FILE

COMMENTS:

September 26, 2008

Attention: Kim Wissman
Executive Director OPSB
180 East Broad
Columbus, Ohio 43215

Enclosed in the packet are hard copies of documents in response to OPSB draft regulations, Case No. noted below.

These documents are for your review and we trust that you will share copies of each of these documents with the following individuals:

OPSB Members, including legislative members
Klaus Lambeck
Stuart Siegfried
PUCO Members
Ohio House of Representatives Public Utilities Committee Members
Ohio House of Representatives Alternative Energy Committee Members
Ohio Senate Energy and Public Utilities Committee Members

Not included in this packet, but received by Ms. Wissman on Sept. 3, 2008, by hand delivery in a personal meeting, as well as personally provided e-mail copies from Richard R. James on his research: ***"The "How To" Guide to Siting Wind Turbines to Prevent Health Risks from Sound" by George W. Kamperman and Richard R. James.*** We trust that you will share this timely and important research with the individuals listed above.

To: Ohio Power Siting Board: Alan Schriber; Lee Fisher; Alvin Jackson; Robert Boggs; Christopher Korleski; Sean Logan; Andrew Boatright; Legislative Members; Kim Wissman

Re: Case No. 08-1024-EL -ORD; Wind Turbine Siting Regulations for the State of Ohio, Chapter 4906-17

Copy: Public Utilities Commission of Ohio; Ohio House of Representatives Public Utilities Committee; Ohio House of Representatives Alternative Energy Committee; Ohio Senate Energy and Public Utilities Committee; Stuart Siegfried; Klaus Lambeck

Respectfully,

Joe Hughes
6320 State Route 540
Bellefontaine, Ohio 43311

209 signatures collected in Jefferson Twp. K.H.

REQUEST FOR RESOLUTION FOR MORATORIUM

REGARDING INDUSTRIAL WIND TURBINES

in support of a moratorium in June, 2008.

The undersigned citizens of the unincorporated areas of Jefferson Township, Logan County, Ohio, request that the Jefferson Township Board of Trustees and/or Jefferson Township Zoning Commission adopt a resolution to establish a temporary moratorium on the construction of any and all industrial wind turbine generators in said township for a period of one year. The moratorium is requested to allow the Board of Trustees and the Zoning Commission the time to undertake studies and investigations as to the best course of action regarding the installation of industrial wind turbine generators in the township and consistent with the stated purpose of the Jefferson Township Zoning Resolution, i.e., protecting public health, safety, comfort, and general welfare.

Whereas, pursuant to the Constitution of the State of Ohio and the Ohio Revised Code, townships have the power to enact planning and zoning laws, including the restriction of industrial development, that are for the health, safety, welfare, comfort, and peace of the citizens of the township.

The proposed installation of a large industrial scale wind farm encompassing Jefferson Township has brought considerable controversy to the area. In the haste to enact zoning, an amendment was adopted that appears to contain arbitrary and unreasonable language and which fails to protect the public's health, safety, and welfare.

In order to meet constitutional requirements of substantive due process, a township zoning resolution may be neither arbitrary nor unreasonable, and must bear a substantial relation to the public health, safety, morals, or general welfare. The current zoning with regards to industrial wind turbines appears to be both arbitrary and unreasonable, and does not reflect a substantial relation to public health, safety, morals, or general welfare.

The following points in the current zoning need to be further clarified and defined:

1. *Roads – The existing condition, damage and repair of roadways in the township is vague and* unusable in its current wording. The only mention of roadways in the current zoning is listed under "Siting Approval Application" and states: "d.) A description of the access route from the nearest County or Township maintained road to include:
    - Road surface material stating the type and amount of surface cover
    - Width and length of access route
    - A road maintenance schedule "

    There is no further mention of roads in the document. As written, it appears the township would bear the economic burden of repairing damage to the roadways without a clear and concise requirement as to what is expected of the wind companies, and fails to establish time limits for said repairs. The subject of road use and damage needs to be studied referencing information from previous industrial wind facilities in other areas. The current condition needs to be

Mr. Joe Hughes
6320 State Route 540
Bellefontaine, OH 43311-9519

determined, the estimated damage provided, and clear requirements stated with regards to the remedial steps to be taken by the wind company to repair the roads to the satisfaction of the township trustees or their representatives.

2. Ground water and wells – any installation of industrial wind turbines that requires digging beyond a depth of 10' and/or blasting to create the base of the industrial wind turbine could have negative impacts on ground water and nearby wells. According to the State of Ohio Geologists, there is the possibility of fracturing of local limestone formations and those fractures intersecting existing caves and/or groundwater sources. The only geological reference in the current zoning is again under the heading "Siting Approval Application" and states: "h.) A soil boring report."

   Studies need to be undertaken to determine what that possibility might be and what can be done to rectify any potential problems and ensure that the residents do not bear the cost or burden of damage to wells or groundwater supplies. Jefferson Township has known karst areas that could make it more susceptible to this type of occurrence.

3. Setbacks – the subject of setbacks has been the subject of the greatest controversy. There is ample scientific study that should be utilized to determine the setback distances. The current zoning is ambiguous regarding the requirements. It states under the heading "Setbacks":

   -All WPGF towers shall be set back at distance of at least 1.1 times the WPGF tower height from any primary structure. The distance for the above setback shall be measured from the point of the primary structure foundation closest to the WPGF tower to the center of the WPGF foundation

   -All WPGF towers shall be setback a distance of 1.1 times the WPGF tower height from the adjacent property lines. The affected owner may waive this setback requirement by signing a waiver with WPGF and to be submitted to the trustees.

   The above two points appear to contradict each other and need to be clarified.

Further, the setback of 1.1 allows the majority of the length of the blade of the industrial wind turbine to fall on the primary structure being referenced. This has obvious safety implications and warrants further investigation to determine a reasonable measure of safety. In addition, no measurement should be taken from the foundation of a home, but rather, from the property line. Be measuring from the foundation of a home, you are, in effect, taking away the landowners property. This could be especially problematic in the situation where a home could have turbines on multiple sides of the property. In the event that each turbine is measured from the foundation of the home, the landowner could live on a virtual island within their home, with their land becoming unusable due to safety considerations, and also making it difficult to sell or partition the property in the future.

The current zoning allows the de facto taking of a landowner's property without just compensation and further jeopardizes the health, safety, and welfare of the citizens of Jefferson Township. The current zoning violates equal protection guarantees, deprives the landowner of a property interest without due process of law, and constitutes a "taking" of property for which the landowner must be compensated.

Numerous studies have found that blade fragments, ice and other debris can be thrown distances up to 1750' from the industrial wind turbines. Setbacks must allow for a safety distance of at least that amount in order for an adjacent landowner to be safe on their own property. Science needs to be the basis for all setbacks, and ample time needs to be taken to study the subject of setbacks in regards to health and safety.

The current zoning also states under the heading "Setbacks":

-The applicant does not need to obtain a variance from the Township upon execution of a contract with WPGF by an adjacent property owner of the above setback requirements. Any waiver of any of the above setback requirements shall run with the land and be recorded as part of the chain of title in the deed of subject property.

There may be reasons that the trustees or zoning commission are aware of that could impact such a waiver and it is felt that the variance should remain in the hands of the trustees. This matter requires further consideration.

4. Interference – The current zoning fails to protect residents from the potential interference by industrial wind turbines with television, satellite, radio, cell phones or other devices. It provides solely that the applicant "must provide copies of the project summary and site plan", and that, if emergency service providers demonstrate a likelihood of interference the wind applicant must take "reasonable measures" to mitigate the interference. "Reasonable measures" is not further defined. Further, the current zoning provides that if the owner/operator receives a written complaint about interference related to emergency services communications, they must take "reasonable measures" to respond to the complaint. Thus, the current zoning fails to ensure that residents will be able to access, at all times, emergency services or that they will have a remedy against interference with television, satellite, radio, cell phones or other devices.

5. Noise Levels – the current zoning states: "Noise levels from each WPGF unit of WPGF project shall be in compliance with applicable State of Ohio regulations. The applicant, through use of a qualified professional, as part of the siting approval application process, shall appropriately demonstrate compliance with the above noise regulations."

   No noise regulations exist for the State of Ohio. Noise regulations are typically done on a local level. No such noise regulation exists at the local level. Noise regulations specific to industrial

wind turbines need to be established at the township level. This will require time to be spent reading noise studies with regards to industrial wind turbines. The noise levels are addressed in numerous scientific studies and those should be perused and referenced when noise regulations are determined.

All noise studies should be conducted by an independent professional noise expert, chosen by the Board of Trustees or their assignees, and paid for by the wind company.

This section also fails to address the filing process or remedy process for noise complaints. Regardless of what future problems may occur there is no method for addressing the issue or resolving it.

6. Birds – the current zoning addresses birds, but does not address bats, which are a known victim of wind turbines. It needs to include bats, and also should set aside a time frame for the study. The study should be conducted by an independent wildlife biologist or as determined by the best practice guidelines of the Ohio Wind Working Group.

7. Decommissioning Plan – the plan as stated in the current zoning states: "Prior to receiving site approval under this Resolution, the applicant, owner, and/or operator must formulate a Decommissioning Plan to ensure that WPGF project is properly decommissioned. " It does not state that the plan must be approved by anyone. Are we to assume the plan is designed solely at the discretion of the applicant, owner, and/or operator?

The document also states: "Financial Assurance, unless contract stipulates a financial set aside for decommissioning secured by the owner/operator (in the form of a surety bond) for the purpose of adequately performing the decommissioning, in an amount equal to the Professional Engineer's certified estimate of the decommissioning costs plus anticipated inflation. The cost of professional engineering for decommissioning will be paid for by the owner/operator." Is this an independent professional engineer? Are they certified in the State of Ohio? This requires further study. In addition, what does "unless contract stipulates a financial set aside" mean? What contract is being referred to? This requires further clarification.

This section does not specify who bears the cost of the actual decommissioning. It state that the owner/operator will pay for the engineer, but not the full cost to decommission. In addition, this seems to imply that the individual contracts may have some decommissioning language, with monies set aside for the landowner. Since each individual in the township is affected by the wind turbines, the cost for decommissioning should be set aside, in total, at the township level. There is no guarantee in this zoning that the monies could not be spent at the landowner's sole discretion if the turbines are abandoned or shut down. The landowner could choose to leave the turbines up and spend the money in other ways. This assures no safety or remedy for the township or residents.

8. Remedies – Alleged defaults have no definition. There may be various reasons for adjudication and these should be more clearly defined. The current zoning states: "If the Township determines in its discretion, that the parties cannot resolve the alleged default(s) within the good faith negotiation period, the resolution of such default(s) shall govern." This is arbitrary and ambiguous. What is the "good faith negotiation period"? What does "the resolution of such default(s) shall govern " mean? What resolution? This entire section needs to be investigated, and legal counsel sought by the Township in order to protect the best interests of the Township and the health, safety, and welfare of its residents.

9. Expenses – the current zoning states: "All reasonable expenses incurred by the Jefferson Township Trustees to review and certify the WPGF plan shall be paid by the applicant." There is no definition of what "reasonable" constitutes. This section needs to be further clarified.

There are a number of other areas that are not mentioned in the current zoning that should be researched and addressed including, but not limited to:

1. Wind studies that should be conducted by a qualified independent firm at the expense of the wind company.
2. Requirements as to what remedial steps will be taken by the wind company to return the landscape to its original condition once the construction of the wind turbines is complete.
3. Studies need to be conducted with regards to the installation of industrial facilities in a U-1 district. The land use plan should be completed and referenced in the process of determining proper zoning in the township.
4. Studies need to be conducted regarding the potential health impacts from living near industrial wind turbines. Scientific studies are available.
5. Consideration needs to be made for the de facto taking of non-participating landowners property. The Fourteenth Amendment to the United States Constitution prohibits any State from denying "to any person within its jurisdiction the equal protection of the laws". The current zoning with regards to industrial wind turbine generators allows a select group of landowners to have special consideration with regards the use of their land, while imposing no protection for the adjacent landowners that choose not to allow construction of industrial wind turbine generators on their property.
6. A method needs to be determined for handling citizen complaints. A time frame and resolution process needs to be determined.
7. It should be required that site plans eliminate shadow flicker on nearby properties. Programs are available that can easily determine shadow flicker and must be used in the siting process.

8. Maximum allowable height of the wind turbines should be defined and should be a measure from the base to the tip of the blade.

There is a need to study all of the above and other issues to determine what regulatory controls need to be adopted to protect public health, safety and welfare. Additionally, significant factors such as height restrictions, visual impact and character of the community all must be fully examined and studied to ascertain the impact of these industrial wind facilities may have upon the community.

A moratorium should be implemented in order to protect the planning process and to prevent approval or development of industrial wind turbines until adequate studies have been completed.

Mr. Joe Hughes
6320 State Route 540
Bellefontaine, OH 43311-9519

1. Introduction

A turbine connected to the grid implies certain elements of danger if it is handled without exercising proper caution.

For safety reasons, at least two persons have to be present during a work procedure.

The work must be properly carried out in accordance with this manual and other related manuals. This implies, among other things that personnel must be instructed in and familiar with relevant parts of this manual.

Furthermore, personnel must be familiar with the contents of the "Substances and Materials" regulations.

Caution must especially be exerted in situations where measurement and work is done in junction boxes that can be connected to power.

Consequently the following safety regulations must be observed.

2. Stay and Traffic by the Turbine

Do not stay within a radius of 400m (1300ft) from the turbine unless it is necessary. If you have to inspect an operating turbine from the ground, do not stay under the rotor plane but observe the rotor from the front.
Make sure that children do not stay by or play nearby the turbine. If necessary, fence the foundation. The access door to the turbine must be locked in order to prevent unauthorised persons from stopping or damaging the turbine due to mal-operation of the controller.

3. Address and Phone Number of the Turbine

Note the address and the access road of the turbine in case an emergency situation should arise. The address of the turbine can often be found in the service reports in the ring binders next to the ground controller. Find the phone number of the local life-saving service.

Mr. Joe Hughes
6320 State Route 540
Bellefontaine, OH 43311-9519

National Wind Watch

September 24, 2008
Opinions, U.S.

Blowback: Is wind the new ethanol?

These are boom times for wind power. T. Boone Pickens, the wildcatter turned oil baron, is building the world's biggest wind farm, in the dry scrub of the Texas Panhandle—a $10 billion bet on wind's future. Twenty-eight states have set ambitious mandates for renewable energy, with wind power shouldering most of the load; many compel electric utilities to get at least 20 percent of their supply from wind and other renewable sources between 2015 and 2025.

Those requirements, along with a generous federal subsidy (20 percent of wind energy's costs), have fostered a turbine-building frenzy. Overall capacity grew by 45 percent last year alone. Several wind-power companies have been snapped up in recent years in a string of multibillion-dollar deals. In May, Jim Cramer talked up wind stocks on *Mad Money* while assembling a model turbine in the studio.

And why not? Wind power seems to promise zero emissions and an endless supply of cheap power.

Still, it's hard to ignore the parallels to the recent ethanol boom, which was also fueled by mandates and subsidies, and which is now viewed almost universally as a disaster. Wind power is unlikely to cause a global food crisis. But heedless investment in it may provoke blowback of a different sort.

Though wind advocates say that we can reliably and economically use wind for 20 percent of our power needs, the experience of Texas, which leads the nation in wind power—2.9 percent of its electricity comes from wind—highlights two big problems: transmission and variability.

Pickens's windmills (like most of Texas's) will be in the west, where the wind blows the most. The big cities are in the east. This problem plagues wind power nationally: people typically don't live where the wind blows hardest, so you have to send power from, say, upstate to downstate New York, or from the Dakotas to the cities of the Midwest.

Texas expects to max out its east-west transmission lines by the end of the year. More wind power means new transmission lines, which will cost between $3 billion and $6.4 billion. Accommodating wind power on the scale foreseen nationally may require 12,000 to 19,000 miles of new high-power lines crisscrossing the country (by way of comparison, the interstate highway system runs 46,837 miles), plunging large parts of America into NIMBY hell.

Wind variability presents a more fundamental problem. Texas's experience, at less than 3 percent wind power, is again instructive. In February, an unexpected cold front calmed the state's wind farms. As power ran out and backup generation proved inadequate, grid operators were forced to call on large industrial and commercial users to power down.

