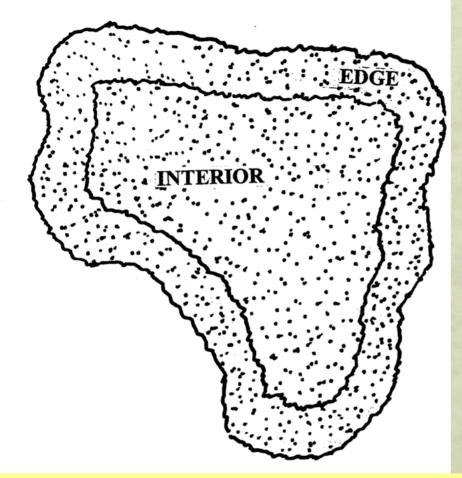
Wildlife Impacts: Indirect

- development will be on high elevation ridges which represent most of our remnant wild land
- site clearing, access roads, and powerline corridors involves substantial disturbance and fragmentation of presently continuous forest
- one project will locate 200 turbines along 14 miles of the Allegheny Front in WV
- The 44-turbine Mountaineer Project in WV essentially involved a 4-mile long, 200foot wide clearcut



125-m wide clearings for each of the 20 wind turbines at Meyersdale

Figure 4. Edge vs. Interior



A Guide to the Conservation of Forest Interior Dwelling Birds in the Chesapeake Bay Critical Area

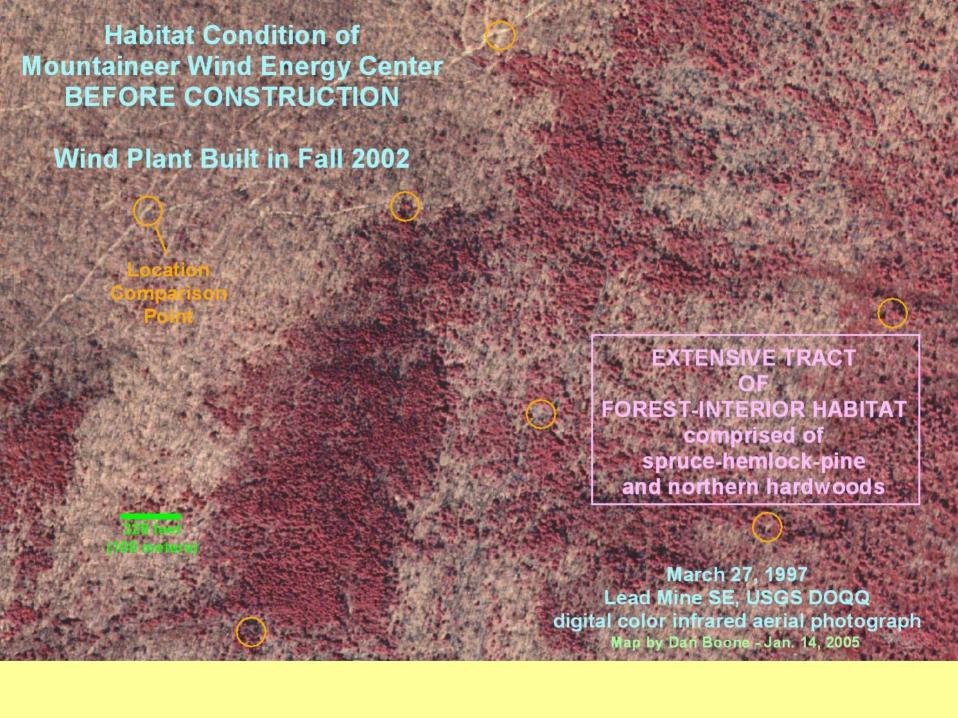


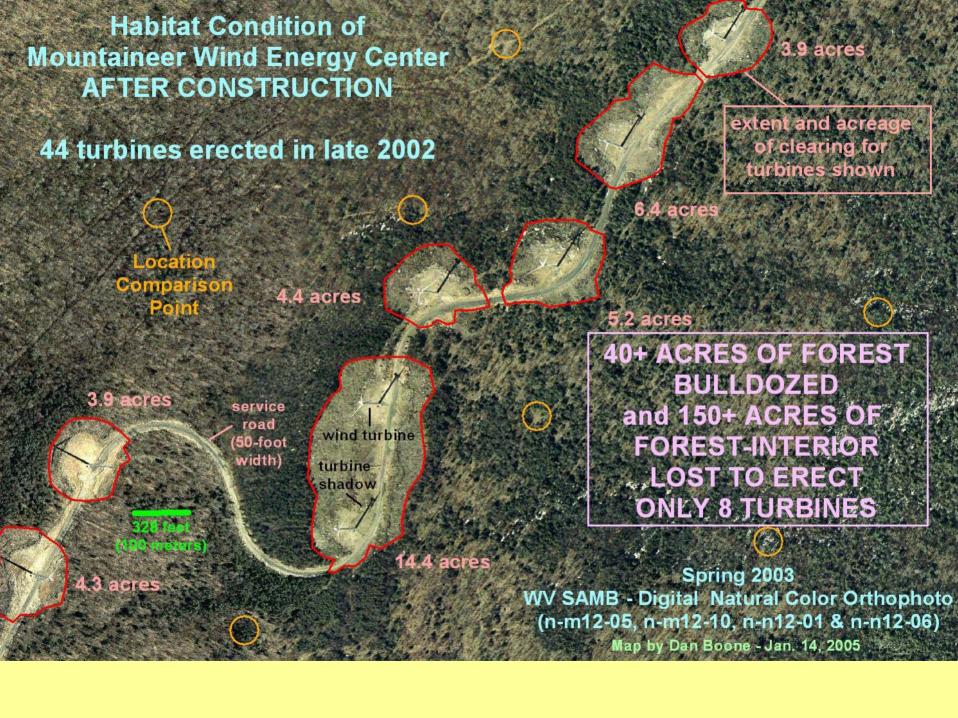
"Edge habitat is created whenever there is a minimum 30-foot wide break in the forest canopy (e.g., a road or a lawn)."

"Interior habitat" is commonly defined as the forest area found greater than 300 feet from the forest edge. Interior habitat functions as the highest quality breeding habitat for FIDS (Forest Interior Dwelling Species).