Wind farms tend to produce the most energy when it's not needed—at night and in the spring and fall, when demand is low. The hottest, highest-demand days of the year are the days when wind's

contribution is likely to be near zero. So wind, if it is to meet demand reliably, must be backed up, typically by (emissions-spewing) natural-gas plants that can ramp up and down quickly.

Powering plants up and down is inefficient, and when backup power is included, wind energy costs 10 to 30 percent more than fossil-fuel energy, even without factoring in the cost of new power lines. (Wind-energy costs have risen, not fallen, in recent years.) And once you include backup power, the cost of averting carbon-dioxide emissions by building a wind plant rises to $67 a ton, according to Cambridge Energy Research Associates. Less sexy emissions-reduction strategies, such as increasing efficiency at current electrical plants, cost between $10 and $30 a ton.

Wind is indisputably a promising source of renewable energy—today, in fact, it looks like the most promising and practical source. But many kinks remain to be worked out. It would be a tragedy if wind power were killed in the cradle by overeager requirements that bring hidden costs, unreliable operations, and higher energy prices, inviting a backlash.

The way to address our greenhouse-gas problems is not to champion wind or any other "silver bullet." It's to pass a national carbon tax or a cap-and-trade system, and let the market find the most efficient way to cut emissions and reduce our dependence on oil.

By Matthew Quirk
staff editor

[1] TheAtlantic.com

October 2008

URLs in this post:
[1] TheAtlantic.com: **http://www.theatlantic.com/doc/200810/world-in-numbers**

Mr. Joe Hughes
6320 State Route 540
Bellefontaine, OH 43311-9519

NORDEX

Micrositing

Choosing the type of wind turbine (WTG) and its exact position are very important parts of the planning work of a wind park. This process is called *micrositing*.

During *micrositing* many aspects have to be regarded:

- wind conditions (statistic data concerning wind speed and wind direction)
- building requirements (e.g. distances to residences)
- ownership structure of the area
- accessibility (existing roads)
- influence of the WTG on the environment (e.g. shadow flickering, noise emission)
- distances between the individual turbines in a park

The knowledge of the wind conditions is very important for the decision about the development of a wind park. It is always the best to have measured data of the planned site for a period of at least two years. But this is not always possible. In case of a shorter measurement period wind consultants can find out the conditions by an interpolation of long-term measurements of near-by weather-stations.

Based on the information about the wind conditions it is possible to choose the type of turbine and the park layout which provides the highest energy production while keeping the external requirements. Based on a realistic forecast of the energy production it is possible to decide whether to invest in wind energy or not.

It is important to keep a distance to the next residences in order to not disturb the inhabitants by *noise emission* and *shadow flickering* of the turbine. Normally there have to be at least 500 m between the WTG and the next residence.

But it is also very important to keep the distance between the turbines in the park. A layout of a wind farm where the turbines are placed too close to each other could endanger the material and reduce the operating life of the turbines. A rotor of a WTG causes high turbulences that reduce the energy output of the next turbine. Compared with a single stand-alone turbine there are also higher loads on the following turbine because of increased turbulences in the wind park. Therefore the minimum distance between two turbines depends on the wind conditions and may be e.g. 6 rotor diameters (D) in the main wind direction and 4 diameters in other directions. As a matter of principle the turbulence intensities at the WTG should not exceed the certificated turbulence intensities.

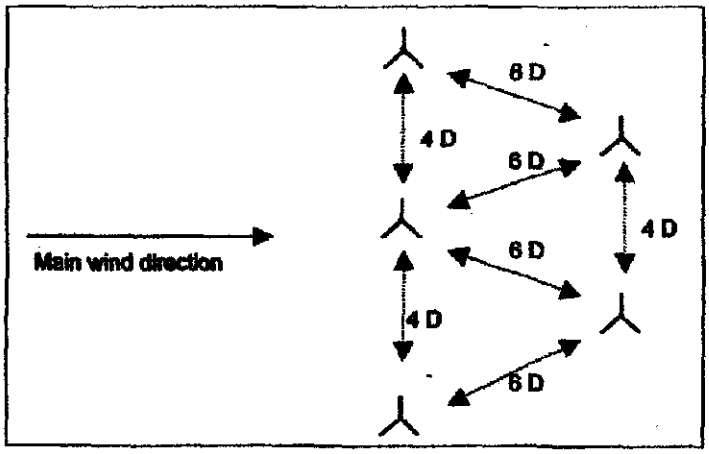


Figure 1: Distances between the turbines in a wind park

The distances between the turbines also have a strong effect on the energy output of the wind park. This effect is described by the park efficiency, the relation between the output of the park and the output of the same number of stand-alone turbines. Therefore the layout has to be planned carefully.

Mr. Joe Hughes
6320 State Route 540
Bellefontaine, OH 43311-9519

WOSU News

Battle Brewing Over Proposed Wind Turbines in Western Ohio

Sam Hendren, WOSU Reporter

Listen MP3

COLUMBUS, OH (2008-07-21) There's a battle brewing along the ridges of Western Ohio. Several wind energy companies might build hundreds of giant turbines to generate electricity. There's support -- but a lot of opposition.

Along the glacial ridge above the tiny community of Zanesfield in Logan County, Page Mays built a comfortable home in an idyllic setting.

"We went ahead and bought this property and built this house, figuring that we were going to see pretty much what we were going to see," Mays says. "But that ridge over there is where they want to put the wind turbines now. We didn't bargain for that."

Touted as the ultimate in clean energy, hundreds of wind turbines may be erected on these hills which are among the highest in the state of Ohio. But the Mayes worry about the effect on their property values, their way of life and their health.

"I think the wind turbine zoning regulations should protect adjacent property owners so there are no problems with noise, vibrations causing health issues or whatever in the future."

Some residents believe the turbines will be noisy; that they'll generate low frequency sound waves that will cause their health to deteriorate; that sunlight flickering through the blades during mornings and evenings will at the least be distracting and at worst cause problems for epileptics. They want to be sure that towers are "set back" far enough from their property lines. The newly established setback regulations are inadequate, they say. Tom Stacy is head of the group Save Western Ohio.

"Unfortunately the State of Ohio is pretty enamored with the job creation potential for wind energy with some idea that it will offset coal burning," Stacy says. "Those forces seem to override the safety concerns that we brought forward.

A year ago Gov. Strickland announced his Energy, Jobs and Progress Plan. Under the plan, a minimum of 25 percent of the electricity sold in Ohio must be generated from advanced energy technology, including wind, by the year 2025. Half of that energy must be generated in Ohio. A day later the governor announced the awarding of $5 million to two wind farm projects - one of them in Logan and Champaign counties. Now yard signs have popped up all over Logan - some in favor of wind energy, many opposed.

"There are so many signs because there are so many rural, residential properties here and so many people who have made their lives out here in this area, to get away from urban sprawl, to embrace the agricultural community," says Stacy. "Understandably people with farms, if they can make more money with their farms in some way, they're going to go after it. Unfortunately it's created a lot of ill will between the residential and agricultural community out here."

Opponents say they're also worried about blades fragmenting and flying off, perhaps landing on their property. They cite cases where wind turbines have fallen over. They wonder if ice accumulations on blades will be thrown hundreds of feet. They worry about the environmental consequences: bird kills and habitat destruction.

But Rick Archer who's already leased his property to one of the wind farm projects says he's not worried about those disruptions.

"Blades coming off? Never heard of it. Noise? Definitely not an issue," says Archer.

Archer says he joined a group that toured an Illinois wind facility and came away impressed. He's not impressed with the arguments that wind turbines will spoil the ridgeline views.

"I also came out here for that same view. And I don't think it's going to hurt the view at all," Archer says. "If you look there's a cell phone tower right over in that direction. Those cell phone towers to me are uglier than a wind turbine and to me actually serve no purpose. We've got to do something about this oil. We're burning natural gas; we burn fuel to produce electricity when we can actually receive it not free but a lot cheaper."

The turbines may be about 500 feet tall - measured from their base to the top of the blade in its highest position. Current law prescribes that the setback from the property line should be at a minimum slightly longer than the turbine is tall. But the head of the Ohio Power Siting Board which has the final authority on where turbines can be built says each will be considered individually. Executive Director Kim Wissman:

"We believe that every single turbine is its own circumstance," Wissman says. "I mean, we will take a look at every single turbine and the circumstances surrounding every single one of those turbines and this is in fact a minimum and there may be circumstances where it is warranted that it be significantly more than that."

Wissman says she believes that wind turbines on the hills of western Ohio are inevitable. But she says there's no reason for the public to be alarmed about their safety.

"We'll do everything in our power to protect the citizens and certainly safety is one of our major concerns so that will be one of the things that we look at first and foremost," says Wissman.

The project director for Babcock and Brown's Logan County wind farm says it will contain between 40 and 60 windmills.

A 1.8 megawatt wind turbine can generate power for about 300 homes.

Mr. Joe Hughes
6320 State Route 540
Bellefontaine, OH 43311-9519

Babcock and Brown Cont'd

Page 7 Section 7.5 Requirements of Governmental Agencies.

Grantee shall comply in all material respects with all laws applicable to Projects, but shall have the right, in its sole discretion and at its sole expense, in its name or in the names of the Grantee and Owner, to the extent permitted by law, where required, to contest the validity or applicability of any law, ordinance, order, rule or regulation of any governmental agency or entity. Grantee shall control any such contest and

Owner shall reasonably cooperate with Grantee in such contest, including, without limitation, by signing applications or affidavits and appearing at hearings and public meetings, at no out-of-pocket expense to the Owner.

Mr. Joe Hughes
6320 State Route 540
Bellefontaine, OH 43311-9519

Babcock and Brown Lease Terms

Page 2 Scope :

(c) Owner hereby grants unto Grantee a non-exclusive easement over and across the Easement Property for the passage, intrusion or impact of any audio, visual, view, light, flicker, noise, vibration, air turbulence, wake, electromagnetic, electrical, and radio frequency interference, and any other effects (the "**Project Effects**") attributable to Grantee's activities pursuant to Sections 2(a) and (b); and **Owner acknowledges the possibility that one or more Project Effects will occur** in the course of Grantee's operations on or in the vicinity of the Easement Property, and hereby waives any cause or claim with regard to any Project Effects

Mr. Joe Hughes
6320 State Route 540
Bellefontaine, OH 43311-9519

National Wind Watch

February 4, 2008
Environment, Noise, Ordinances, Safety, Siting, Wisconsin

Union Township (Wisc.) Wind Energy Systems Licensing Ordinance

Noise emitted by Wind Turbines shall not exceed 38 dBC, 35 dBA, or 5 dBA over background ambient noise levels, whichever is lower, when measured from the outside of the nearest residence, business, school, daycare facility, church, hospital and other inhabited structures.

Each Wind Turbine must be set back:

a. at least 1,000 feet from the nearest property line and at least 5 times the rotor diameter of the rubine from the property lines of all adjoining property owners who have not granted an easment for a lesser setback; and
b. at least 1,000 feet of three (3) times the total height of the Wind Turbine, whichever is greater, from any public road, railroad or power line right-of-way; and
c. at least 1,000 feet of three (3) times the total height of the Wind Turbine, whichever is greater, from the nearest above-ground public electric power line or telephone line; and
d. [redacted]
e. at least 1,000 feet from all sinkholes to prevent groundwater contamination; and
f. one mile from emergency communications towers.

Download "Town of Union Wind Energy Systems Licensing Ordinance"

Mr. Joe Hughes
6320 State Route 540
Bellefontaine, OH 43311-9519

News

Industrial wind turbines, infrasound and vibro-acoustic disease (VAD)

Documented in a press release dated May 31, 2007 from the Vibro-Acoustic Disease (VAD) research group in Portugal, people living in the shadow of industrial wind turbines have moved a step closer to understanding the nature of the Wind Turbine Syndrome many of them experience and complain about. Professor Mariana Alves-Pereira (an acoustical engineer) and Dr. Nuno Castelo Branco (a surgical pathologist) recently took numerous noise/vibration measurements within a Portuguese home surrounded by four (4) industrial wind turbines. The closest turbine is nearly 1000 feet (300 meters), from the affected home. The turbines have been operating since November 2006. The scientific report on this research will be formally presented at Internoise 2007, to be held on 28-31 August in Istanbul, Turkey.

Visitor rating: ★★★★★

Top of Form

Rate this item:

Bottom of Form

May 31, 2007 by Mariana Alves-Pereira, PhD

Excessive exposure to infrasound and low frequency noise (ILFN, defined as all acoustical phenomena occurring at or below the frequency bands of 500 Hz) can cause vibroacoustic disease (VAD).[1]

Research into VAD has been ongoing since 1980, conducted by a multidisciplinary team of scientists and led by pathologist Nuno Castelo Branco, MD.

In March 2007, and for the first time, the Portuguese *National Center for Occupational Diseases* attributed 100% professional disability to a 40-year-old flight attendant who had been diagnosed with VAD since 2001. Two other VAD patients have also been attributed a similar disability status.

Initially, only ILFN-rich occupational environments were investigated. However, over the past several years, many individuals and their families have approached our team because of the ILFN contaminant in their homes. The sources of residential ILFN vary from industrial complexes, to large volume highways, to public transportation systems, etc.

In a case study published in *Proceedings of Internoise 2004* (a annual scientific meeting dedicated to all aspects of acoustics), one of the first documented cases of environmental VAD was reported in a family of four, exposed to the ILFN produced by a port grain terminal.[2]

Over the past three years, several families have contacted this team complaining of noise caused by the proximity of industrial wind turbines (windmills). However, only within this past month has this team obtained detailed acoustical measurements within a home surrounded by 4, recently installed industrial windmills.

This acoustical data was essential in order to compare in-home, windmill-produced acoustical environments with the residential, ILFN-rich environments that are known to be conducive to VAD.

The levels of ILFN inside the windmill-surrounded home are <u>larger</u> than those obtained in the home contaminated by the port grain terminal.

The scientific report will be formally presented at *Internoise 2007*, to be held on 28-31 August in Istanbul, Turkey.[3]

These results irrefutably demonstrate that windmills in the proximity of residential areas produce acoustical environments that can lead to the development of VAD in the nearby home-dwellers.

In order to protect Public Health, ILFN-producing devices <u>must</u> not be placed in locations that will contaminate residential areas with this agent of disease.

Mariana Alves-Pereira, PhD
School of Health Sciences (ERISA), Lusofona University Portugal Department of Environmental Sciences & Engineering, New University of Lisbon Portugal

Nuno Castelo Branco, MD
Surgical Pathologist President, Scientific Board Center for Human Performance (CPH)

The **Center for Human Performance** is a civilian, non-profit organization dedicated to research in vibro-acoustic disease. CPH was founded in 1992 has been the organization which coordinates all the different teams that work on vibro-acoustic disease research, and that include (in Portugal) the cardiology and pulmonary departments of the Cascais Hospital, the neurophysiology department of the National Institute of Cancer, the department of human genetics of the National Institute of Public Health, the department of speech pathology of the School of Health Sciences of the Polytechnical Institute of Setúbal, among several others over the past 25 years.

Contact: Professor Alves-Pereira, *vibroacoustic.disease@gmail.com*

---

[1] Castelo Branco NAA, Alves-Pereira M. (2004) Vibroacoustic disease. *Noise & Health* 2004; 6(23): 3-20.

[2] Castelo Branco NAA, Araujo A., Joanaz de Melo J, Alves-Pereira M. (2004) Vibroacoustic disease in a 10-year-old male. *Proc. Internoise 2004*, Prague, Czech Republic, August 22-25, 2004: No. 634 (7 pages).