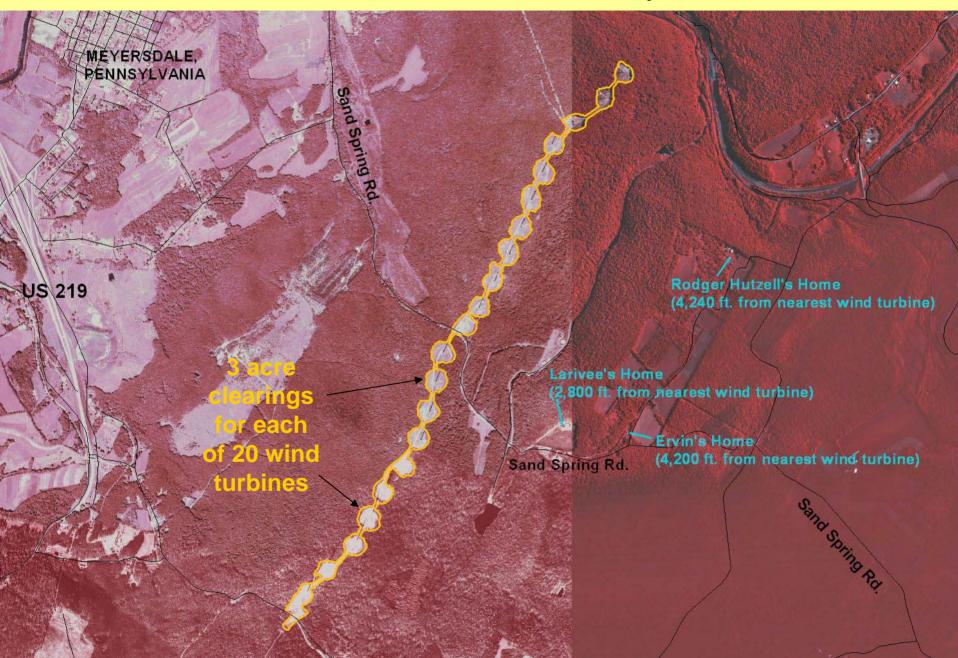
http://www.dnr.state.md.us/education/envirothon/wildlife/criticalareareg_FIDS.pdf







Disturbing noise levels found at great distance (4,000 feet) from the 20 industrial wind turbines located near Meyersdale, PA



Acoustic Noise Generated by Wind Turbines

Presented at the
Lycoming County, PA
Zoning Board Hearing on 12/14/2005
Oguz A. Soysal, Ph.D.
Frostburg State University
Department of Physics and Engineering
Frostburg, MD 21532
osoysal@frostburg.edu

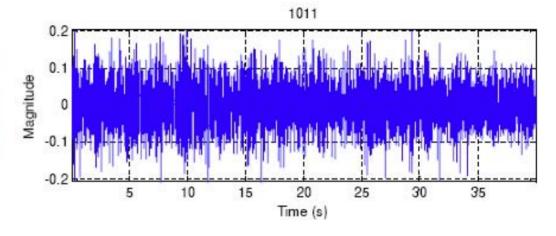


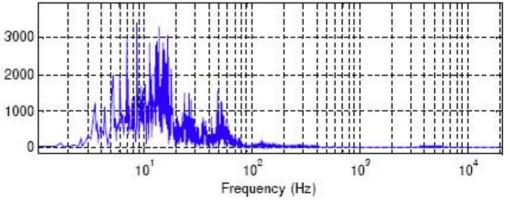
Distance to windmills: 0.55 miles

Recording date: October 29, 2005

Time: 11:16

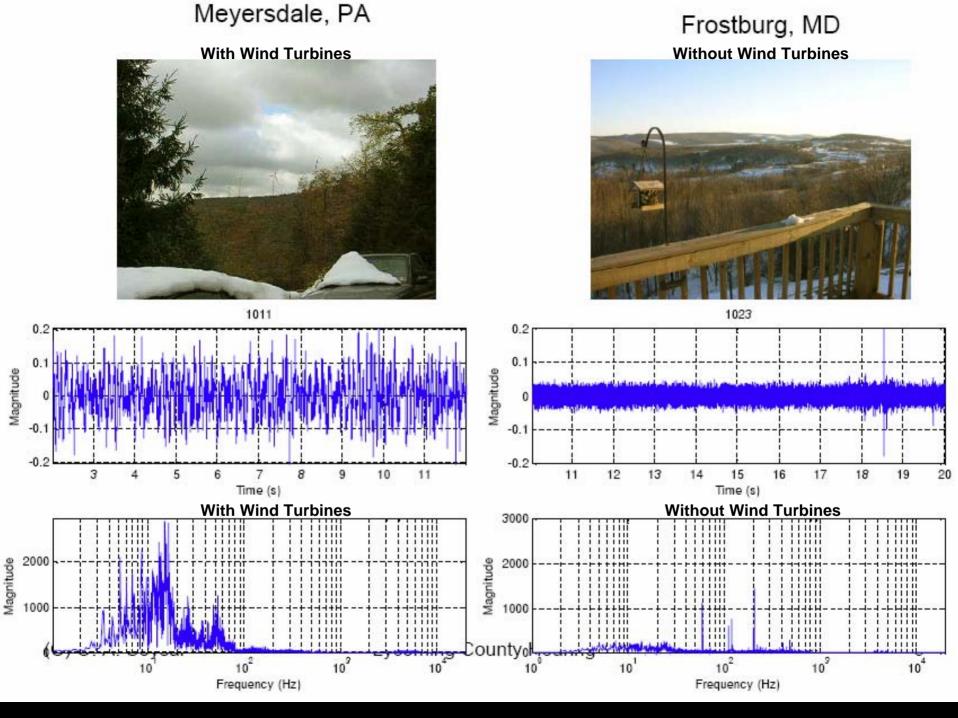
Meyersdale, PA Sound recordings





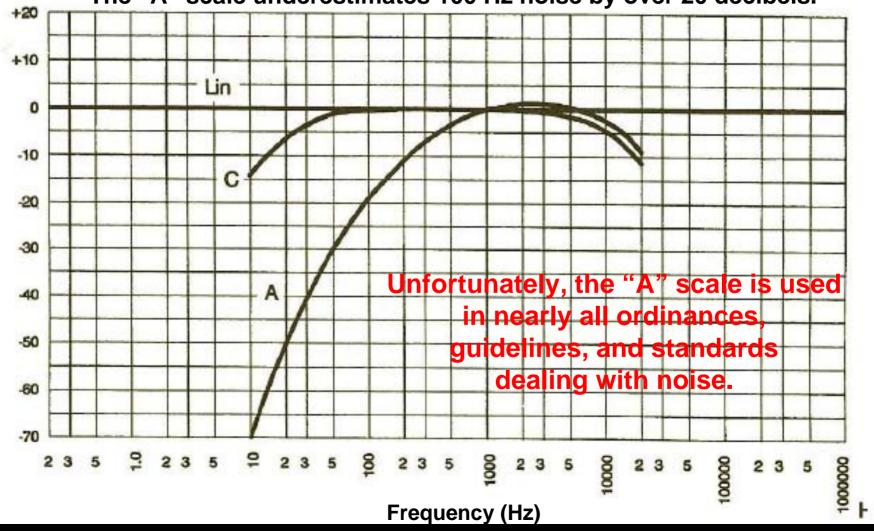
Note: Low Frequency Sounds Predominate

Magnitude



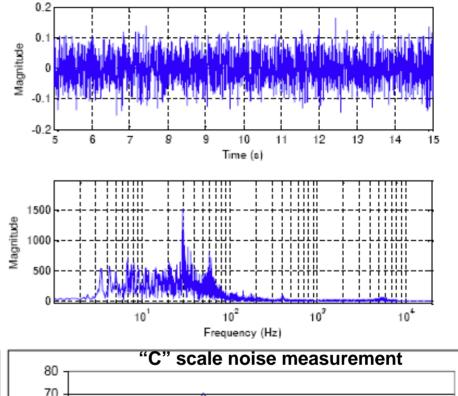
dB Weighing

The "C" weighted decibel scale more accurately estimates loudness of low frequency noises, such as those produced by large wind turbines. The "A" scale underestimates 100 Hz noise by over 20 decibels.