[3] www.internoise2007.org.tr

Filed under : Noise : Impact on People

< prev next >

Mr. Joe Hughes
6320 State Route 540
Bellefontaine, OH 43311-9519

Health Effects of Wind Turbine Noise

Nina Pierpont, MD, PhD

(www.ninapierpont.com)

March 2, 2006

Industrial wind turbines produce significant amounts of audible and low-frequency noise. Dr. Oguz A. Soysal, Professor and Chairman of the Dept. of Physics and Engineering at Frostburg State University in Maryland, measured sound levels over half a mile away from the Meyersdale, PA, 20-turbine wind farm. Typical audible (A-weighted) dB (decibel) levels were in the 50-60 range, and audible plus low-frequency (C-weighted) dB were in the 65-70 range.[1] 65-70 dB is the loudness of a washing machine, vacuum cleaner, or hair dryer.[2] A difference of 10 dB between A and C weighting represents a significant amount of low-frequency sound by World Health Organization standards.[3]

The noise produced by wind turbines has a thumping, pulsing character, especially at night, when it is more audible. The noise is louder at night because of the contrast between the still, cool air at ground level and the steady stream of wind at the level of the turbine hubs.[4] This nighttime noise travels a long distance. It has been documented to be disturbing to residents 1.2 miles away from wind turbines in regular rolling terrain,[5] and 1.5 miles away in Appalachian valleys.[6]

At night, the WHO recommends, the level of continuous noise at the outside a dwelling should be 45 dB or less, and inside, 30 dB or less. These thresholds should be even lower if there is a significant low-frequency component to the sound, they add – as there is for wind turbines. Higher levels of noise disturb sleep and produce a host of effects on health, well-being, and productivity.[7]

The decibel is logarithmic. Increasing the dB level by 10 multiplies the sound pressure level by 10. Increasing the dB level by 20 multiplies the sound pressure level by 100 (and 30 dB multiplies by 1000, etc.). Thus the 65 dB measured day and night half a mile from the Meyersdale wind farm has a measured intensity 100 times greater than the loudest continuous outdoor nighttime noise (45 dB) recommended by the WHO.

Typical ordinances proposed or passed for NY State communities considering industrial wind turbines allow A-weighted noise levels of 50 dB and construction of turbines only 1000 ft. from dwellings. These ordinances meet neither WHO nor NYS DEC standards, especially compared to the very low ambient noise levels (with dB levels typically in the 20's) in rural NY.[8]

The health effects of excessive community noise are carefully documented in the WHO report with reference to scientific and medical literature. Effects relevant to wind turbines, in terms of dB levels and noise type, are paraphrased and summarized from this report:

- For people to understand each other easily when talking, environmental noise levels should be 35 dB or less. For vulnerable groups (hearing impaired, elderly, children in the process of reading and language acquisition, and foreign language speakers) even lower background levels are needed. When noise interferes with speech comprehension, problems with concentration, fatigue, uncertainty and lack of

[1] Soysal, OA. 2005. Acoustic Noise Generated by Wind Turbines. Presented to the Lycoming County, PA Zoning Board 12/14/05. osoysal@frostburg.edu

[2] www.ihh.org/noise/decibel.htm

[3] World Health Organization, 1999. *Guidelines for Community Noise*. Ed. by Berglund B et al. Available at www.who.int/docstore/peh/noise/guidelines2.html

[4] van den Berg, FGP. 2005. "The beat is getting stronger: The effect of atmospheric stability on low frequency modulated sound of wind turbines." *Journal of Low Frequency Noise, Vibration, and Active Control*, 24(1):1-24.

[5] van den Berg, FGP. 2003. "Effects of the wind profile at night on wind turbine sound." *Journal of Sound and Vibration* 277:955-970.

[6] Linda Cooper, Citizens for Responsible Windpower, "Activist Shares Wind Power Concerns," *The Pendleton Times*, March 3, 2005, p. 4.

[7] WHO, 1999. *Guidelines for Community Noise*.

[8] NYS DEC, 2001. *Assessing and Mitigating Noise Impacts*.

self-confidence, irritation, misunderstandings, decreased work capacity, problems in human relations, and a number of stress reactions arise.[9]

- Wind turbine noise, as described above and experienced by many turbine neighbors, is easily within the decibel levels to disturb sleep. Effects of noise-induced sleep disturbance include fatigue, depressed mood or well-being, decreased performance, and increased use of sedatives or sleeping pills. Measured physiologic effects of noise during sleep are increased blood pressure and heart rate, changes in breathing pattern, and cardiac arrhythmias.[10] Certain types of nighttime noise are especially bothersome, the authors note, including those which combine noise with vibration, those with low-frequency components, and sources in environments with low background noise.[11] All three of these special considerations apply to industrial wind turbines in rural NY State. Children, the elderly, and people with preexisting illnesses, especially depression, are especially vulnerable to sleep disturbance.

- Noise has an adverse effect on performance over and above its effects on speech comprehension. The most strongly affected cognitive areas are reading, attention, problem solving, and memory. Children in school are adversely affected by noise, and it is the uncontrollability of noise, rather than its intensity, which is most critical. The effort to tune out the noise comes at the price of increased levels of stress hormones and elevation of resting blood pressure. The adverse effects are larger in children with lower school achievement.[12]

- What is commonly referred to as noise "annoyance" is in fact a range of negative emotions, documented in people exposed to community noise, including anger, disappointment, dissatisfaction, *withdrawal, helplessness, depression, anxiety, distraction, agitation, and exhaustion.*[13] Numerous reports from neighbors of new industrial wind turbine installations document these symptoms. The percentage of highly annoyed people in a population starts to increase at 42 dB, and the percentage of moderately annoyed at 37 dB.[14]

Low-frequency sound is also sensed as pressure in the ears. It modulates the loudness of regular audible frequencies, and is sensed as a feeling or vibration in the chest and throat.[15] Neighbors of industrial wind turbines describe the distressing sensation of having to breathe in sync with the rhythmic thumps of the turbine blades, especially at night when trying to sleep.

The participants in noise studies are selected from the general population and are usually adults. Vulnerable groups of people are underrepresented. Vulnerable groups include people with decreased personal abilities (old, ill, or depressed people), people with particular diseases or medical problems, people (children) dealing with complex cognitive tasks such as reading acquisition, people who are blind or hearing impaired, fetuses, babies and young children, and the elderly. These people may be less able to cope with the impacts of noise exposure and at greater risk for harmful effects than is documented in studies. Attention needs to be paid to them when developing regulations and setback requirements for industrial wind turbines and other sources of annoying and debilitating noise.

Wind turbines also create moving visual disturbances, especially early and late in the day when the long shadows of moving blades sweep rhythmically over the landscape. That portion of the population which is susceptible to vertigo, unsteadiness, or motion sickness (including many children and a large proportion of the elderly) will be vulnerable to unsteadiness and nausea when subjected to this visual disturbance. People with seizure disorders are susceptible to triggering of seizures by the strobe effect of seeing the sun through the moving blades.

To protect the public health, it is critical that industrial wind turbines not be placed within a minimum of 1.5 miles of human dwellings (homes, hospitals, residential schools, nursing homes, prisons, etc.) or schools. In mountainous terrain the setback should be greater, especially in topography with long parallel ridges and valleys as in the Appalachians.

---

[9] WHO. 1999. *Guidelines for Community Noise*. pp. 42-44.
[10] Ibid. p. 44.
[11] Ibid. p. 46
[12] Ibid. pp. 49-50
[13] Ibid. p. 50
[14] Ibid. p. 51
[15] Moller, H. and CS Pedersen. 2004. Hearing at low and infrasonic frequencies. *Noise & Health* 6 (23):37-57.

Mr. Joe Hughes
6320 State Route 540
Bellefontaine, OH 43311-9519

NINA PIERPONT M.D. PH.D.

Letter from Dr. Pierpont to Kim Iles
Chatham, Ontario
re. Wind Turbine Syndrome

February 16, 2008

Dear Ms. Iles,

Yes, there are indeed medical problems caused by noise and vibration from current, upwind, three-bladed industrial wind turbines. I am in the process of preparing a paper for publication in a medical journal documenting the consistency of these problems from family to family, the study subjects being a collection of families in several countries who have been driven from their homes by problems with sleep, headaches, tinnitus, equilibrium, concentration, memory, learning, mood, and child behavior—problems which started when the turbines went into operation and which resolve when the family is away from the turbines. These problems all occur in proximity to recently built industrial turbines, put into operation in 2005, 2006, and 2007.

The ear is indeed the most sensitive receptor for noise and vibration. This does not mean, however, that if you cannot hear it, it cannot hurt you. The ear does more than hear. A number of the effects of noise and vibration from wind turbines appear to be mediated by the inner ear, which is a complex organ, only one of whose functions is detecting certain sorts of vibration as noise. The inner ear also detects movement, acceleration, and position relative to gravity. Inner ear (vestibular) signals ramify throughout the central nervous system, influencing brain functions related to sleep, vision, hearing, movement, digestion, thinking, and learning and memory. My data indicate that one of the principal effects in Wind Turbine Syndrome is vestibular detection of either airborne pressure waves or solid-borne vibration (via bone conduction), which is influencing the vestibular system as if the body or head were moving, when it's not.

People disturbed by noise and vibration from industrial wind turbines generally can hear the

19 Clay Street
Malone, New York 12953

(518) 483-6481
Fax: (518) 483-6481

pierpont@westelcom.com
www.ninapierpont.com

noise when it bothers them, though it may not seem particularly loud. Several people I have interviewed speak favorably of living next to an elevated urban train line, compared to living at their rural home next to wind turbines. They can sleep with traffic or train noise, but not with the wind turbine noise/vibration. They consistently described a penetrating and intrusive quality to the wind turbine noise, several describing in different ways a very disturbing feeling that the noise is somehow inside their bodies. This latter effect suggests detection of vibration in body cavities, especially since people who say this generally localize the feeling to their chest or their head.

Published research from Sweden (doctoral thesis by Pedersen and published papers incorporated into the thesis) shows that the percentage of annoyed people (which include people who move out or undertake major house renovations to try to do something about the noise) goes up at 37.5–40 dBA.[1] This is probably because A-weighted noise representations are not capturing the parts of the wind turbine noise and vibration spectrum which are disturbing. The Pedersen studies are also based on modeled noise, not actual measurements, though there is a close correlation between actual dBA measurements and the Swedish governmental modeling protocols, the author says. Even if we do not know exactly what parts of the noise and vibration spectrum are bothersome, and to what extent these are represented in a dBA measurement, we have in the Pedersen research clear evidence that when noise is modeled prior to wind turbine construction, the allowed levels of noise should not exceed 37.5 to 40 dBA outside of dwellings. Because the noise level is especially important at night, and it is at night that there tends to be a "stable atmosphere," with cool, still air at ground level and a brisk wind at turbine hub height, modeling of noise prior to wind turbine construction should use both a 37.5 to 40 dBA ceiling of tolerability, and van den Berg's models of noise propagation in a stable atmosphere.[2]

Based on my 3½ years of researching Wind Turbine Syndrome (WTS), including interviews with scores of people around the world who clearly suffer from WTS, it is my strong clinical recommendation (in line with the *French National Academy of Medicine*) that industrial wind turbines be sited a minimum of 1½ miles away from homes, schools, hospitals, places of business, and anywhere else people regularly congregate.

Sincerely,

Nina Pierpont

Nina Pierpont, MD, PhD

---

[1] Eja Pedersen, "Human response to wind turbine noise: Perception, annoyance and moderating factors," PhD. Dissertation, Occupational & Environmental Medicine, Department of Public Health and Community Medicine, Institute of Medicine, The Sahlgrenska Academy, Goteborg University, 2007, 86 pp.

[2] G.P. van den Berg, "Effects of the wind profile at night on wind turbine sound," *Journal of Sound and Vibration* 277 (2004):955-970.

Published: February 15, 2008 11:31 am

Mr. Joe Hughes
6320 State Route 540
Bellefontaine, OH 43311-9519

Wind turbines impact health, quality of life

To the Editor:

There have been a number of recent articles and letters to the editor concerning the construction of industrial wind turbines on western Maryland mountain ridges. However, very few have addressed the impact on health and quality of life of people living with wind turbines, in other words, how close is too close?

People living near wind turbines in Meyersdale, Pa., as well as near the Mountaineer Wind Energy Center, W.Va., have reported a number of health and quality of life issues stemming from living near industrial wind turbines. Complaints fall into 1 of 2 categories: 1) different sounds produced by the rotation of turbine blades and nacelle to which the blades are attached, and 2) the "sun or shadow flicker" caused by the sun shining behind the rotating blades.

Sounds produced by turbines are present all the time, 24 hours a day, 7 days a week, and cover a spectrum of frequencies, particularly infrasound and low frequency noise below 500 Hz. Audible sounds include rhythmic "thumping" or continual "droning" and a "screeching" or "banging." The noise from the turbines at Mountaineer has been described as "incredible," sounding like helicopters accompanied by a low frequency hum. One resident near the Meyersdale wind facility reported sounds coming from nearby turbines that affected sound sleep.

Dr. Oguz A. Soysal, Frostburg State University, measured sound levels over half a mile away from the Meyersdale 20-turbine wind facility. Typical audible decibel levels were in the 50-60 range, and audible plus low-frequency decibels were in the 65-70 range. Low-frequency sounds can actually be *felt by particular people rather than being heard, manifesting itself as a low-frequency vibration* that is more a sensation than a noise.

Sounds can also vary with the time of day and year, atmospheric conditions, wind direction and velocity, lay of the land, as well as size of the wind facility. Residents in Appalachian valleys have reported disturbing noise levels from turbines 1.5 miles away, while others reported noise pollution up to three to five miles away. Noise is especially noticeable in quiet rural areas, where a 10-decibel increase over ambient levels represents a subjective doubling of noise levels.

Noise levels sufficient to prevent or interrupt sleep have been reported in homes near wind turbines *throughout the world. In Denmark, where wind turbines were introduced 30 years ago, there has* been increased public opposition to onshore turbines near homes because of the noise hazard.

Health problems include sleep deprivation; headaches; dizziness, unsteadiness, and nausea; exhaustion, anxiety, anger, irritability, and depression; problems with concentration and learning; and *ringing in the ears.*

Another problem mentioned by residents living near turbines is the "sun or shadow flicker" caused by the sun shining behind the rotating turbine blades. This situation can occur at different times of the day and year depending on orientation of the sun, turbine, and home and is comparable to *turning lights on and off, on and off, in a room. This visual pollution can range from merely* annoying to some people getting dizzy, losing their balance, or even becoming nauseated. People *who suffer from migraines or who are epileptic often have their condition made worst by this strobe* effect.

In summary, there is high potential for noise and visual effects adversely affecting the health and quality of life of residents near wind turbines. To prevent this occurrence, realistic setbacks need to be established by health and government agencies for wind turbines near homes.

The French Academy of Medicine and the UK (United Kingdom) Noise Association recommend a 1.24-mile setback between industrial wind turbines and private residences. In Manitoba, Canada, the recommended setback is 1.24 miles from adjacent property lines. Recommendations made for the Appalachian highlands are for wind turbines not to be built within 1.5 mile of homes.

There may still be health and quality of life problems caused by wind turbines beyond this radius, even 1.5 to 3 miles away. These people should be compensated for any infringement on their human rights attributed to industrial wind turbines affecting "life, liberty, and the pursuit of happiness." For further information and resources on this important topic, readers can Google "living near wind turbines" on the World Wide Web.

John E. Gates
Frostburg

Mr. Joe Hughes
6320 State Route 540
Bellefontaine, OH 43311-9519

Testimony of Wendy Todd to Maine legislature, April 30, 2007

My name is Wendy Todd. I am from Aroostook County. I am a resident of Mars Hill and live approximately 2600 feet from the Mars Hill Wind Project. I am here today to offer testimony that residents around the project are suffering. There are 18 families that I know of that are negatively impacted on a regular basis from the noise, strobe effect and shadow flicker from the turbines. Most of these 18 families live less than 3000 feet from the turbines. There is no one that I know of from 425 East Ridge Road to 212 Mountain Road that does not agree that there are issues with noise. Issues that are changing the way residents view life around the mountain. We have formed a group called the Mountain Landowners Association in an attempt to share information and come up to speed on the issues of living this close to turbines of this size and generation. We have had to struggle through massive amounts of documentation from the Internet and from other towns dealing with same issues.

We have tried and I believe have succeeded in finding the answers to many of our questions but it has all been from our own efforts. We have received very little help from our town or the company that sited the windmills. Nick Archer with the Maine Department of Environmental Protection has been a helpful resource, but I believe even he would say that the State has a ways to go to educate itself on the pros and cons of wind turbines and how to best site a project. It would be a recommendation from our group for the State to look to California and other states in the nation that have been dealing with these issues for years, as well as other countries who have gleaned a great deal of information from years of studies, to help form guidelines to protect not only the land but the residents that live nearby proposed projects. We should learn from those who have gone before us. We shouldn't have to reinvent the wheel.

Let me make it very clear that no one in our group is opposed to wind turbines. We are for alternative, renewable forms of energy. Some from our group supported this project from the beginning. Some hated the project from the beginning and still do. Some were on the fence, but because of the points of renewable energy, landowner rights and proposed benefits for our town, county and state were swayed to sacrifice precious views of Mars Hill Mountain and our quiet with the disruption of the construction phase of the project. Nobody really knew or realized what was about to happen and how it would change our lives.

My husband and I moved to Southern Maine after we were married. We left for the adventure and for good paying jobs. We lived in Portland for 2 years then purchased our first home in Buxton, Maine. That house sat about 40 feet from the edge of Route 22 (a major route leading to/from Portland) and was directly in the path of the approach to and from Portland International Jetport. The noise at that little house could reach unbelievable levels, but somehow we learned to deal with them. After 10 years of planning and saving we moved back home to Mars Hill where I was born and raised. The desire was to get away from the craziness of the corporate world, the noise that surrounded us and to seek solitude and a place to raise our children.

My family has owned land on Mars Hill Mountain for almost 100 years. My father and grandfather were potato farmers. I learned from a very young age to have a close connection with the land from my parents. They allowed us to carve out a small lot in the center of the family farm and we began the process of building our dream home. Part of that process was to ask questions about the proposed wind farm. We learned early on that the town residences would not have an opportunity to vote on this $55 million dollar project. I attended the Evergreen / UPC TIF meeting in Mars Hill, in November of 2004. At the meeting the question of noise was posed. The answers are documented. Basically the noise was described as silent, nearly silent and you would have to be 500 feet or less from the site to hear it. Printed documents and the UPC, Evergreen Web site stated that, "You will not be able to hear any noise at all at the bottom of the mountain." The morning after the TIF meeting I was at the town office and got to speak directly with Peter Gish from UPC. I told him where my parents lived and described where we hoped to build and asked whether noise would be an issue. He said, "You won't hear anything from these things." Our town manager confirmed that this was true because he had visited a site in Canada and heard very little noise being emitted from the site.

Perrin and I on a visit to PEI took a drive to the north shore to stand under the turbines there and found them not to be intrusive. We felt we had enough proof on the issue of noise that we went ahead and built our home. We figured that if we could deal with the aesthetics and the construction phase that we would be fine. If we had known then what we know now or if we had been made aware of the noise section of the permit with the sound analysis from RSE, we would never have built where we did. The report from RSE clearly stated that some residences would experience noise levels at or above DEP level limits. My parents own over 200 acres of land, many of which are much farther away from the turbines.

Clear cutting began in the fall of 2005. I believe the figure is 150 acres of land that was cleared. Heavy equipment started the process of developing roads and in April of 2006 blasting started. We watched with heavy hearts as the North end peak was literally blown away. No one ever notified us of the blasting, but our houses shook, silverware and dishes rattled, and sheet rock dust fell as it took place. Soon the huge trucks arrived with the components of the wind turbines. Traffic was interrupted which made daily comings and goings difficult. The cranes arrived and the towers began to rise. People came from all over to watch. Cars stopped in the middle of the road to view the spectacle. People repeatedly left their vehicles to take pictures with not even a

(over)

Mr. Joe Hughes
6320 State Route 540
Bellefontaine, OH 43311-9519

WHAT HAVE I DONE?

Now each morning when I awake, I pray and then ask myself, "What have I done?"

I am involved with the BlueSky/GreenField wind turbine project in N.E. Fond du Lac County. I am also a successful farmer who cherishes his land. My father taught me how to farm, to be a steward of my fields, and by doing so, produce far better crop production. As I view this year's crops, my eyes feast on a most bountiful supply of corn and soybeans. And then my eyes focus again on the trenches and road scars leading to the turbine foundations. **What have I done?**

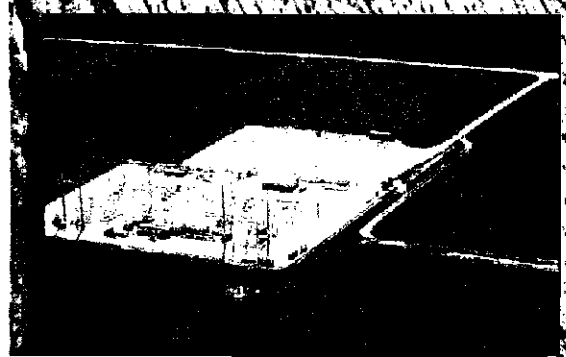
In 2003, the wind energy company made their first contacts with us. A $2000 "incentive" started the process of winning us over, a few of us at a time. *The city* salesman would throw out their nets, like fishermen trawling for fish. Their incentive "gift" lured some of us in at first. Then the salesmen would leave and let us talk with other farmers. When the corporate salesmen returned, there would be more of us ready to sign up; farmers had heard about the money to be made. Perhaps because we were successful farmers, we were the leaders and their best salesman. What have I done?

Sometime in 2004 or 2005, we signed $4000.00 turbine contracts allowing them to "lease" our land for their needs. Our leases favored the company, but what did we know back then? Nobody knew what we were doing. Nobody realized all the changes that would occur over which we would have no control. How often my friends and I have made that statement! What have I done?

I watched stakes being driven in the fields and men using GPS monitors to place markers here and there. When the cats and graders started tearing 22 foot wide roads into my fields, the physical changes started to impact not only me and my family, but unfortunately, my dear friends and neighbors. Later, a 4 foot deep by 2 foot wide trench started diagonally across my field. *A field already divided by their road was now being divided again by the cables running to a substation. It was now making one large field into* 4 smaller, irregularly shaped plots. Other turbine hosts also complained about their fields being subdivided or multi cable trenches raquiring more land. Roads were cut in using anywhere from 1000 feet to over a 1/2 mile of land to connect necessary locations. We soon realized that the company places roads and trenches where they will benefit the company most, not the land owner. One neighbor's access road is right next to some of his out buildings. Another right next to his fence line. What have I done?

At a wind company dinner presented for the farmers hosting the turbines, we were repeatedly told - - nicely and indirectly - - to stay away from the company work sites once they start. I watch as my friends faces showed the same concern as I had, but none of us spoke out. Months later, when I approached a crew putting in lines where they promised me they would definitely would not go, a representative told me I could not be here. He insisted that I leave. The line went in. The company had the right. I had signed the lease. What have I done?

Grumbling started almost immediately after we agreed to a 2% yearly increase on our 30 year lease contracts. Some felt we should have held out for 10%. What farmer would lock in the price of corn over the next 5 years, yet alone lock one in at 2% yearly for 30 years? Then rumors leaked that other farmers had received higher yearly rates, so now contracts varied. The fast talking city sales folk had successfully delivered their plan. Without regard for our land, we were allowing them to come in and spoil it. All of the rocks we labored so hard to pick in our youth were replaced in a few hours by miles of roads packed hard with 10 inches of large breaker rock. Costly tiling we installed to improve drainage has now been cut into pieces by company trenching machines. What have I done?



Each night, a security team rides down our roads checking the foundation sites. They are checking for vandals and thieves. Once, when I had ventured with guests to show them foundation work, security stopped us and asked me, standing on my own property, what I was doing there. What have I done?

Now, at social functions, we can clearly see the huge division this has created among community members. Suddenly, there are strong-sided discussions and heated words between friends and, yes, between relatives about wind turbines. Perhaps this is of greater consequence than the harm caused to my land! Life is short and my friendships precious. What have I done?

I tried, as did some of the other farmers, to get out of our contracts, but we had signed a binding contract and a contract is a contract. If you are considering placing wind turbines on your property, I strongly recommend that you please reconsider. Study the issues. Think of the all the harm versus benefits to your land and, in the future, to your children's land by allowing companies to lease your land for turbines.

WHAT HAVE I DONE?

PLEASE DO NOT DO WHAT I HAVE DONE!

Mr. Joe Hughes
6320 State Route 540
Bellefontaine, OH 43311-9519

Problems associated with wind turbines

Artin Monfils, February 1, 2000

[This letter was written by Mr. Monfils, Lincoln Town Board Chairman, about living near wind turbines in Kewaunee County, Wisconsin. He wrote it hoping that it will help other communities facing wind power plant proposals.]

To Whom It May Concern:

One lesson learned from our experience with the process of the request for locating wind turbines in the Town of Lincoln in Kewaunee County, was never to assume that what the Utilities or their private supporters tell you about the project is accurate. They put out information, which was beneficial to them and the project and downright wrong.

When dealing with the utilities or private companies, try to deal with one or two persons in charge. This avoids having to repeat your concerns and helps to avoid problems about who said what and who promised this or that about your concerns about the project. Get their promises in writing with guarantees about what they are promising. If their promises are not met, written penalties of appropriate, but substantial size must be provided and enforced. Written conditions and penalties are mandatory if you plan to accept the wind farm project.

Problems that are of strong concern, and problems that we had warned the utilities about but were assured that they would not occur are as follows: interference with T V reception, Microwave reception interference, depreciating property values, flashing red lights (FAA) interfering with nearby homes, wind turbine NOISE which interferes with neighbors sleep and their mental health, increased traffic, road damage, cattle being scared from rotating shadows cascading from the blades in a setting sun, rotating shadows in nearby homes, concerns about stray voltage, concerns about increased lightening strikes, environmental damage to birds, etc. etc. etc. But the proponents for wind energy will dismiss all of these concerns and tell you that they will not occur. THEY ARE WRONG. Ask the neighbors who are not property owners reimbursed by the utilities through lease agreements on their property or people who want to lease in the future. They will verify these problems.

If a town has zoning, establish written conditions with penalties to ensure that the utilities and companies follow the regulations of the local town zoning. Also, look into the establishment of a moratorium on the project so more time can be used to collect or research information about the concerns voiced in areas like Kewaunee County. These concerns are about the public health and safety of our residents and this grand idea of "sticking" these huge towers in near by residents is not a proven success story. It's a trial by ERROR! Only time will tell what the effects of this "EXPERIMENT" will be. This is especially true with the issues of noise, its effect on the neighbors, their mental health related to the noise and its disturbance, the effect of stray voltage on the nearby cattle, as well as other safety issues. Other concerns like the distractions of drivers from the rotating blades, increased lightening strikes in the areas of the towers (not to the towers directly because they are grounded), and other public health and safety issues need to be analyzed on into the future.

Once again, let me stress the importance of taking your time and asking the questions and researching the answers. Forget about deadlines, don't be intimidated by the attorneys of the utilities, their deadlines are their problem and don't make them yours. Once the turbines are up and operating the wind turbine noise will be there. It will not be constant and it may not be above the decibel level that they establish as a maximum, but it will be irritating, at any time of day or night and will vary in its intensity with the wind direction and speed. It violates the very basis of what a zoning ordinance is meant to protect - the welfare of the people who already live in that community. The responsibility of your zoning board and your town board is to protect the residents of your community. Further, these elected or appointed people are supposed to represent the will of the people. You the electorate must demand no less than that, and the town board and the zoning board must vote accordingly.

Sincerely,

Artin Monfils
Chairperson, Lincoln Town
Kewaunee County, Wisconsin

Mr. Joe Hughes
6320 State Route 540
Bellefontaine, OH 43311-9519

Appendix A

Town of Chilton Measurement Protocol for Sound and Vibration Assessment of Proposed and Existing Wind Energy Systems

---

Introduction

The potential sound and vibration impact associated with the operation of wind powered electric generators is often a primary concern for citizens living near proposed wind energy systems (WES(s)). This is especially true of projects located near homes, residential neighborhoods, businesses, schools, and hospitals. Determining the likely sound and vibration impacts is a highly technical undertaking and requires a serious effort in order to collect reliable and meaningful data for both the public and decision makers.

This protocol is based in part on criteria published in the Standard Guide for Selection of Environmental Noise Measurements and Criteria.[1] and the Public Service Commission of Wisconsin publication Measurement Protocol for Sound and Vibration Assessment of Proposed and Existing Electric Power Plants (February 2002).[2] It also includes by reference the procedures of American National Standards S12.9 - Quantities and Procedures for Description and Measurement of Environmental Sound, and S12.18 and S12.19, for the measurement of sound pressure level and impulse sound outdoors.

The purpose is to first, establish a consistent and scientifically sound procedure for evaluating existing background levels of audible sounds and Low Frequency Sound in a WES project area, and second to use the information provided by the Licensee in its Application showing the predicted over-all sound pressure levels in terms of dBA, dBC and dBZ (linear) over the frequency range from the Blade Passage Frequency through at least 10,000 HZ and the corresponding 1/1 or 1/3 Octave Band sound pressure levels for the same frequency range. These values shall be presented in graphic contours of the iso-levels and in tabular form at sufficient sites to permit comparison of the baseline results to the predicted levels. This comparison will use the level limits of VI. F. 4 and 5 to determine the likely impact that operation of a new wind energy system project will have on the existing environment. If the comparison demonstrates that the WES project will not exceed any of the level limits for over-all or 1/1 or 1/3 Octaves the project will be considered to be within allowable limits for safety and health. If the Licensee submits only partial information required for this comparison the burden to establish the operation as meeting safety and health limits will be on the Licensee.

Third, if the project is approved, this Appendix covers the study needed to compare the post-build sound levels to the predictions and the baseline study. The level limits in VI. F. 4 and 5 apply to the post-build study. In addition, if there have been any complaints about WES sound or low frequency noise emissions by any resident of an occupied dwelling that property will be included in the post-build study for evaluation against the rules of VI F..

The characteristics of the proposed WES project and the features of the surrounding environment

will influence the design of the sound and vibration study. Site layout, types of WES(s) selected and the existence of the significant local sound and low frequency noise sources and sensitive receptors should be taken into consideration when designing a sound and vibration study. It will be necessary to have a qualified independent consultant conduct the pre-construction background and post-construction sound (and vibration) studies

Instrumentation

All instruments and other tools used to measure audible sounds and low frequency noise shall meet the requirements for ANSI Type 1 performance and accuracy. Measurements shall be made with a manufacturer's approved wind screen protecting the microphone and only when winds are less than 10 mph at the microphone that has been designed to maintain the Type 1 accuracy requirements. The microphone shall be located at a height of 1.2 to 1.5 meters for all tests unless circumstances require a different measurement position. In that case the reasons shall be documented and include any adjustments needed to make the results correspond to the preferred measurement location.

Measurement of the Existing Sound and Vibration Environment

An assessment of the proposed WES project areas existing sound and vibration environment is necessary in order to predict the likely impact resulting from a proposed project. The following guidelines must be used in developing a reasonable estimate of an area's existing sound and vibration environment. All testing is to be performed by an independent acoustical testing engineer or other qualified noise consultant approved by the Town Board. The WES applicant may file objections detailing any concerns it may have with the Town Board's selection. These concerns will be addressed in the study. Objections must be filed prior to the start of the noise study. All measurements are to be conducted with industry certified testing equipment[4]. All test results must be reported to the Town Board.

Sites with No Existing Wind Energy Systems

Sound level measurements shall be taken as follows:

The results of the model showing the predicted worst case sound emissions of the proposed WES project will be overlaid on a map of the project area. A grid comprised of one (1) mile boundaries (each grid cell is one square mile) will be used to identify between five (5) to ten (10) measurement points. The grid shall extend to 2500 feet beyond the perimeter of the project boundary. The measurement points will be selected to represent the noise sensitive receptor sites that will be most likely to be negatively affected by the WES project's sound emissions. These sites may include sites adjacent to occupied dwellings or other noise sensitive receptor sites and, if deemed appropriate by the Town of Chilton, the inside occupied structures. Sites shall be selected to represent the locations where the background soundscapes reflect the quietest locations of the sensitive receptor sites. Background sound levels and sound pressure levels shall be obtained according to the definition provided in the WIND ENERGY SYSTEMS LICENSING ORDINANCE definitions and generally recognized acoustical testing practice and standards.

All properties within the proposed WES project boundaries will be considered for this study.[5]

One test shall be conducted during period defined by the months of April through November with the preferred time being the months of June through August. Unless directed otherwise by the Town of Chilton the season chosen for testing will represent the background soundscape for other seasons. At the discretion of the Town of Chilton, tests may be scheduled for other seasons.