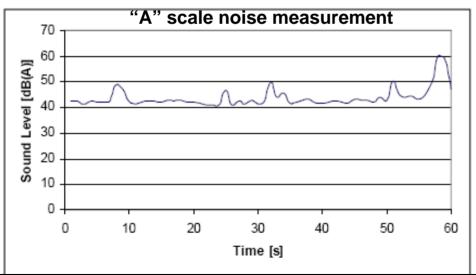


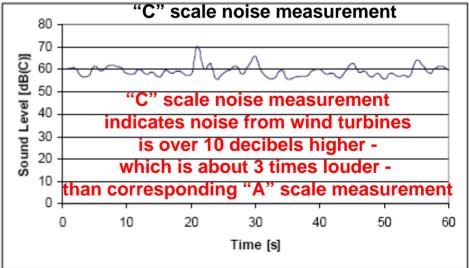
Sound recording and sound level measurements at Meyersdale, PA Recording date: November 2, 2005

Time: 4:02PM



1014





Full presentation available at: http://www.windaction.org/documents/1503



THE EFFECT OF WIND DEVELOPMENT ON LOCAL PROPERTY VALUES

GEORGE STERZINGER FREDRIC BECK Damian Kostiuk



AWBA News Rele

. . Clean Energy for our Environment & Economy

FOR IMMEDIATE

RELEASE: May 20, 2003

Contact: Christine Real de Azua (512)-404-4609 - (May 22) (202) 383-2508 (After May 22)

WIND FARMS DO NOT HURT PROPERTY VALUES, STUDY **FINDS**

First-ever national analysis of data refutes claim

advanced by wind energy opponents

The presence of commercial-scale wind turbines does not appear to harm "viewshed" property values, according to a study the Renewable **Energy Policy Project (REPP)** presented on May 20 at WINDPOWER 2003, the annual Conference and Exhibition of the American Wind Energy Association (AWEA) in Austin, Texas.

REPP'S PROPERTY VALUE IMPACT STUDY OF INDUSTRIAL WINDPLANTS FOUND TO BE "EXTREMELY WEAK, IF NO ENTIRELY MISLEADING"

"Sterzinger et al., (2003) ["The Effect of Wind Development on Local Property Values"] analy[z]es roughly 24,000 transactions near 11 windfarms in the U.S., and compared average transaction values for houses in a control area outside the viewshed of the windfarm with transactions occurring within the viewshed (a 5-mile radius). The study comes to the conclusion that, "There is no support for the claim that wind development will harm property values." (p. 9), and even declares, "For the great majority of projects [windfarms] the property values rose more quickly in the viewshed than they did in the comparable community." (p. 2). Although this study is often quoted, its methods have been criticized...for four reasons... Combined, these four omissions in rigor render the results of the report extremely weak, if not entirely misleading."

Source: p. 16 &17 in: Ben Hoen, 2006 - "Impacts of Windmill Visibility on Property Values in Madison County, New York" - http://www.aceny.org/pdfs/misc/effects_windmill_vis_on_prop_values_hoen2006.pdf

Acreage of Potentially Developable Wind Areas on PA State Forests

| PA State Forests | Class 3 | Class 4+ | Class 5+ | Class 3+ |
|----------------------------|---------|----------|----------|--------------|
| BALD EAGLE STATE FOREST | 6,446 | 478 | | 6,924 |
| BUCHANAN STATE FOREST | 5,885 | 3,458 | 1,128 | 9,343 |
| DELAWARE STATE FOREST | 60 | | | 60 |
| ELK STATE FOREST | 1,063 | 137 | 15 | <u>1,199</u> |
| FORBES STATE FOREST | 8,122 | | 75 | 8,122 |
| GALLITZIN STATE FOREST | 5,469 | 1,067 | 588 | 6,536 |
| MICHAUX STATE FOREST | 4,558 | 89 | | 4,647 |
| MOSHANNON STATE FOREST | 939 | | | 939 |
| ROTHROCK STATE FOREST | 3,928 | 1,621 | 439 | 5,549 |
| SPROUL STATE FOREST | 904 | | | 904 |
| SUSQUEHANNOCK STATE FOREST | 453 | | | 453 |
| TIADAGHTON STATE FOREST | 787 | 158 | | <u>945</u> |
| TIOGA STATE FOREST | 957 | <1 | | 958 |
| TUSCARORA STATE FOREST | 9,745 | 4,132 | 1,360 | 13,877 |
| WEISER STATE FOREST | 546 | | | 546 |
| WYOMING STATE FOREST | 58 | | | 58 |
| TOTALS | 49,921 | 11,140 | 3,605 | 61,061* |

^{*}Total of Class 3+ includes State Forest acreage which has average annual winds that are rated Class 3, 4, 5, 6 & 7. Class 4+ includes acreage of Class 5+.



Pennsylvania Department of Conservation and Natural Resources

Rachel Carson State Office Building, P.O. Box 8767, Harrisburg, PA 17105-8767 Office of the Secretary 717-772-9084

FAX: 717-705-2832 ·

Stan Kotala, M.D. President Juniata Valley Audubon RR 3, Box 866 Altoona, PA 16601-9206

Dear Dr. Kotala:

Thank you for your letter of December 22 concerning wind energy and state forest lands. I appreciate your taking the time to share your thoughts with me.

DCNR has received a number of inquiries from wind developers about the possibility of leasing state forestland for wind development projects, and for right of way access. We currently do not have legislative authority to lease these lands for wind power development, and we are not entertaining access requests. However, because of the real and significant environmental benefits of renewable energy generation, we feel it necessary to evaluate the requests in a manner that is in keeping with our stewardship mission.

Thus, our Office of Conservation Science is developing an evaluation tool that we intend to employ to make a determination as to whether or not any portion of state forest lands might be appropriate for wind development. The tool as currently drafted takes into account a host of environmental and ecological factors. Prominent among them are the potential impacts on birds (as well as bats and other wildlife). The tool would enable us to identify areas of state forest lands where wind power clearly would not be appropriate, as well as any areas where it may be appropriate – at best perhaps a percent or two of state forest lands - which would be verified by further detailed evaluation.

We intend to involve the conservation and environmental communities, wind developers, state and federal wildlife agencies, and the general public in refining this tool, so that it incorporates the best available science. Tim Schaeffer of Audubon PA and Lee Schisler of Hawk Mountain Sanctuary have both agreed to participate in the process of refining the screening tool. Once this process is complete, we'll be in a position to determine whether or not it's appropriate to seek legislative permission to lease some small portion of state forest lands for wind power, and to form a policy on access requests from wind developers.

Be assured that, as stewards of Pennsylvania's rich and irreplaceable natural heritage, we are very sensitive to the concerns you raised.

Secretary

Thank you again for your time and interest.