All measurement points (MPs) shall be located in consultation with the Town staff and property owner(s) and such that no significant obstruction (building, trees, etc.) blocks sound and vibration from the nearest proposed WES site.

Duration of measurements shall be a minimum of ten continuous minutes for each criterion at each location. The duration must include at least 6 minutes that are not affected by transient sounds from non-nature sources. Longer durations such as 30 minutes or one (1) hour are preferred to improve the reliability of the L_{90} values.

The tests at each site selected for this study shall be taken during the expected 'quietest period of the day or night' as appropriate for the site. For the purpose of determining background sound characteristics the preferred testing time is from 8pm until 4 am. If circumstances indicated that a different time of the day should be sampled the test may be conducted at the alternate time if approved by the Town of Chilton.

Sound level measurements must be made on a weekday of a non-holiday week.

Measurements must be taken at 1.2 to 1.5 meters above the ground and at least 15 feet from any reflective surface[3].

For each Measurement Point and for each measurement period, provide each of the following measurements:

1. Un-weighted octave-band analysis (from Blade Passage Frequency up to 16, 31.5, 63, 125, 250, 500, 1K, 2K,4K, and 8K Hz and over-all linear or dBZ level)
    a. L_{Aeq}, L_{10}, L_{50}, and L_{90}, in dBA
    b. L_{Ceq}, L_{10}, L_{50}, and L_{90}, in dBC
    c. L_{Zeq}, L_{10}, L_{50}, and L_{90}, in dBLinear (sometimes referred to as 'Z' weighting)

2. A narrative description of any intermittent sounds registered during each measurement.

3. A narrative description of the steady sounds that form the background soundscape.

4. Wind speed and direction at the Measurement point, humidity and temperature at time of measurement will be included in the documentation,

Measurements taken when wind speeds exceed 5 mph at the microphone location will not be considered valid for this study. A windscreen of the type recommended by the monitoring

instrument's manufacturer meeting Type 1 standards must be used for all data collection.

Provide a map and/or diagram clearly showing:

1. The layout of the project area, including topography, the project boundary lines[5], and property lines

2. The locations of the Measurement Points.

3. The minimum and maximum distance between any Measurement Points

4. The location of significant local sound and vibration sources

5. The distance between all MPs and significant local sound vibration and sources

6. The location of all sensitive receptors including but not limited to: schools, day-care centers, hospitals, residences, residential neighborhoods, places of worship, and elderly care facilities.

Sites with Existing Wind Energy Systems

Two complete sets of sound level measurements must be taken as defined below:

1. One set of measurements with the wind generator(s) off unless the Town of Chilton elects to substitute the sound data collected for the background sound study as permitted in Section VI. F. 2 of the License.

2. One set of measurements with the wind generator(s) running with wind speed at hub height sufficient to meet nominal power output or higher. Conditions should reflect the worst case sound emissions from the WES project.

Sound level measurements shall be taken as follows:

1. At all properties within the proposed WES project boundaries that were selected for the background sound study. Additional points may be added at the discretion of the Town of Chilton. [5]

2. One test shall be conducted during period defined by the months of April through November with the preferred time being the months of June through August. Unless directed otherwise by the Town of Chilton the season chosen for testing will represent the background soundscape for other seasons. At the discretion of the Town of Chilton, tests may be scheduled for other seasons.

3. All measurement points (MPs) shall be located in consultation with the Town of Chilton and property owner(s) and such that no significant obstruction (building, trees, etc.)

blocks sound and vibration from the nearest proposed WES site.

4. Duration of measurements shall be a minimum of ten continuous minutes for each criterion at each location. The duration must include at least 6 minutes that are not affected by transient sounds from non-nature sources. Longer durations such as 30 minutes or one (1) are preferred to improve the reliability of the L_{90} values.

5. The tests at each site selected for this study shall be taken during the expected worst-case WES sound emissions as appropriate for the site. For the purpose of determining sound characteristics when WES are operating, the preferred testing time is from 8pm until 4 am. If circumstances indicated that a different time of the day should be sampled the test may be conducted at the alternate time if approved by the Town of Chilton.

6. Sound level measurements must be made on a weekday of a non-holiday week.

7. Measurements must be taken at 1.2 to 1.5 meters above the ground and at least 15 feet from any reflective surface[3].

For each Measurement Point and for each measurement period, provide each of the following measurements:

1. Un-weighted octave-band analysis (from Blade Passage Frequency up to 16, 31.5, 63, 125, 250, 500, 1K, 2K,4K, and 8K Hz and over-all linear or dBZ level)
    a. L_{Aeq}, L_{10}, L_{50}, and L_{90}, in dBA
    b. L_{Ceq}, L_{10}, L_{50}, and L_{90}, in dBC
    c. L_{Zeq}, L_{10}, L_{50}, and L_{90}, in dBLinear (sometimes referred to as 'Z' weighting)

2. A narrative description of any intermittent sounds registered during each measurement.

3. A narrative description of the steady sounds that form the ambient with WES operating soundscape.

4. Wind speed and direction at the Measurement point, humidity and temperature at time of measurement will be included in the documentation,

Measurements taken when wind speeds exceed 10 mph at the microphone location will not be considered valid for this study. A windscreen of the type recommended by the monitoring instrument's manufacturer meeting Type 1 standards must be used for all data collection. If measurements must be conducted with wind speeds in excess of 10 mph at the microphone to meet the worst-case requirement for WES sound emission, the method used to isolate the microphone from the effects of wind and turbulence must be approved by the Town of Chilton and meet procedures generally recognized as appropriate by acoustical standards for measurement under those conditions.

Provide a map and/or diagram clearly showing:

1. The layout of the project area, including topography, the project boundary lines[5], and property lines

2. The locations of the Measurement Points.

3. The minimum and maximum distance between any Measurement Points

4. The location of significant local sound and vibration sources

5. The distance between all MPs and significant local sound vibration and sources

6. The location of all sensitive receptors including but not limited to: schools, day-care centers, hospitals, residences, residential neighborhoods, places of worship, and elderly care facilities.

Sound level Estimate for Proposed Wind Energy Systems

In order to estimate the sound and vibration impact of the proposed WES project on the existing environment an estimate of the sound and vibration produced by the proposed WES(s) under worst-case conditions for producing sound emissions must be provided. This study may be conducted by a firm chosen by the WES operator with oversight provided by the Town Board. The qualifications of the firm should be presented along with details of the procedure that will be used, software applications, and any limitations to the software or prediction methods.

Provide the manufacturer's sound power level (L_w) characteristics for the proposed WES(s) operating at full load for Blade Passage Frequency up to 16, 31.5, 63, 125, 250, 500, 1K, 2K,4K, and 8K Hz and over-all linear or dBZ level. Include an unweighted octave-band from Blade Passage Frequency up to 16, 31.5, 63, 125, 250, 500, 1K, 2K,4K, and 8K Hz and over-all linear or dBZ level. Sound pressure levels predicted for the WES(s) at full operation and at maximum sound power output shall be provided for distances of 500, 1000, 1500, 2000, 2500 feet from the WES(s).

Estimate the sound levels for the proposed WES(s) in dBA, dBC and dBZ at distances of 500, 1000, 1500, 2000, 2500 feet from the WES(s). For projects with multiple WES(s), the combined sound level impact for all WES(s) operating at full load must be estimated.
The above two requirements should be presented in a table that includes the impact of the WES operations on all residential and other noise sensitive receiving locations within the project boundary. To the extent possible, the tables should include the sites tested in the background study.

Provide a contour map of the expected sound level from the new WES(s), using 5 dBA increments created by the proposed WES(s) extending out to a distance of 2500 feet from the project boundary.

Determine the impact of the proposed sound and vibration from the WES project on the existing environment. The results should anticipate the receptor sites that will be most negatively impacted by the WES project and to the extent possible provide data for each MP that are likely to be selected in the background sound study (note the sensitive receptor MPs):

1. Report expected changes to existing sound levels for L_{Aeq}, L_{10}, L_{50}, and L_{90}, in dBA
2. Report expected changes to existing sound levels for L_{Ceq}, L_{10}, L_{50}, and L_{90}, in dBC
3. Report expected changes to existing sound levels for L_{Zeq}, L_{10}, L_{50}, and L_{90}, in dBZ
4. Report the predicted sound pressure levels for each of the 1/1 or 1/3 octave bands included in the table of VI.F.5 of the License and those not included up to the 8000 Hz octave band.
5. Report all assumptions made in arriving at the estimate of impact, any limitations that might cause the sound levels to exceed the values of the estimate, and any conclusions reached regarding the potential effects on people living near the project area.
6. Include an estimate of the number of hours of operation expected from the proposed WES(s) and under what conditions the WES(s) would be expected to run. Any differences from the information filed with the Application should be addressed.

Post-Construction Measurements

Post Construction Measurements should be conducted by a qualified noise consultant selected by and under the direction of the Town. The requirements of this Appendix for Sites with Existing Wind Energy Systems shall apply

1. Within twelve months of the date when the project is fully operational, and within two weeks of the anniversary date of the Pre-construction ambient noise measurements, repeat the existing sound and vibration environment measurements taken before the project approval. Post-construction sound level measurements shall be taken both with all WES(s) running and with all WES(s) off except as provided in Section VI.F. 2 of the License.
2. Report post-construction measurements to the Town Board using the same format as used for the background sound (and vibration) study.

[1] Standard Guide for Selection of Environmental Noise Measurements and Criteria (Designation E 1686-96). July 1996. American Society for Testing and Measurements.

[2] Measurement Protocol for Sound and Vibration Assessment of Proposed and Existing Electric Power Plants. February 2002. Public Service Commission of Wisconsin.

[3] Environmental Noise Guidelines: Wind Farms. (ISBN 1 876562 43 9). February 2003. Environment Protection Authority, Adelaide SA.

[4] The Public Service Commission of Wisconsin Staff acknowledges that few sound level meters are capable of measurement of the 16 Hz center frequency octave band. However, because noise complaints from the public most likely involve low frequency noise associate with proposed WES [power plants], we encourage applicants to pursue the collection of this important ambient noise data. If obtaining the 16 Hz and lower data presents a problem contact PSCW Staff prior to collection of any field ambient measurement data.

[5] Project Boundary: A continuous line encompassing all WES(s) and related equipment associated with the WES project.

REFERENCES

- **ANSI S12.9-1988/Part 1 (R 2003)** American National Standard Quantities and Procedures for Description and Measurement of Environmental Sound, Part 1.
- **ANSI S12.9-1992/Part 2 (R 2003)** American National Standard Quantities and Procedures for Description and Measurement of Environmental Sound, Part 2: Measurement of Long-Term, Wide-Area Sound.
- **ANSI S12.9-1993/Part 3 (R 2003)** American National Standard Quantities and Procedures for Description and Measurement of Environmental Sound, Part 3: Short-Term Measurements with an Observer Present.
- **ANSI S12.9-2005/Part 4** American National Standard Quantities and Procedures for Description and Measurement of Environmental Sound, Part 4: Noise Assessment and Prediction of Long-Term Community Response.
- **ANSI S12.9-1998/Part 5 (R 2003)** American National Standard Quantities and Procedures for Description and Measurement of Environmental Sound, Part 5: Sound Level Descriptors for Determination of Compatible Land Use.
- **ANSI S12.9-2000/Part 6 (R 2005)** American National Standard Quantities and Procedures for Description and Measurement of Environmental Sound, Part 6: Methods for Estimation of Awakenings Associated with Aircraft Noise Events Heard in Homes.
- **ANSI S12.17-1996 (R 2006)** American National Standard Impulse Sound Propagation for Environmental Noise Assessment.
- **ANSI S12.18-1994 (R 2004)** American National Standard Procedures for Outdoor Measurement of Sound Pressure Level.

Mr. Joe Hughes
6320 State Route 540
Bellefontaine, OH 43311-9519

Town of Bethany Wind Turbine Study Committee Report

Ramon J. Cipriano, editor
January 8, 2007

Introduction

Although this report is the "final" report as necessitated by the urgency of the impending moratorium expiration in July, readers are reminded that due to the extremely fluid nature of the issue, the committee and in particular this editor will continue to provide new information to town officials as it becomes available in the form of addenda, newsletters, or whatever means required.

As seen below, the previous introduction is retained as a point of reference in time. In the roughly five months since it was written, the development pressure, itself a function of factors both local and international in scope, has continued to increase relentlessly. Middle East cognoscienti believe that Israel is now preparing to use both conventional and nuclear warheads to attempt to destroy Iran's blossoming nuclear capability. Such could easily ignite a conflagration of uncertain scope, since the United States and Russia back opposite sides, and both countries have enough warheads to retard civilization. Even without a doomsday scenario, or an attack on Iran by whomever, instability in the region could cause the price of oil to skyrocket with minimal provocation. At a more local level, the state of New York has committed itself to the development of alternative energy sources including wind. In a recent position paper distributed by County Planning Board Executive Jim Duval on Sept. 7, 2006 to town supervisors, the law firm of Thomson/West of Rochester spells out in no uncertain terms what is going to happen (New York Zoning Law and Practice Report, July/August 2006). They cite numerous instances in case law to show that wind turbine farms meet the three essential criteria required to have them enjoy the relaxed zoning laws applicable to public utilities. Translation: wind farms are coming to New York State regardless of the opposition of individual towns. Any town not recognizing this is in for a rude awakening.

In the opinion of this editor and most of the members of this committee, this extremely complicated issue can be boiled down to two main factors: money, and location. The wind development companies are interested primarily in making as much money as possible, not the welfare of the towns. The fraction of the revenue that they do release is going to be fought over by towns, school districts, and counties, and if a town isn't careful they could end up with so little that the project is not worth doing (specifically, less that $8,000/MW/turbine/year directly into the town coiffers, according to Eagle Town Supervisor Joseph Kushner....see PILOT section below). These are industrial machines and will have significant impact wherever they are sited for decades. Few people would object to siting them on the shores of Patagonia (where the wind is fearsome), whereas in a bedroom community such as Bethany the situation is different. If the setbacks are "adequate" to mitigate local concerns people do not object. The definition of "adequate" is key here. Some members of this committee have recommended a setback of one mile. The company approaching Bethany, UPC, would probably consider that to be cost prohibitive. One can show that increased line loss (power loss from the turbine to the grid) is not the major problem. Charles Pfaff, an electrical engineer and contractor who is not affiliated

with any wind development company, notes that such line losses are deliberately engineered to be less that about two percent, by appropriate choice of conductor size, insulation, and distribution voltage. Simple arithmetic shows that the revenue generated, compared to the revenue offered to towns or landowners, can easily absorb this two percent. Their main concern would likely be the initial cost of installation....and that could probably be absorbed by extending the term of operation by a year or so. On the other hand, a one mile setback is overly restrictive if ice throw is the determinant issue (see comments in that section).

Original Introduction (August, 2006)

As I write this in the early hours of August 2, 2006, the country is sweltering under a massive heat wave, and the world, particularly that part which produces most of the global oil supply, is in turmoil. Recently the Town of Bethany has been approached by a major wind developer, keenly interested in installing here a wind farm of truly industrial scale. Such a project could generate revenue for the town the likes of which it has never seen. Improperly executed, it could also have devastating effects on the pastoral quality of this rural area, and far more importantly, quite negative effects on the health and safety of our residents. As pointed out in our town's Comprehensive Plan, we the town residents are willing to encourage some responsible industrial development in this largely agricultural region, so long as the aforementioned negative effects do not ensue. The members of this truly democratic committee have a broad spectrum of opinions as to the advisability of this highly controversial proposal. Charged with finding out the facts, which are buried in a massive amount of information both pro and con, as is always the case when the situation is not simple (and this particular issue is extremely complicated), we have worked long and hard to ferret out those facts, and in this report will focus on them. Anecdotal information, misinformation, innuendo, and just plain falsehoods will be pointed out as necessary. We will concentrate as much as possible on that which can be substantiated with references to peer-reviewed articles in scientific, engineering, medical, and other relevant, reputable journals, and will include those references. We have worked long and hard on this, uncompensated, and have traveled many miles to see for ourselves what is going on. During the course of the past several months, some of our opinions have shifted, in either direction. This report will reflect the diverse nature of such and consequently will itself prove to be controversial. The relationship between wind and other forms of alternate energy, the word's energy sources, current focus on oil, and consequent threats to global security, are far beyond the scope of this report. We will point out that our mandate is to gather facts to determine the advisability of such a project in general, and not necessarily with respect to the particular company, UPC, which is now approaching us. The situation is fluid, dynamic, changing by the day, and this must be forefront in our thinking and recommendations.

Issues

ENVIRONMENTAL - HEALTH & SAFETY

- ### Hazards to aviation

This topic is still under investigation by the editor. Information solicited from the Federal Aviation Administration and the Department of Defense has so far not been made available. There are two main concerns: (1) possible collision hazards of approaching (landing) aircraft at major airports, especially in bad weather, and (2) possible interference with military aircraft operations. As for the first concern, we note that there are no major airports in Bethany, although there is at least one uncontrolled airstrip. As for the second, inhabitants of our town are aware of large military aircraft from the Niagara Falls Air Reserve Station occasionally passing low overhead (< 1000 feet AGL). One would assume they are aware of what is going on, and will not hesitate to contact UPC or any other development company if necessary (if they haven't already).

Note: there is the rare but still possible chance that a piece of ice, or turbine blade, could become detached while the turbine is spinning, and impact a low-flying aircraft. The maximum height such could possibly achieve, which could be significantly higher that the ground-to-blade-tip height, can be calculated using the same physical analysis discussed by the editor in the section on Ice Throw.

- ### Lightning protection and fire department equipment needs

Lightning occurs when the electrical potential between the ground and a storm cloud becomes great enough to exceed the breakdown potential of the air between ground and cloud. The mechanisms responsible for the charge separation, after decades of study, are still not well understood. Nonetheless the potential difference can exceed several million volts, and the current flow can reach over two hundred thousand amperes. The heat energy released in a large flash, if converted to mechanical energy, is adequate to lift a railroad freight car from the ground to the base of the cloud. The conducting path will follow that of least resistance, although the potential difference is so great that current will flow even in "non-conductors" such as fiberglass and wood turbine blades. The Joule heating is so great that unless conductors are built into the turbine blades, they will catch fire and/or explode, with obvious potential for fatal injury to anyone in or very near (5 or 10 meters) the tower. There is no way to prevent the turbine from being hit by lightning. The best one can do is provide a good and robust conducting path to ground. If a tower did catch fire, there would be no way to put it out save for very special equipment not normally available to most rural fire departments. Such departments could of course keep the fire from spreading, so if turbines are sited well away from residential structures, the latter would be safe.

- ## Stray voltage

The following report was submitted by Steve Breckenridge in September 2006 and is reproduced here unedited.

Stray Voltage - Apprehension ?

Apprehension over stray voltage has been expressed by committee members and other concerned members of the community.

Extraneous voltage appears on grounded surfaces in buildings, barns, and other structures. It is classified as a low frequency form of conductive electromagnetic interference.

In most buildings stray voltage is *not* a problem, because the levels are generally below the perception level of humans. Usually, there is *no* sensitive electronic equipment, which can be affected by it.

Concern in the agricultural field - However, in the 1970's, stray voltage became a concern in the agricultural field with dairy farmers. Cattle are ten times more sensitive to electricity and electronic interference than humans, as they are constantly standing in water or on moist areas of the barn.

Proper Installation/Grounding - if equipment is properly installed and properly grounded...evidence *does not* lead to wind projects as being a major source of stray voltage.
Unsubstantiated problems - Concerns in the Midwest with *stray voltage* on farms and their connection to wind farms are non-conclusive at this time. Supposed documentation, concerning herd and health and reproductive problems, is *unsubstantiated* at this time.

Conclusion - people should be concerned about *stray voltage*, however, if equipment is properly installed and maintained according to proper engineering standards, the wind turbines should not themselves dictate a major concern in the community.

- ## Earthquake - Fault line - seismic effects - hydrology

The following report was submitted by Geoffrey A. Briggs on August 26, 2006 and is reproduced here unedited.

Report summary, hydrology, seismology, conclusions
Attached are Fig. 1 - Map of Proposed Wind Turbine Project - Bethany (NY) obtained, with much difficulty, from C. Swartley, UPC Project Director.

Fig. 2, New York Faults (1989, 2002) provided by the geology department of the State University of New York at Buffalo, a map showing faults, fractures and the main traces of the Clarendon - Linden Fault System.

Fig. 3, Black Creek Watershed

Figure 1, the proposed wind turbine project map shows that close to one-quarter of the town of Bethany would be under the control of UPC leases. Of significance is the fact that these leased areas are in or surround the Black Creek drainage system. To date, the project developer (UPC) has provided no field-based studies on the effects of excavation for tower bases, roads, staging areas, buried or surface cables or subsequent removal of vegetation. Again, due to lack of information from UPC, it is necessary to interpolate within the wind turbine areas. Regardless of wind turbine density or distribution there is major potential for disruption of both surface and groundwater flow due to the proximity of project excavation to Black Creek. Aquifer recharge, perched water tables and wildlife would be severely affected, especially if a north-south configuration is utilized as this would effect a continuous, parallel disruption of flow to and from recharge areas.

Figure 2, the map of New York Faults shows that the areal extent of the wind turbine project proposed by UPC is directly on the main traces of the Clarendon-Linden in western New York. Historical seismic data shows that in the 1920's and 1930's major structural damage was recorded in Genesee and Wyoming counties, including the area proposed for the wind turbine project. Significant structural damage was observed in buildings and masonry from Attica to the hamlet of Little Canada, a damage trajectory which cuts directly through the proposed wind turbine project area.

Conclusions:

In my review of hydrological and seismological concerns regarding the proposed UPC wind energy project in the Town of Bethany (NY) I have presented data and factors, both current and historical. Surficial features in the town are a complex mix of fluvioglacial and ice contact features which yield a great variety of soil types and drainage patterns. From what I have seen - or been allowed to see by the project developer UPC, the developer has made, literally, a superficial review of existing geological information on the town. Major field investigation of the proposed project area is essential if seismic hazards and risks and hydrologic impacts are to be addressed.

Editor's comment: *It is certainly true that it has been difficult to obtain specific engineering or scientific information from UPC. Purportedly we were told this was because the project director for our area, Mr. Swartley, did not himself possess such knowledge. Eventually Mr. Swartley did organize a teleconference at which town officials were able to ask technical questions from a UPC engineer. At that conference it became obvious that the issue raised above by Mr. Briggs pertaining to possible seismic activity in the area proposed for turbine installation had not been adequately addressed by UPC. Mr. Briggs specifically attempted to get some quantitative assessment of the probability of tower failure in the event of a local earthquake, to no avail. It is apparent to the editor that such assessment would in any event be extremely difficult to get meaningfully in view of the many unknown variables. For example, if the frequency of the seismic activity happened to match the natural resonant frequency of the tower, the tower would likely collapse in spite of otherwise robust construction, as was observed to happen to the Tacoma Narrows Bridge in November of 1940.*

- **Storm water runoff - erosion - sedimentation**
- **Construction disruption - road upkeep & repair**
- **Security - vandalism - terrorism**
  To be addressed by the editor forthwith.
- **Noise - infrasonic (below 20 Hz)**
  To be addressed by the editor forthwith.
- **Shadow and flicker effects**

The following report was submitted by Loy Ellen Gross and is reproduced here unedited.

Shadow Flicker and Blade Glint

Flicker: Definition

Flicker (also called the Disco Effect of Strobe Effect) is caused when the rotating wind turbine blades cast moving shadows that cause a flickering effect, or when glossy blades reflect light in a moving pattern, causing a reverse flicker (also called Blade Glint).

Shadow flicker occurs under a combination of conditions at particular times of the day or year. It happens when the sun shines behind a turbine rotor. This can cause the shadow of the turbine blades to be cast onto roadways, buildings and other objects; which appears to flick the sun on and off as the turbine rotates. Reverse flicker occurs, likewise, under certain conditions. It happens when the sun reflects off turning rotor blades, reflecting a bright light back to the sun ward side of the turbine (5).

The distance between a wind turbine and a potential shadow flicker receptor affects the intensity of the shadows cast by the blades, and therefore the intensity of the flickering. Shadows cast close to a turbine will be more intense, distinct and 'focused'. This is because a greater proportion of the sun's disc is intermittently blocked.

Sources of Flicker, for Comparison

Fluorescent Lights:	120 Hz
Computer Screens :	75 Hz
Televisions:	60 Hz interlaced
Vehicle Turn Signals:	13 Hz
Wind Turbine Shadow:	1.25 - 5 Hz

Most people notice flicker up to about 50 Hz, after which the brain's response to the flash lasts longer that the flash itself. Epileptic responses to flicker typically run from 12 Hz and up, but can be as low as 3 Hz.

Effects of Flicker

Shadow flicker is one of the "annoyance' or 'nuisance' effects of wind turbines, similar to noise and view complaints, however it is unique among these. While all are somewhat subjective and tolerated by different percentages of nearby residents, shadow flicker is the least well tolerated. Residents impacted by flicker complained of headaches, migraines, nausea, vertigo and disorientation after only 10 minutes of exposure (2,3).

As with car of seasickness, this is because the three organs of position perception (the inner ear, eyes, and stretch receptors in muscles and joints) are not agreeing with each other: the eyes say there is movement, while the ears and stretch receptors do not. People with a personal or family history of migraine or migraine-associated phenomena such as car sickness or vertigo are more susceptible to these effects.

The most well-known response to flicker was the Pokemon cartoon incident. Episode #38, originally broadcast in 1997, included red and blue flashes at 12 Hz for about 5 seconds. This caused convulsive epileptic seizures violent enough to create emergency services calls in 685 children, most of whom had no previous seizure episodes. The Japanese government responded by setting new guidelines with maximums of 3 Hz and 2 second duration for any flashing images on screen (8).

While the annoyance factors are obvious, yet subjective, other medical factors are measurable. Photosensitive epilepsy is triggered when the visual disturbance is within certain frequency ranges. Older model turbines generate flicker at about 1.1 Hz, which is outside the boundaries of photosensitive epilepsy (although is still may cause nausea and migraines). Newer turbines, however, can generate disturbances of 2.5 Hz, which can cause epileptic seizures and neural dysfunction in people who are susceptible.

Calculating Flicker Areas

While some wind developers tout a flat distance (usually 10 rotor diameters) as a radius, the best calculation of seasonal timing and duration of flicker effects uses computer software to accurately calculate

amount of shadow per year in the area around the tower. The relevant data points are the latitude and longitude of the site, used to create a shadow map. This map will clearly outline affected areas by distance and direction from the turbine. Any properties which may potentially be affected can be identified and the risk calculated.

For purposes of zoning, it may be sufficient to create one shadow geometry for the center of the Town of Bethany and use it as a guideline for all areas. A map generated online showed a maximum distance of about 1,8000 ft for noticeable flicker . (9)

Reducing Flicker

Wind turbines can be painted by the manufacturer so that they blend with the natural environment. In most cases turbines are painted gray so that they will blend well with the skyline, but some are also painted green or are two-toned. Other turbines are manufactured with a galvanized metal so that the metal will weather and turn gray naturally. Zoning can require the turbine to be painted with a blending color that is non-reflective in nature, removing Reverse Flicker effects altogether.

One of the simplest and most controversial ways to reduce shadow flicker on an existing turbine is to plant tall vegetation in the shadow path. This overrides the flickering shadow and provides relief from its effects. However, many property owners object to this strategy as they desire sunlight on their home and/or yard.

Installing special controllers on the turbine which automatically turn it off during peak times is a common and reasonably inexpensive solution, but one that must be pressed by the town and/or landowner to be implemented (1).

Moving the turbine is the most expensive option and one that is nearly impossible to effect without strict zoning laws. Proving the annoyance factor of flicker is difficult as it is often viewed as a subjective determination and property owners are typically asked to sign "hold harmless" clauses with the wind developer, preventing many suites from coming to court.

Zoning Precedents

The most effective way to reduce flicker effects is to zone them away from residences, schools, churches, libraries and places of business prior to construction, via materials requirements and setback requirements. Some communities also take care to prevent flicker from distracting drivers on the road. Irish guidelines state that due to the height and movement of wind turbines, the towers should be set back from the road by up to 300 m (990 feet) depending on circumstances (6). A report by the Michigan State University Extension suggests that a shadow flicker study be commissioned and included with each tower permit application (6). In any case, it is recommended that turbines be limited to a flicker frequency of 3 Hz or less, regardless of whether a residence is affected (4).

References

(1) Berkshire Today, PowerGen Renewables vs Cumbria residents, 2004.

(2) Western Morning News, Plymouth GB, January 6, 2004.

(3) Health, hazard, and quality of life near wind power installations: How close is too close? by Nina Pierpont, MD,PhD March 1, 2005
http://www.responsiblewind.org/docs/wind_turbines_and_health.pdf

(4) Photosensitive epilepsy - other possible triggers by Professors g Harding (Aston University, England) and S Seri, 28 October 2005

http://www.epilepsy.org.uk/info/photo_other.html

(5) Good animated image at http://www.windpower.org.en/tour/env/shadow/index.htm

(6) Land Use and Zoning Issues Related to Site Development for Utility Scale Wind Turbine Generators, Michigan State University Extension, January 2004
http://web1.msue.msu.edu/cdnr/otsegowindflicker.pdf

(7)http://www.brucecountry.on.ca/download/Wind-Farm-Requirements-ZBA.pdf

(8) http://faculty.washington.edu/chudler/pokemon.html

(9) http://www.windpower.org/en/tour/env/shadow/shadowc.htm

Editor's comment: *Flicker vertigo and vertigo are two different phenomena. The latter is variously defined as* "an illusion of movement, a sensation as if the external world were revolving around the patient (objective vertigo) or as if he himself were revolving in space"(subjective vertigo)...see On-Line Medical Dictionary, University of Newcastle upon Tyne), *and is fairly well understood, it's etiology having a variety of factors chief of which are pathologies in the middle ear, or actual lesions in the Vestibulocochlear nerve or Medulla Oblongata* (Clinical Neuroanatomy for Medical Students, ISBN 0-7817-2831-2, p213, p361). *Flicker vertigo is so rare it's difficult to find a good reference in the standard medical literature (neither the above references nor Medline's On-Line Medical Dictionary, nor Mosby's Medical, Nursing, and Allied Health Dictionary, have it). Nonetheless it is well documented and has been experimentally studied in the psychology laboratory. It is relatively well-known by experienced helicopter pilots. One definition is* "A steady light flicker, at a frequency between approximately 4 to 20 Hz can produce unpleasant and dangerous reactions in normal subjects, including nausea, vertigo, convulsions, or unconsciousness. The exact physiological mechanisms are unknown" (United States Naval Flight Surgeon's Manual: Third Edition, 1991: Chapter 9: Ophthalmology). *The key here is the frequency of the light source, with a lower bound of 4 cycles per second. An industrial turbine turns at about 20 revolutions per minute, and since there are three blades the frequency is 60 cycles per minute, or one cycle per second, i.e. a factor of four lower even than the lower bound said to induce flicker vertigo. Ms. Gross states above that "Newer turbines, however, can generate disturbances of 2.5 Hz, which can cause epileptic seizures and neural dysfunction in people who are susceptible".* ***There is absolutely no credible reference in the medical, scientific, legal, or other peer-reviewed literature that wind turbines have ever caused anyone to have an epileptic seizure.*** *One notes that VFR helicopter pilots flying into the sun really have no choice as to whether they look out the window or not. Someone near a wind turbine isn't under a gun to keep staring at it...if looking at it is unpleasant, they will simply turn away. Same goes for shadow flicker.*

- **Interference with any form of electronic or electromagnetic communication**
  To be addressed by the editor forthwith.

- **Esthetic impact - quality of life**

Submitted by Paul Lewis, reproduced unedited

Loss of Property Use and Esthetic Impact - Quality of Life

One of the controversies over wind turbines is the massive size and placement of these structures and how they may change your lifestyle. How would you like to go out of your front of back door and have a 450 tower staring you in the face or have numerous people stopping by questioning the wind turbines? This would be part of the lifestyle change you would have to make. The placement of these towers in Bethany is proposed to be as close as 1000 ft from property lines and other residences. When you look over the rolling

hills of Bethany you may see a farmers silo or two, which in most cases are less than 100 feet tall and are part of the agricultural district we live in. What if you looked over the rolling hills of Bethany and now you see up to eighty 450 foot towers. This would definitely take away from the esthetics of the countryside. In many cases the people who live in the agricultural/residential sections of these towns moved there to get away from the city hustle and bustle. After my trip to Wethersfield and the committee's trip to Tug Hill it became very apparent these things will never blend into the rural country setting like farm buildings/silos do.