Muhauf Ul Mardyn Michael DiBerardinis "The tool would enable us to identify areas of state forest lands where wind power clearly would not be appropriate, as well as any areas where it may be appropriate – at best perhaps a percent or two of state forest lands..."

Michael DiBerardinis, DCNR Secretary

2% of PA's state forest lands would be over 40,000 acres – and the impacts of wind turbines would extend far beyond their "footprint"



United States Department of the Interior

FISH & WILDLIFE SERVICE

FISH AND WILDLIFE SERVICE

300 Westgate Center Drive Hadley, MA 01035-9589

In Reply Refer To: FWS/Region 5/MBSP-FA

> <u>FA Memo No. 04.05</u> September 27, 2004

FEDERAL AID MEMORANDUM TO STATE FISH AND WILDLIFE DIRECTORS

SUBJECT: Commercial Facility Site Development on Lands Bought or Managed with

Federal Aid or License Dollars

Dear Federal Aid Coordinator:

In recent weeks we have received a number of inquiries from States regarding new and significant pressures to develop wind power, cell towers, billboards, pipelines, and other commercial facilities on Wildlife Management Areas or Game Lands. In order to correctly apply the new Commercial Use Policy (Director's Order Number 167; http://policy.fws.gov/do167.html) regarding these matters, you need to consider the following guidance from Section 6 of the policy: "The State agency may not allow a commercial activity or facility that will interfere with the fulfillment of the restoration, conservation, management, and enhancement grant objectives for sport fish, wild birds, or wild mammals on the area, and the provision for public use of and benefits from these resources." As such, it should be clear that:

- 1. The Commercial Use Policy does not preclude any part of 50 CFR 80 or the current Federal Aid Handbook, but rather places more initial responsibility on the State Fish and Wildlife Agency. We urge you to review 50 CFR 80 with this in mind.
- 2. Many of the above mentioned activities <u>inherently</u> interfere with wildlife restoration and public access purposes. For instance, a group of wind turbines or cell towers scattered along a ridgeline require a considerable amount of space just for the footprint of the infrastructure (access roads, pilings, fenced areas, guy wires, towers, cleared zones to prevent signal interference, transmission lines, etc.). They are also documented as capable of causing significant mortality to birds and bats some of the very wildlife that are supposed to be restored by our efforts. In areas where these features already exist, the owners often insist on extensive buffer strips or safety zones to protect their equipment from being vandalized, thus further encroaching on legitimate uses of the areas.

Wind turbines on SGL that
were bought or managed
with Federal Aid or License
Dollars are considered to be
Commercial Development,
which would be restricted by
USFWS policy directives.

However, PGC may grant rights-of-way to wind energy development infrastructure through SGL – allowing huge access roads and powerlines to cross through these publicly-owned lands.

With all of the above in mind, we urge you to be very conservative in considering commercial uses on lands purchased with Federal Aid funds or hunting and fishing license revenues contributed by hunters and anglers. These lands are the living legacy of generations of American anglers and hunters who paid for them, and the heart of our collective efforts in restoration and conservation. Let us not devalue them for purposes which are not supportive of fish and wildlife or lose them on our watch.

Sincerely,

Robert J. Sousa, Chief

Federal Aid Division

POTENTIAL AMOUNT OF ELECTRICITY THAT COULD BE GENERATED ANNUALLY FROM RENEWABLE SOURCES WITHIN MID-ATLANTIC STATES

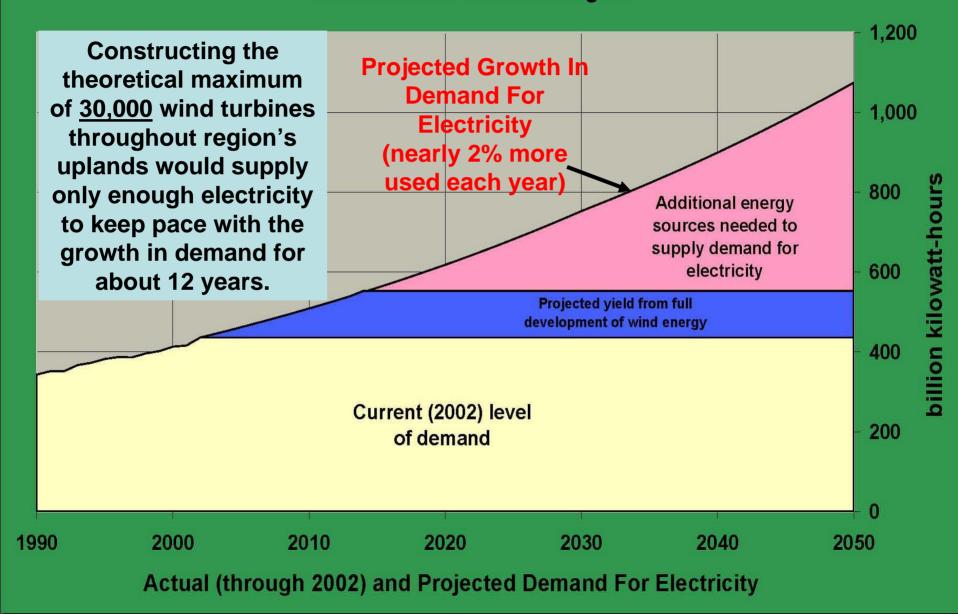
| | RENEWABLE ENERGY SOURCES 1 | | | | | NUMBER OF UTILITY-SCALE |
|---------------|--------------------------------------|--|--|--|----------------------------|--|
| STATE | Landfill Gas Potential (million kWh) | Clean Biomass Potential (million kWh) | Wind Potential ² (on-shore) (million kWh) | TOTAL OF RENEWABLE ENERGY SOURCES (million kWh) | % TOTAL FROM WIND | WIND TURBINES TO GENERATE WIND POTENTIAL 3 |
| DC | 0 | 0 | 0 | 0 | 0 | 0 |
| Delaware | 123 | 561 | 4,806 | 5,490 | 88% | 1,219 |
| Maryland | 515 | 2,333 | 5,640 | 8,489 | 66% | 1,431 |
| New Jersey | 1,374 | 482 | 15,327 | 17,182 | 89% | 3,888 |
| Pennsylvania | 1,748 | 9,969 | 67,894 | 79,611 | 85% | 17,223 |
| Virginia | 1,098 | 11,669 | 13,366 | 26,132 | 51% | 3,391 |
| West Virginia | 0 | 5,323 | 9,764 | 15,087 | 65% | 2,477 |
| TOTAL | 4,858 | 30,337 | 116,797 | 151,991 | 77% | <u>29,629</u> |

¹ Source information is from a national report entitled - **Generating Solutions: How States Are Putting Renewable Energy Into Action** - A Report of the U.S. PIRG Education Fund and the State Public Interest Research Groups. February 2002.

² Union of Concerned Scientists estimate - based on a state breakout of data developed for Doherty, Julie P., "U.S. Wind Energy Potential: the Effect of the Proximity of Wind Resources to Transmission Lines," Monthly Energy Review, Energy Information Administration, February 1995. Areas with Class 3 up to maximum of Class 7 winds are included in this estimate.