When wind towers are placed in line with residences then you start to lose your quality of life. Some of these issues are the low frequency noise, flicker effect, loss of TV (antenna), cell phone and satellite cable reception. Low frequency noise is generated while at various speeds. The noise is not always present but there is definitely times when the noise is very noticeable. As you will see when you read the attached article, if the proper precautions are not taken during the planning stages then the land owner may pay the price by having to keep their doors and windows shut and also by not going out of doors for a peaceful evening due to the noise. See noise article in the attached article by Nina Pierpont, MD, PhD dated March 1, 2005.

Another problem is the flicker effect. When the turbines are placed so that the wind turbine is between the sun and the residence at some period of time during the day or night; there will be a strobe effect at the residence on the opposite side of the turbine as the suns rays pass through the rotating turbine blades. Again, when there is poor planning this flicker may cause health hazards to people who are epileptic or who have a very low tolerance to shadows. Again, please see Flicker in the attached article by Nina Pierpont, MD, PhD dated March 1, 2005.

It has been noted in several cases that there is a loss of TV and Cell phone reception due to interference from the rotating turbine blades and also the tower itself. During our trip to Tug Hill it was noted during my video taping that when the camera was pointed in the right direction there was interference on the video tape. This is the same type of low frequency noise that causes interference with cell phones, TV antennas and satellite TV reception.

The other issue is the continuous traffic that is brought in with people questioning the wind turbines, just like we and every other towns people have done at Wethersfield and Tug Hill. I know several people are getting tired of people always coming around asking questions.

- **Wildlife effects**

- **Ice throw**

The following report was submitted by Loy Ellen Gross and is reproduced here unedited.

Ice Throws

Definition

Ice throw occurs when condensation from the air or naturally occurring precipitation collect on the turbine blades and freeze. Thin sheets of ice form along the length of the blade, with larger "ball-like" chunks created at the tips.

Effects of Ice Throws

In Minnesota, 2002, a maintenance worker preparing to ascend the turbine was cut in half by a falling sheet of ice. There are reports too numerous to count of automobile damage due to falling lumps of ice - usually described as about the size of tennis balls.

Damage has occurred as far away as 80m (264ft), including smashed windshields and windows; dented cars and roofs; and accidents on roadways (cars hitting large chunks of ice lying in the road, not ice hitting cars).

These incidents are pulled from a fairly complete list of wind turbine accidents from the late 1990's to present, compiled by Caithness Wind Farms in the UK. This list is available online (5). It is 17 pages long and includes at least 20 accidents per year since 1999.

Mitigation

Wind turbines can be equipped with ice-resistant mechanics - both in terms of the materials used to construct the turbine and additional electronics added to prevent spin-up in the event that ice forms. However, independent tests have not been completed on either of theses solutions. Given the liability issues, it is desirable to use tested or guaranteed mitigation. The only known guaranteed mitigation is setback.

My first finding is that zoning ordinances vary widely in which physical (property) setbacks are required or even mentioned. Most (if not all) ordinances include distances from residences and property lines, while others include these plus roadway, right-of-way, livestock barns and pastures, and others listed below. Obviously, not all communities measure the same types of setbacks and some clearly place more value on livestock and outbuildings than others. I have grouped together definitions that appear to be set for the same or similar reasons.

1) **Roadways / Right of Ways / Utility Elements / Buildings / Storage Barns:** this setback is typically based on the belief that ice throws or high-voltage electric fields may interfere with traffic or the activities of persons not related to the project; or damage property. A team of German scientists have put together a simplified equation for calculating that risk (1), d = (D + H)*1.5, meaning add the diameter of the rotors to the hub height (tower height), then multiply that number by one and a half. With the proposed 3.0mW turbines, that means (240' + 330') *1.5 or 855 feet. Because the German scientists designate this as a rough calculation and recommend further local studies to determine the exact conditions in a given area, some communities are adding a 10% margin of error (which would make our calculation 951ft.)(8).

This setback is normally not applied to the access roads built by the wind company for the purpose of erecting, maintaining and decommissioning the turbine itself. In reading various town and county ordinances available online, it is not clear whether the setback applies to established public trails or snowmobiling paths (most likely this information is found in the communities' base zoning definitions, which are not included in the turbine document). In only one Minnesota document was i able to find a direct reference that snowmobile and walking trails were specifically included (that was a proposal from a wind turbine company, not a zoning paper). Given that, in New York, snowmobiling paths are created, mapped and maintained with public money, they might be something the town would like to consider including in any right-of-way setbacks.

Zoning Precedents

References

(1) Michigan State University Extension: Community Development and Natural Resources Studies (German study regarding risk from ice throws) http://web1.msue.msu.edu/cdnr/icethrowseiferth.pdf

(2)National Wind Energy Association Siting Guidelines http://www.nationalwind.org/publications/permit/permitting2002.pdf

(3)American Wind Energy Association Small Wind Turbine Siting Guidelines (This is a small turbine document; I have seen it applied to larger turbines, but could not find the reference again when I looked) http://www.awea.org/smallwind/documents//permitting.pdf

(5)Caithness Wind Farms Accident Report
http://www.caithnesswindfarms.co.uk/Downloads/Accidents%20-%20June%2030%202005.pdf

(8)Michigan State University Extension: Community Development and Natural Resources Studies (Application of German Study to zoning)
http://web1.msue.msu.edu/cdnr/otsegowindicethrow.pdf

Editor's comment:

The spectre of ice throw is one of those "hot button" issues relating to wind turbine installation. There are plenty of anecdotal reports. I personally find the report of someone being cut in half by a falling sheet of ice hard to swallow, and can find no reliable reference. At the scene of fatal accidents involving high speed collisions, one rarely encounters severed bodies. The kinetic energy per unit mass is usually insufficient, unlike the case for airline crashes, where the impact velocity is several times greater, and the kinetic energy greater by the square of that.

The meteorological conditions necessary for the formation of ice on turbine blades are rare in our location. Contrary to popular belief, water does not always freeze at zero degrees Centigrade. Absolutely pure water can be cooled far below that, until what is termed homogeneous nucleation occurs. Skipping the thermodynamics, one does often find liquid water drops at temperatures as low as -40C high up in Cirrus clouds (Heymsfield and Miloshevich, Journal of the Atmospheric Sciences, Vol 50, issue 15, August 1993). *If one of these "supercooled" droplets impacts an airplane wing, the wing metal provides a substrate for the ice crystal lattice formation, and the drop freezes instantly. In the lower atmosphere, ice nuclei from automobile exhaust (lead iodide) are copious and this process is rare. Ice can form during "ice fogs", when supercooled fog droplets contact anything (grass, cars, turbine blades, etc). Such fogs however form only when the air is very calm, and the turbine blades are still. If the ice has already formed and then the wind picks up, the blades will turn much slower than normal or not at all, depending on the design and built-in safeguards. The other germane meteorological situation is wind and freezing rain. That happens when raindrops in above-freezing temperatures aloft fall into a surface layer of below-freezing air. The drops do not freeze (except in extremely polluted air with copious ice nuclei, as in the Lincoln Tunnel) at first but do become chilled to less than zero degrees Centigrade, ie they become supercooled. Then they freeze on contact when they land. This is the so called "ice storm" which is uncommon here. Again, the blades will turn slower due to the greatly increased aerodynamic drag on the turbine blades, or not at all if appropriate shut-down mechanism are designed into the machine.*

We next assume for the sake of argument that ice has managed to form on the turbine blades, that the aerodynamic drag of the blades is not increased (in reality not possible) and furthermore that no shut-down or slow-down mechanisms are in place, and the blades continue to turn at their maximum rotational speed. We ask, how far, theoretically, could the ice be thrown? To do that would require detailed knowledge of the shape of the ice fragments, and a supercomputer. It has never been done. However, one can obtain an idea of the ***maximum*** *distance the ice could be thrown, by calculating it's trajectory in a vacuum, where air drag can't affect it. The calculation is straightforward and requires only high-school mathematics and physics, albeit a bit lengthy. Sparing the reader that derivation, one can show that the maximum horizontal distance D from the base of a wind turbine with hub height H and blade length R (or one half the rotor diameter) that the ice would be thrown in a vacuum is given almost exactly by*

$$D = (1/2)(2*(1/2))R + (V*2)/2G +$$

$$V/(G*(1/2))[\ (V*2)/4G + (1 - (1/2)(2*(1/2))R + H\ ]*(1/2)$$

*where the asterisk denotes exponentiation (3*4 means 3 multiplied by itself four times), where* V *is the speed at the blade tip, and* G *is the acceleration due to Earth's gravity. [The maximum throw obviously is from the tip, where speed is greatest. The equation is valid for any radius less of course]. Assume the same dimensions as above for the 3.0 MW machines proposed for Bethany, that is,* **H** *= 330 feet or about 100 meters, and* **R** *= 120 feet or about 36.7 meters. Assume also that the blades have no controller and are spinning at their maximum rate of about 20 revolutions per minute. That would give a tip speed* **V** *of 77 meters per second or about 172 miles per*

hour. G is given (by God) at about 10 meters per second per second. Keeping our units and dimensions straight and putting these values into the above equation, we get

D = 743 meters = 2438 feet

So that's where the phrase "turbines can throw ice up to half a mile" probably comes from. We know that that is nonsense because we are not in a vacuum, nor would the blades turn if we were. ***However,*** *our equation is not quite completely useless. Not only does it give an upper bound, physically possible limit in a vacuum, it can also be analyzed term by term to see the relative importance of the variables determining that maximum-possible throw distance. In the first term, note that the blade length is just to the first power, that is, if the blade length were doubled, the throw distance would be doubled, all other things being equal, if that were the only term in the equation...but it isn't. The blade length appears in the square bracketed expression in the third term, again to the first power, but the whole square bracketed expression is raised to the one half power (square root), so the dependence is even weaker. By far the variable with the strongest influence is the tip speed, since that appears in both the second and third terms to the second power, ie the square of the tip speed. But that speed is limited to about four times the wind speed on the basis of aerodynamic considerations far beyond the scope of this note. Finally we turn to the tower height, or alternatively the hub height. Note that it also appears in the third term, in the third sub-term in the square bracketed expression, to the first power. But the bracketed expression itself is raised to the one half power, so the dependence on hub height is weak even if it were the only term in square brackets, which it is not. But it's very illuminating to see what would happen to the throw distance if, all other things being equal, the hub height were* ***doubled*** *to 200 meters, or a ground-to-blade-tip height of 777 feet ! Plugging in the numbers, one is surprised to find that now*

D = 813 meters

In other words, even in a vacuum, doubling the tower height only increases the throw distance by less than 10 percent! So the dependence on height is very weak, and would be even weaker if one included aerodynamic drag in the calculations. This is mentioned because many people are frightened by the sheer size of these machines, which admittedly can be very intimidating when viewed close up for the first time by the uninitiated.

Let's wrap this up by abandoning the theoretical stuff and having a look at what has been observed in the real world. The study most cited in this respect is ***Risk Analysis of Ice Throw From Wind Turbines*** *by Henry Seifert, Annette Westerhellweg, and Jurgen Kroning, presented at BOREAS in Finland, April 2003 (these are the same "German scientists" responsible for the equation d= 1.5(D+H) mentioned by Ms. Gross in her analysis above, although she does not include their original paper in her list of references). They plotted the throw distance of ice pieces observed versus radius, and also included the weight of the ice pieces (page 2, figure 2). They observed only three pieces heavier than 1 KG (2.2 pounds), hardly heavy enough to sever a human body, and more importantly, the farthest throw distance they observed was less that 125 meters or 410 feet. This emphasizes the ridiculousness of calculations in a vacuum, and also the ridiculousness of requiring a one-mile setback based on fears of ice throw. Seifert et al did make a guesstimate as to the risk of a person being hit (not necessarily fatally) by ice from a turbine as follows (page 8):* "If 15,000 persons pass the road close to the wind turbine per year, there might be one accident in 300 years".

It should be noted here that the same physical principles discussed above also apply to the throw of pieces of turbine blade which might become detached (by perhaps a lightning strike), as long as they are small compared to the blade itself. In that case the relevant radius to use would be the distance from the hub at which they detach. If a blade tip detaches, obviously it's the same **R.** *If the pieces are a significant fraction of the entire blade (say, one third), the physics is more complicated, since the free-flying piece is both translating and rotating due to it's inherent angular momentum before detachment. However, in this case the throw distance would be even less: the detached piece will be rotating about it's center of mass, which itself is following a similar parabolic trajectory (in a vacuum) but smaller in amplitude, having an effective radius significantly less than that of the entire blade.*

- ## Siting and placement issues

The following report was submitted by Jim Hinkson and is reproduced here unedited.

Bethany Wind Turbine Committee report on turbine sites and avian concerns. Other related topics are covered by separate reports from the Committee.

Our committee was formed and research on wind turbines commenced in March, 2006. Our conclusions are based on literature, both pro and con, guest speakers and, visits to Weathersfield, Fenner, and Maple Ridge farms. Our thanks also go to the wind turbine crew that allowed us to inspect the Maple Ridge turbines from both inside and out. Thanks too, to the residents living near these wind farms that took the time to share their experiences with us.

Location...location...location...is the key to determining the best-for-all placement of wind turbines. Location or more specifically, the distance wind turbines are placed from residential areas may or may not mitigate some of the issues and/or problems reported with wind turbines.

Depending on personal opinion and lease holder status, wind turbines may have a place among current green energy options, but the placement of approximately 35 to 80, 450' towers in the residential area(s) of Bethany, NY is not recommended. Turbines do not make good neighbors (1). If the Planning Board or Town are of a different opinion, then we strongly recommend a minimum
one mile setback from all residences and, the placement of each turbine to be unanimously approved by the Town, land-owner(s), abutters, and neighbors within the view-shed, not just the lease holders and the wind development company which in our case is UPC. As UPC reported to the citizens of Stafford, NY, when properly sited, wind-power provides an overall net benefit to the natural environment and, UPC will work with land-owners to site turbines in locations with the least impact on the landowners existing and future use(5). Again, we recommend that UPC include the Town and all other "neighbors" affected by the placement of the turbines.

The recommended one mile setback is greater that some and less than others. For example, in Pavilion, NY the set back from residences is 1,000' Perry and Cohocton, NY set 1,500'. In France, the National Acedemy of Medicine recommended that due to significant health hazards caused by turbine noise and infrasound, a moratorium be placed on all construction within a 1.5 km radius (2). The U.S. National Wind Coordinating Committee recommends 1/2 mile from any dwelling (3). German marketer RETEXO-Rise specifies turbines not be placed within 2 km (1.24 miles) of any dwelling. WOW, (We Oppose Wind farms), cites health issues as the reason they recommend 1.5 mile setbacks in any ordinance written to allow wind farms. As wind turbine sizes have grown, siting concerns have become more commonplace especially in areas of higher population (4).

With regards to turbines being considered near the Bethany Airport, the Federal Aviation Administration defines an obstruction to navigation as being 200' or taller above ground level and within three miles of a runway length > 3200' (7).

UPC reports that "siting" is the key to mitigating the disruption of migrating birds. UPC said they *(have)* extensive studies to ensure that an area does not have a high concentration of migrating birds (6). We recommend the research company be of our choice, at UPC's expense, and the study completed prior to any turbine installation. There will be bird kill. In the Maple Ridge - Tug Hill wind farm, a few local people have been hired to collect and dispose of the dead birds found near the turbines.
Wind turbines are relatively new to our area and the information provided herein is based on other people's experiences with smaller turbines. Unfortunately, the 450' turbines proposed for Bethany have never been installed anywhere before. New clean, safe and "green" technology may be right around the corner. Or a report due out in November, 2006 from the U.S. National Research Council (NRC) addressing the same concerns we have may help decide the future of turbines in Bethany (8).