³ Number of modern utility-scale wind turbines is calculated by dividing each state's Wind Potential by the average amount of electricity annually generated by a 1.5-MW turbine. A 1.5-MW turbine produces only about 1/3 of its rated capacity each year (i.e., Capacity Factor = .30), so its annual output is approximately 4 million kilowatt-hours (1,500 kW *.30 * 8760 hrs/yr). May 31, 2005

Relationship between demand for electricity and the estimated supply from full development of the wind energy potential within the Mid-Atlantic Region





December 3-5, 2003 • Metropolitan Hotel • New York, NY

Featuring Experts from:

AEP Energy Sen Excerpt from this brochure in next slide

Association

ANZ Investment Bank

Babcock & Brown LP

Chadbourne & Park LLP

Fortis Capital Corp.

FPL Energy, LLC

FreeStream Capital Partners Limited

Garrad Hassan America, Inc.

Global Energy Concepts, LLC

Marsh USA, Inc.

Meridian Investments, Inc.

Milbank, Tweed, Hadley & McClov LLP

- Structuring Wind Power Developments— Assessing and Allocating On-Shore and Off-Shore Project Risks
- Assessing Technical and Wind Risk
- Institutional Investors, Ratings Agencies
 Non-Traditional Equity
- How Federal and State Incentives Affect Wind Project Feasibility

Tax Issues and Incentives for Wind Power

Keith Martin, Partner, CHADBOURNE & PARKE LLP Federal tax benefits pay as much as 65% of the capital cost of wind power projects in the United States. State incentives cover on average another 10%. However, the problem with tax subsidies is developers without the tax base to use them fully are disadvantaged compared to their competitors who can use them. This presentation will cover the following:

- Current structures for transferring tax benefits to institutional equity participants who can use them
- "Haircuts" caused by state incentives, pre-1987 power contracts, and other overlooked issues with the production tax credit
- "Depreciation Bonus" issues

SOURCE: http://www.pmaconference.com/wind2_bro2_pma.pdf

A 2-MW wind turbine costs up to \$3-million to purchase and erect – a very high capital cost (\$1.50 per Watt). However, extensive federal tax subsidies allow wind energy developers to shelter vast amounts of otherwise taxable income, resulting in the LOSS OF \$2-MILLION in payment to the federal treasury PER TURBINE over the 1st 10 years of a project (65% of \$3-million).

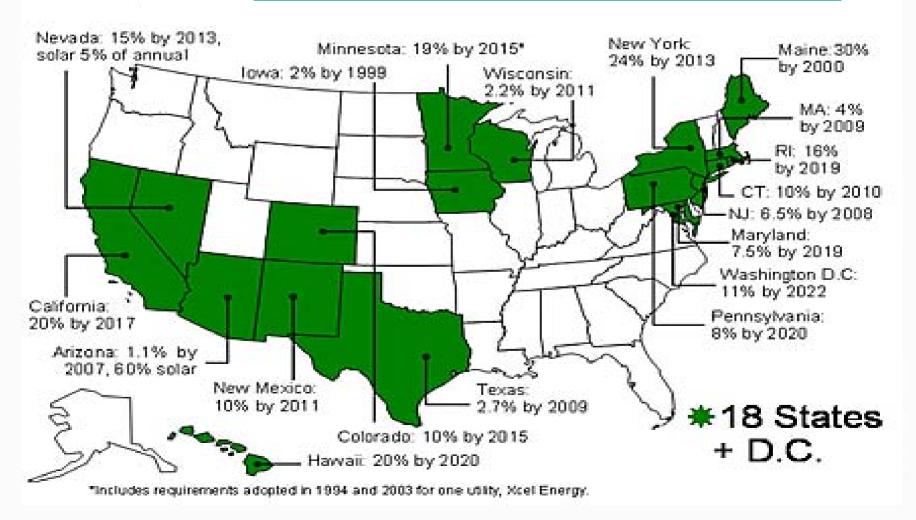


Most of the wind turbines erected in PA will be due to RPS demands of other states

Renewable Energy Standards

Mandates percentage of electricity sold in state to come from renewable sources

SOURCE: http://www.ucsusa.org/clean_energy/renewable_energy/page.cfm?pageID=47



"If state RPS laws remain at current levels and are enforced over the forecast period, they will be a catalyst for about 80 percent of renewable power development."

"Wind capacity in PJM will grow from only 195 MW today to 4,023 MW by 2016."

Platts - Renewable Power Outlook 2005

http://www.esource.com/members/prc_rps/pdf/rps7.pdf



The installation of 4,000 MW of wind turbines in our region likely will cause the federal treasury to lose \$3.5-billion in income tax revenue due to tax credits and shelters which large corporations will use to avoid paying taxes. However, much greater benefits to our region would result if instead this revenue were used to implement electricity conservation programs or power plant emissions reduction technologies.

Number of Utility-Scale Wind Turbines needed to supply electricity demand in 2030 due to Renewable Portfolio Standards (RPS) planned for Mid-Atlantic Region states

| STATE | Projected 2030 Electricity Consumption ¹ (million kWh) | Enacted/ Proposed RPS Percentage ² | RPS Share of Electricity Demand (million kWh) | NUMBER OF UTILITY-SCALE TURBINES TO GENERATE 75% RPS DEMAND3+ |
|---------------|---|--|---|---|
| Delaware | 24,368 | 10% | 2,437 | 464 |
| DC | 13,453 | 11% | 1,480 | 282 |
| Maryland | 130,019 | 7.5% | 9,751 | 1,855 |
| New Jersey | 109,897 | 20% | 21,979 | 4,182 |
| Pennsylvania | 232,007 | 8% | 18,561 | 3,531 |
| Virginia | 195,318 | 15% proposed | 29,298 | 5,574 |
| West Virginia | 45,632 | 0% | 0 | |
| TOTAL | 750,693 | | 83,506 | 15,888 |

¹ Each state's projected electricity consumption was based on 2002 level and the state-specific annual growth rate (1993-2002 average) to forecast future demand. 2002 level is from: http://www.eia.doe.gov/cneaf/electricity/st_profiles/ (Table 8)

² Renewable Portfolio Standards (RPS) are state-legislated mandates governing the % of renewable energy that must be sold in each state – see: http://www.dsireusa.org/index.cfm. NJ raised their RPS level in April 2006 to from 6.5% to 20%.

³ Number of modern utility-scale wind turbines is calculated by dividing each state's share of electricity consumption for RPS by the average amount of electricity generated from a 1.5-MW turbine. A 1.5-MW turbine produces only about 1/3 of its rated capacity each year, so its annual output is approximately 4 million kilowatt-hours (1,500 kW * .30 * 8760 hrs/yr).

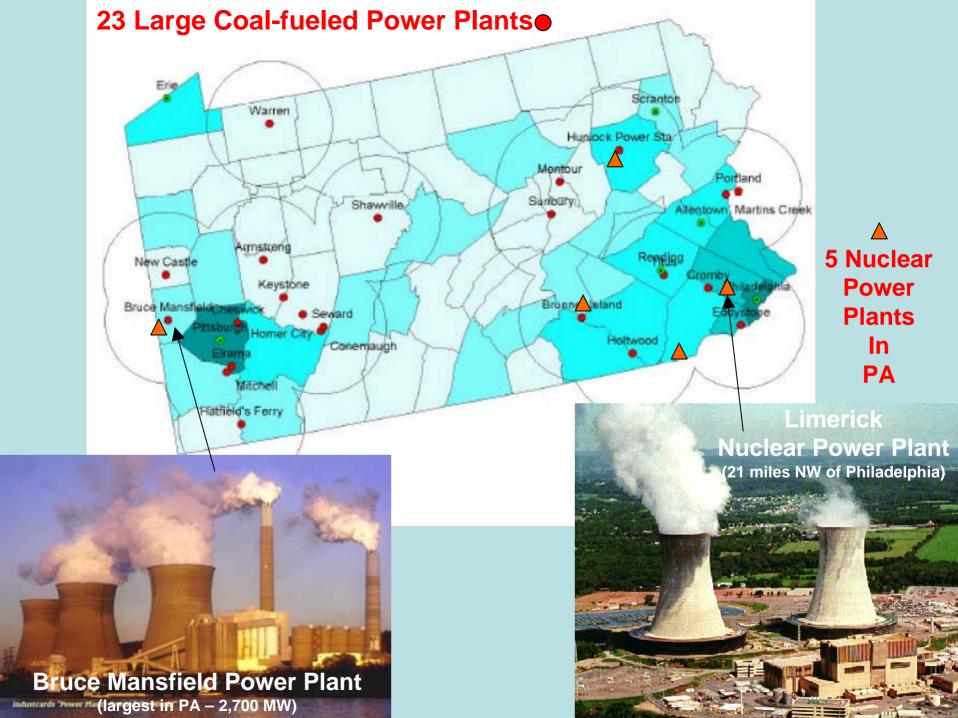
⁺ Assumes that 75% of the renewably-generated electricity for which wind energy is a qualifying source (e.g., Tier 1) under a state's RPS law or official proposal will be supplied by utility-scale wind turbines.

WILL WIND ENERGY DEVELOPMENT IN THE EASTERN U.S. REDUCE CURRENT EMISSION LEVELS OF GREENHOUSE GASES (GLOBAL WARMING) OR MERCURY OR

REDUCE THE PRESENT RATE OF BURNING OF COAL AND OTHER FOSSIL FUELS?

NO

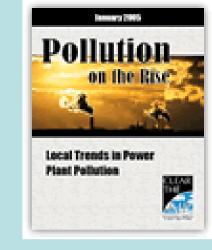
AT BEST WIND ENERGY DEVELOPMENT IN THE EAST WILL ONLY SLIGHTLY LESSEN THE INCREASING RATE OF GROWTH IN DEMAND FOR POWER, WHICH IS NOW EXPANDING AT ABOUT 2% PER YEAR (i.e., EACH YEAR WE USE 2% MORE ELECTRICITY THAN THE PREVIOUS YEAR)



STATE TRENDS IN POWER PLANT EMISSIONS - NITROGEN OXIDES, 1995-2003

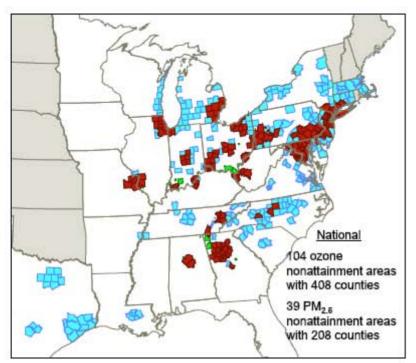
SOURCE: U.S. Environmental Protection Agency data on power plant emissions

REGION'S ELECTRICITY OUTPUT (kWh) FROM POWER PLANTS INCREASED ABOUT 15% BETWEEN 1995 AND 2003 ACCORDING TO USDOE'S EIA DATA



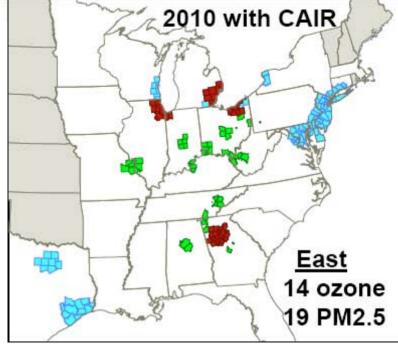
| NOx | 1995 Emissions | 2003 Emissions | Emission Change, | |
|----------------|-------------------|-------------------|---------------------|----------|
| state | (tons) | (tons) | 1995-2003 | % change |
| Pennsylvania | 272,942 | 203,142 | -69,800 | -26% |
| West Virginia | 259,897 | 174,280 | -85,617 | -33% |
| Maryland | 116,204 | 69,337 | -46,867 | -40% |
| Virginia | 96,158 | 68,438 | -27,720 | -29% |
| DC | 357 | 97 | -260 | -73% |
| Regional Total | 745,558 | 515,294 | -230,264 | -31% |

http://uspirg.org/reports/pollutionontherise.pdf



Projected
Non-attainment
Areas in 2010 &
2015 after
reductions from
Clean Air
Interstate Rule
(CAIR) and
existing Clean
Air Act (CAA)

programs

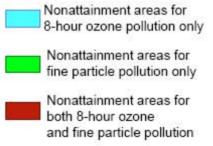


Ozone & Fine Particle Nonattainment (Apr. 05)

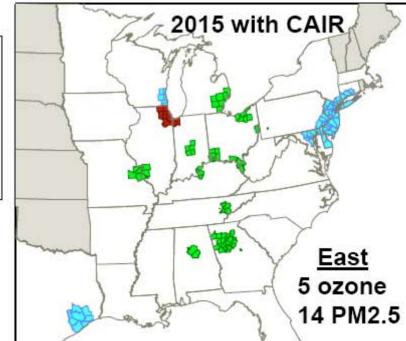
CAIR and Other CAA
Programs Will Help
Bring Many Eastern
Areas into Attainment
- However, a number
of areas are projected
to not attain through
2010 and 2015

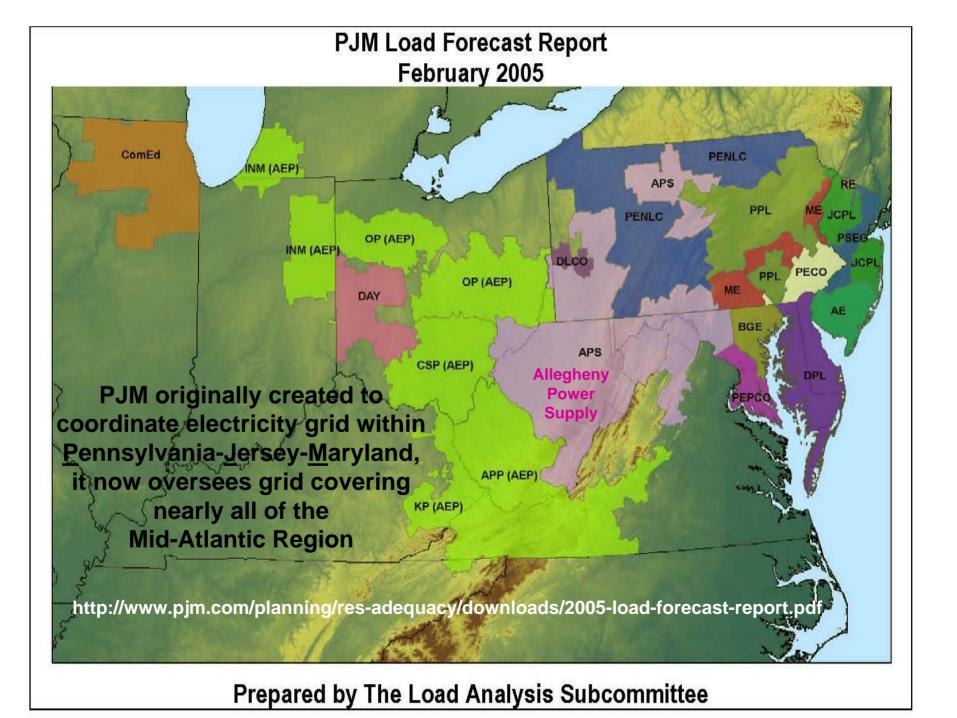
SOURCE:

http://cleanairinfo.com/modelingworkshop/presentations/PM2 5 Damberg.pdf

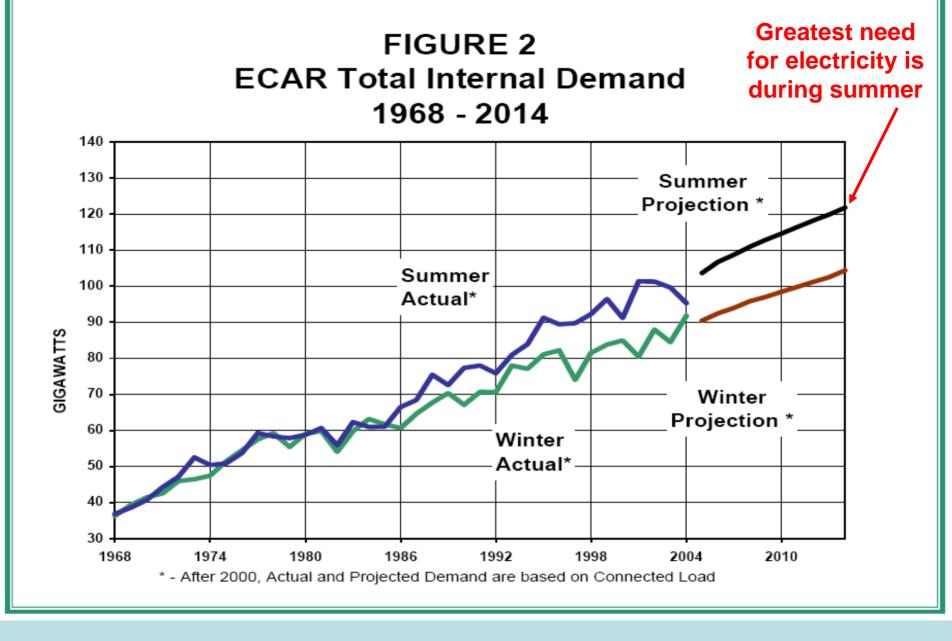


Projections concerning future levels of air pollution in specific geographic locations were estimated using the best scientific models available. They are estimations, however, and should be characterized as such in any description. Actual results may vary significantly if any of the factors that influence air quality differ from the assumed values used in the projections shown here.





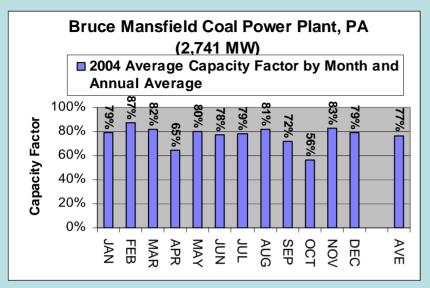


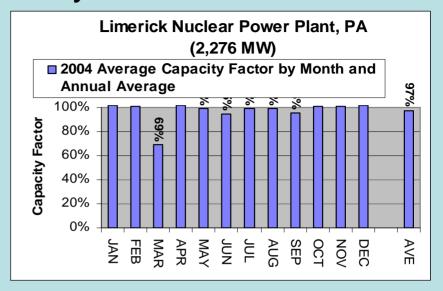


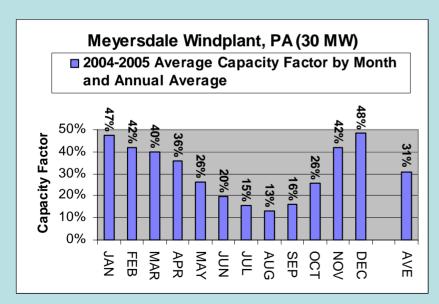
From: Assessment of ECAR-wide Capacity Margins 2005-2014

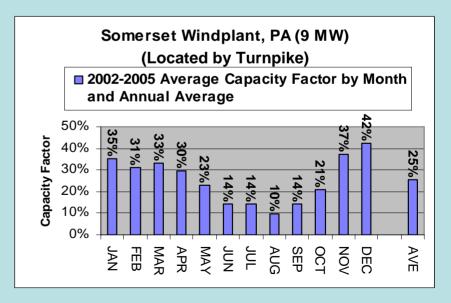
http://www.ecar.org/publications/GRP/2005-GRP-57.pdf

Average Monthly and Annual Capacity Factors for Wind, Coal, and Nuclear Power Plants in Pennsylvania









Source: USDOE EIA's 906/920 Monthly Time Series data and FERC's EQR data; corrected for errors and omissions

Note: little electricity is generated during summer by wind turbines.

Data summarized by Dan Boone, 5 March 2006

10 LARGEST POWER PLANTS IN PENNSYLVANIA AND NUMBER OF WIND TURBINES NEEDED TO PROVIDE EQUIVALENT ANNUAL OUTPUT OF ELECTRICITY (kWh)

| Facility Name | Capacity (MW) | Owner | Fuel Type | Annual Capacity Factor | # Wind Turbines To Equal Output* | # Miles Ridgecrest Covered+ |
|-----------------|---------------|-----------------------|--------------|------------------------------|----------------------------------|-----------------------------|
| Limerick | 2,276 | Exelon | Nuclear | 97% | 4,904 | 613 |
| Peach Bottom | 2,304 | Exelon | Nuclear | 93% | 4,770 | 596 |
| Bruce Mansfield | 2,741 | Penn Power | Coal | 77% | 4,663 | 583 |
| Susquehanna | 2,596 | PPL Corp. | Nuclear | 79% | 4,568 | 571 |
| Beaver Valley | 1,847 | Penn Power | Nuclear | 86% | 3,547 | 443 |
| Homer City | 2,012 | Edison Mission | Coal | 75% | 3,354 | 419 |
| Conemaugh | 1,872 | Reliant | Coal | 79% | 3,296 | 412 |
| Keystone | 1,872 | Reliant | Coal | 75% | 3,107 | 388 |
| Hatfields Ferry | 1,728 | Allegheny Energy | Coal | 56% | 2,137 | 267 |
| Brunner Island | 1,559 | PPL Corp. | Coal | 76% | 2,636 | 330 |

^{*} Number of 1.5 MW wind turbines operating with 30% Annual Capacity Factor (the highest average efficiency in region)

Note: # of kWh produced per year by facility = Capacity (in MW) x 1000 kW/MW x Annual Capacity Factor x 8760 hrs/yr; 8760 hrs per year based on: 24 hr/day x 365 day/yr

⁺ Based on 8 utility-scale wind turbines per mile of ridgetop (typical spacing)

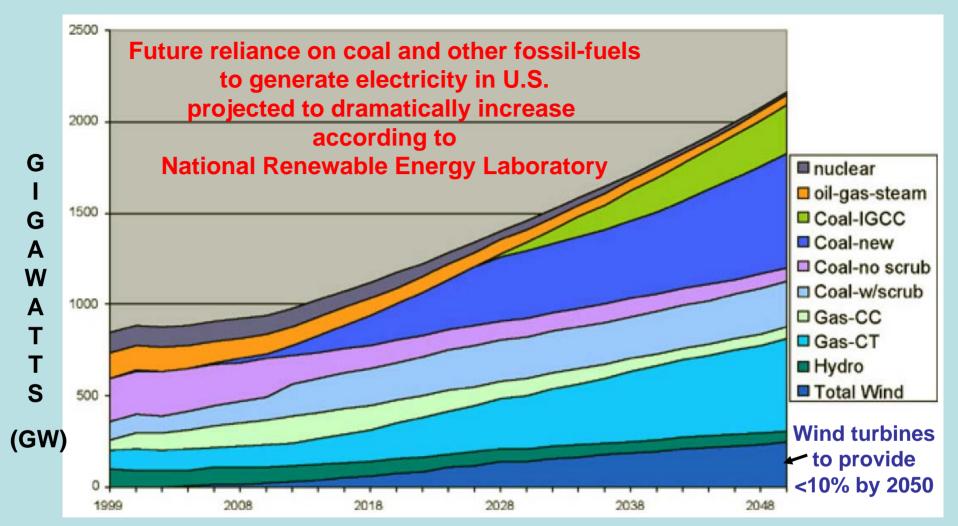
10 LARGEST POWER PLANTS IN PENNSYLVANIA AND NUMBER OF WIND TURBINES NEEDED TO PROVIDE EQUIVALENT SUMMER OUTPUT OF ELECTRICITY (kWh)

| Facility Name | Capacity (MW) | Owner | Fuel Type | Summer Capacity Factor | # Wind Turbines To Equal Output* | # Miles Ridgecrest Covered+ |
|-----------------|---------------|-----------------------|--------------|------------------------------|----------------------------------|-----------------------------|
| Limerick | 2,276 | Exelon | Nuclear | 98% | 9,935 | 1,242 |
| Peach Bottom | 2,304 | Exelon | Nuclear | 87% | 8,910 | 1,114 |
| Bruce Mansfield | 2,741 | Penn Power | Coal | 77% | 9,424 | 1,178 |
| Susquehanna | 2,596 | PPL Corp. | Nuclear | 87% | 9,994 | 1,249 |
| Beaver Valley | 1,847 | Penn Power | Nuclear | 90% | 7,350 | 919 |
| Homer City | 2,012 | Edison Mission | Coal | 80% | 7,145 | 893 |
| Conemaugh | 1,872 | Reliant | Coal | 88% | 7,306 | 913 |
| Keystone | 1,872 | Reliant | Coal | 72% | 5,995 | 749 |
| Hatfields Ferry | 1,728 | Allegheny Energy | Coal | 69% | 5,281 | 660 |
| Brunner Island | 1,559 | PPL Corp. | Coal | 75% | 5,226 | 653 |

^{*} Number of 1.5 MW wind turbines operating with 15% Summer Capacity Factor (average efficiency in region)

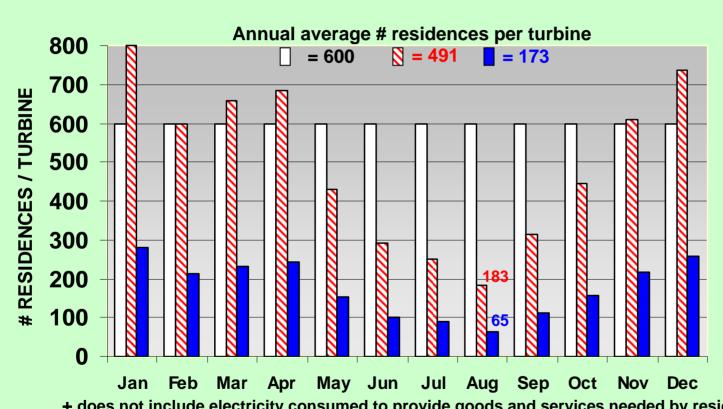
Note: # kWh produced in Summer by facility = Capacity (in MW) x 1000 kW/MW x Summer Capacity Factor x 2208 hrs; 2208 hrs based on: 24 hr/day x 92 days/Summer, Summer is July 1 through September 30, 2004 – 92 days

⁺ Based on 8 utility-scale wind turbines per mile of ridgetop (typical spacing)



<u>types</u>. Actual generation depends on amount of capacity, as indicated by the thickness of the section of the graph, and on annual capacity factor (efficiency) of each generation source. Due to wind intermittency, the annual capacity factor for wind energy projects is only about 30% - much less than for other utility-scale electricity generator types. (The graphic is from the National Renewable Energy Laboratory, DOE: http://www.nrel.gov/analysis/winds/qualitative.html) NOTE: 1,000 MW = 1 GW & 1,000 kW = 1 MW

AVERAGE # OF HOUSEHOLDS IN PENNSYLVANIA WHOSE MONTHLY TOTAL ELECTRICITY USAGE CAN BE MATCHED BY ONE 2.0-MW WIND TURBINE -3 SCENARIOS



- □ DEVELOPER'S
 CLAIM 600
 RESIDENCES
 PER TURBINE
- NESIDENTIAL CONSUMPTION ONLY (10,132 kWh/yr 2003)+*
- PER CAPITA
 CONSUMPTION
 WITH 2.48
 PERSONS PER
 HOUSEHOLD*
- + does not include electricity consumed to provide goods and services needed by residents e.g., street lights, offices, restaurants, stores, factories, etc.
- * Based on actual performance of 117 1.5 MW industrial wind turbines sited atop ridges in Mid-Atlantic region (2004); output of 2.0 MW wind was estimated by multiplying output of average 1.5 MW turbine by 4/3

Sources: 906/920 EIA 2004 data for the Mountaineer (WV) and Mill Run, Meyersdale & Waymart (PA) windplants; http://quickfacts.census.gov/qfd/states/51000.html; http://www.eia.doe.gov/cneaf/electricity/esr/table1abcd.xls#Table1!A1