In closing, the Town of Eagle, NY recently went through a process similar to our own. Their Town Supervisor, Mr. Joe Kushner met with us to share his experiences. Mr. Kushner explained how turbines will benefit his Town and expected the developer to agree to all of the Town's conditions. However, Mr. Kushner pointed out that our situation is different because the turbines for Bethany are being proposed near residential areas. Not so, or to the same degree in Eagle. Mr. Kushner recommended that either way, the committee come to a consensus and if we are not comfortable with turbines in Bethany, don't do it. At this time, we are not comfortable.

Editor's comment: *The situation in France must be considered in the context of the financial/political realities there. France leads all nations in the fraction of it's electricity generated from nuclear energy (75%!). In spite of and apart from the very significant and as yet unresolved problem of waste disposal, the nuclear industry in France is so well ensconced in the national economy that alternate forms of energy generation such as wind are not accorded the same potential future importance as they are in more forward-looking countries such as the United States. The conclusion of the French National Academy of Medicine that turbine associated health hazards mandate a 1.5 km setback is not universally accepted.*

LEGAL

- **Set backs - residential - farm - park - roads**
- **Zoning**
  To be addressed forthwith by the Town Planning Board
- **Contract control - landowners - town**
- **Owner guarantee issues**
- **De-commissioning issues**

This report was submitted by Paul Lewis and is reproduced here unedited

Windpower De-commissioning Issues

There are many issues that require investigation when a project of this magnitude is in the engineering and planning phases. One of the major issues with wind turbines is the de-commissioning of these units whether it is at the end of their service life or the unit is out of commission due to not being profitable. Should the town decide to allow wind turbines to be placed in the Town of Bethany the following issues should be addressed within the contract:

Who is responsible for the removal of these units? The committee suggests the town have a clause written into the contract that states the owner of the turbine(s) be responsible for all costs in the removal of the turbine(s) and restoration of the property where the where the wind turbines are (were) located. The wind power companies shall also be responsible for the restoration of the town, county or state property that may be affected by the de-commissioning. These issues and costs should be addressed in the contract along with a bond in the name and held by the town. This bond should also have an annual escalation clause that raises the bond by the rate of escalation for each year.

At what degree will the property be restored? The contract should read that the property is to be restored to the same condition as it was prior to the erection of the wind turbines, including the removal of the buried concrete used as the substructure. Based on another town's responses and investigation everything would be removed from the site including the concrete but only within the top two feet of the surface. This doesn't seem acceptable and the complete concrete structure should be removed due to possible future development within the town.

What will happen with the overhead and buried underground transmission lines during de-commissioning? Again we suggest a written agreement by generated and agreed to by the landowner and town which includes who will be responsible for the costs of removal and restoration of the property. Again, a bond with an annual escalation clause would be required to address this issue.

The committee asked UPC the following question about de-commissioning a unit:

If a wind turbine is placed on the landowners property and is not producing or has not produced for several months for some reason what would UPC do? Remove?

UPC's answer:

Yes, we would, and often town codes stipulate this. We would be interested in speaking further with you regarding our experience with towns that have produced wind code. The town of Cohocton is one such town. I think our ideal picture would be to work with Bethany to develop a code that works for Bethany and for the wind farm. There are quite a few precedents out there. Please take a look at the following link from NYSERDA for a start. This was especially developed for towns and communities and includes examples of wind codes from other New York towns.
http://www.powernaturally.org/Programs/Wind/toolkit.asp

Along with the above issues the town needs to develop a contract that will cover any and all ownership changes that may take place from the time that the initial contract and turbines are installed until they are de-commissioned. This would include the transfer of the bond money and the annual escalation factor.

If the town were to allow the development of wind turbines then we believe the contracts should be reviewed by several town land owners, not just those who have wind turbines on their property, to assure the right controls are put into the contract.

- **Potential lawsuits**

- **Legal - philosophical - view from Albany**

On June 16, 2006 a conference titled *"Siting Wind Power in New York"* was jointly presented by The Government Law Center of Albany Law School and New York State Energy Research and Development Authority. One of us (RJC) attended. There were three main take-home messages: (1) Wind energy is becoming increasingly competitive with other sources (2) Whether or not a town or local government is pro or con, New York State is committed to developing wind energy. If development lags behind state expectations, it was strongly implied that steps will be taken to ensure it. For example, declaring industrial wind farms to be public utilities. (3) Town and local governments, whether pro or con, are strongly advised to get the best lawyers they can afford when dealing with wind development companies, since the latter will surely have them.

FINANCIAL

- **Effect on property values**

The following was submitted by Francis Ashley and is reproduced unedited except for grammar.

As of the date of this report the effect on property values is far from clear, in our visits to other towns that have turbines installed. The property values in towns with turbines have increased, and conversely for property that does not have turbines in the immediate area, the picture is far from clear. We have reports of property owners trying to sell their housed and not being able to *sell because of the possibility of turbines being sited in the vicinity.*

However because of relatively little hard data on this subject, the committee believes it is much too early to make a definitive statement on this topic, regardless of what the wind development companies would like us to believe.

Editor's comment: *Mr. Kushner (personal communication) informs us that since the Town of Eagle has signed a contract with Noble Environmental to install an industrial wind farm, no town property is up for sale.*

- **PILOT - approach of other towns**

When one walks through woods and field, one observes patterns in nature that often parallel the affairs of humans. For example, when an animal dies or is killed, that carcass is a source of meat, i.e. energy, for other creatures, who will compete to get it. The smartest and/or strongest succeed. If an industrial wind farm were to be installed in Bethany, the revenue generated would be of an unprecedented magnitude. The turbine company itself of course would like to take the bulk of that money, and give back to the community as little as they can arrange for. Companies have offered two or three thousand dollars per megawatt per turbine per year. The economic situation at this time (December 2006) is such that an offer of anything less than $8,000 means the community will be shorted. But the company isn't the only entity out there which can "screw" the town. PILOT (payment in lieu of taxes) agreements are often touted as the means to a fair distribution. For example, some counties in western New York, working through their respective IDA's (industrial development agencies), have realized roughly the following distribution: The county: 40%; the school district: 30%; and finally the town: 30%. But each county is different: in Livingston county, the county gets 30%, the town 12 to 18%, and the schools 52 to 58%. Thus the Town of Eagle posed the following question: How many new school students result from the installation of an industrial wind farm? Essentially none, of course. That being the case, they asked, "Why should the school district get the bulk of the money?" In fairness, they shouldn't. Convincing the Wyoming County IDA of the wisdom of this approach, Eagle was able to arrange a licensing agreement (between the turbine company and the town), whereby the Town, *prior to the PILOT payments kicking in,* gets 80% of the wind-generated revenue up front. The *remaining* 20% then goes into PILOT, and that portion is divided as follows: the county: 30%; the schools: 40%; and the Town: 30%. So by this method the town of Eagle receives 86% of the wind generated revenue. Needless to say this arrangement is highly satisfactory to the town fathers. This is a new, unprecedented development, and may well become a model emulated in the future by counties in New York State developing wind energy. No doubt the Bethany Town Board will take note of this situation, as well as the Genesee County Planning Board and IDA.

- **Payments to landowners**

The following was submitted by Paul Lewis and is reproduced here unedited.

The installation of wind turbines and the requirements to install high voltage transmission cables both above and below ground would require Right of Way permission from the private landowners and possibly that of the town and state for the use of their land. There is also the issue of restoring the property to its original configuration after the underground or overhead transmission lines are installed. The committee contacted UPC about this requirement and UPC stated they would pay the landowner a Right of Way payment for the use of their property. There was no mention as to how much that payment would be but it would be based on a case by case basis. We suggest the town

provide payment and restoration guidance to the landowners and/or include the payment structure into the UPC/town contract. Although there are several other towns in the area that are reviewing turbine development in their own towns we were not able to get any information on this topic.

- **Depreciation and Financial Effects**

The following was submitted by Loy Ellen Gross on March 02, 2006, and is reproduced here unedited

Town of Bethany
Bethany Center Road
East Bethany, NY 14054

Re: Wind Farm Depreciation and Financial Effects

To whom it may concern:

To begin with, I would like to make it clear that I am neither a lawyer or an accountant, merely a concerned homeowner. But I have been looking into the financial operations of commercial wind farms and have learned several things that I would like to share with the town. Wind developers quickly see handsome profits, while many communities and property owners see little of nothing in the way of tax revenue - even when taxed - due to state and federal tax shelters which are provided to the industry.

Depreciation

In particular, developers can recover their capital investment very quickly, because wind energy facilities are eligible for "five-year double declining balance accelerated depreciation" for federal income tax purposes (1). In an example $500,000,000 wind farm (the approximate cost of a 480 MW farm), UPC Wind Partners can recover the entire investment through depreciation charges to offset income tax liability in just six years (1).
In order to benefit from tax shelters, the wind developer must have income. For this reason, many wind farm developments consist of two or more small companies. One company will develop the wind farm and then sell it to the partner company, using the income for depreciation and presenting an entirely different company for the community to deal with. This is true even of UPC Wind, which typically partners with an affiliate company right from day one (3).
Due to these unique tax situations for wind farms, there is a great incentive for wind farm owners to abandon these projects one the five to six year term of tax credits have dried up, forsaking their projections and promises of twenty- to thirty-year life expectancies for the project.

Follow the Money

At the"informational meeting" in June 2005, Chris Swartley presented a few hard numbers on the proposed project. UPC Wind intends to build between 30 and 40 turbines in the Town of Bethany. Forty is about all they can fit and less than thirty would not be worth their time. For the purposes of our calculations, we will the average, or 35 turbines. They are to be GE 3.5 MW turbines, a model just barely on the market, with a quoted price tag of $2.6 million each.

Now, some numbers we must quesstimate based on current and completed wind turbine projects. Landowner payments can be as high as $10,000 per year, but are somewhat less in rural areas. The rural range is $2,500 to $5,000. We'll assume the high number of $5,000 (7) or $174,000 for the entire project.

Wind farm developers acknowledge that wind electricity costs more that traditional electricity - a cost that is ultimately passed on to the consumer. (Note that we are not talking about the SBC credit - that money is used to

fund wind developer's preliminary studies). Let's take a conservative number: two cents more per KWH (8). If the Bethany wind turbines generated electricity 100% of the time, they would produce 1,073,100,000 KWH annually. However, experts acknowledge that wind turbines only produce about 30% of their rated capacity due to lack of wind and other factors, which make the annual production 321,930,000 KWH.

Electricity from wind turbines therefore cost consumers an additional $6,438,600/year - with only $175,000 of that going to the landowners, or a net $6,263,600 loss for the community.

Not only will consumers pay via higher electricity costs, but also through federal tax dollars. Wind farm developers are eligible for a federal Production Tax Credit of $0.017 per KWH produced during the first ten years of the project. If the wind turbines generate the 321,930,000 KWH listed above, wind farm owners will receive an additional $5,472,810 in tax credits.

The upshot: while Bethany landowners will receive $175,000 in payments, $11,736,410 in electric fees and tax credits will be heading to Massachusetts.

"Grassroots" Green

Many wind power producers try to sell their product on it's environmental advantage - fewer emissions for our atmosphere. Yet even a quick analysis of their profitability leads us to more likely motives for large corporations to be involved with such projects. A simple revenue vs. expenses comparison nets us these numbers for the first year:

Costs:	
35 GE 3.5MW turbines:	$91,000,000
Annual Maintenance (first ten years):	$7,000,000
35 Landowner Payments:	$175,000
Tax Credits:	
Federal Production Credit:	$5,472,810
Federal MACRS Depreciation Credit:	$18,000,000
Sales:	
321,930,000KWH x $0.05(9)	$16,096,500
Total:	-$58,605,690

Extrapolating over the six year MACRS deduction gives us:

Costs:	
35 GE 3.5MW turbines:	$91,000,000
Annual Maintenance (first ten years):	$42,000,000
35 Landowner Payments:	$1,050,000
Tax Credits:	
Federal Production Credit:	$32,836,890
Federal MACRS Depreciation Credit:	$91,000,000
Sales:	
321,930,000 KWH x $0.05 x 6 yrs.	$96,597,000
Total:	$86,365,860

Zoning Suggestions

While a community cannot zone for lost profits and tax dollars, I have located a number of suggestions made by and for communities to zone such that at least some funds remain local.

1. First, it is recommended that towns do not attempt to override state tax shelters for wind farms, as they will have limited "on the books" income. Instead, negotiate fixed annual payments to the community in lieu of taxes. The Weathersfield Project, a much smaller farm, negotiated annual payments of just over $30.000 to the community, school board and other local agencies, funding which has been used to improve roads and other institutions. The Fenner project is based on MW produced and may (or may not) add up to as much as $150,000 annually (5).

2. In relation to the lifespan of the project, it is recommended that any "annual" payments, whether made to individual property owners or community agents, be contracted for a specific number of years and placed in escrow. Most ordinances are settling on 10 years as a compromise between the 20 years the developers are promising and the five to six year term of the bank loans and tax credits. This prevents the developer from abandoning their financial responsibilities along with the project when the tax credits dry up. (4). Ten years also tends to be a common length for electricity purchasing contracts, which makes the developer comfortable with that number (6).

3. With respect to the depreciated value of the structures over time, it is recommended that insurance covering full replacement value (not actual cash value) be required for the wind turbine during its entire production cycle. Should the structure be damaged after depreciation, any insurance policy which does not cover full replacement cost will likely leave the town and residents with an eyesore.

4. With respect to the expected sale of the wind power facility to an affiliate company, it is strongly recommended that contracts are worded so that any financial and community burdens of the parent company (original developer) are passed unchanged to any and all subsequent owners of the wind facility.

All of these requirements are most effective when added directly to zoning ordinances. I hope that you find this information useful and welcome your comments and criticisms on how I could be of better help. Thank you for your time.

Sincerely,
Loy Ellen Gross

Editor's note: Mr. Kusnher informs us that he would like to address the above analysis in the near future.

- **Employment issues during and following construction**
- **Why only one company interested in Bethany?**
- **Success of wind power in other countries - trends**
  To be addressed by the editor forthwith.
- **Back-up power issues**

RECOMMENDATIONS

Note: written Aug. 02, modified only as noted by editorial comment, on 01/08/07

The following recommendations are current as of Aug. 2, 06 and subject to change, bearing in mind the dynamic nature of this issue. Although UPC is specifically mentioned, they are to be applied to any entity intending the development of industrial wind turbines in the Town of Bethany.

- For any Bethany resident whose TV, cable, cell phone, or any other form of electromagnetic or electronic communication which is in any way adversely affected by industrial wind turbine installation, we recommend the responsible entity, in this case UPC, restore such communication to pre-installation quality.

- Extant maps provided by UPC so far to the WTSC do not give confidence that turbine siting will not have significant negative impact to a number of the aforementioned issues. Therefore we recommend the Town make the decisions regarding turbine siting in Bethany.

- It concerns us that, relative to the approach taken by other wind-turbine-development companies in nearby towns, UPC has not in our considered opinion been as forthcoming as per providing information regarding relevant issues. We recommend that UPC correct that.

- We are aware that Noble Environmental, which is now developing an industrial wind farm in southern Wyoming county, has provided a pro-forma statement to town officials. According to our information, UPC has indicated such a statement would not be provided since they maintain it would compromise their competitive posture. We nonetheless recommend UPC provide a pro-forma statement.

- We recommend UPC offer Bethany *no less* monetary compensation than any other nearby town, up to and including that equal to full property assessment.
  Editor's note: *Based on his experience with the contract garnered with Noble Environmental to place a turbine farm in the Town of Eagle, Mr. Kushner's opinion is that unless a town receives at least $8,000 per turbine per megawatt per year in revenue generated by the farm, the project is not worth doing. Regardless of setback, the turbine farm will have significant impact, esthetic at the least, for decades on the town.*

- Since UPC is intending to install 3.5 megawatt, 450' high turbines, and consonant with the setback requirements for such large turbines in the UK and Finland, we recommend a minimum setback of one mile.
  Editor's note: *If the etiology for this setback is concern to protect people from ice throw, it is unnecessarily restrictive. Since the greatest distance ice has been observed to be thrown is less that 125 meters, a setback of a quarter mile (402 meters) would be plenty to protect from ice.*

- We recommend any other alternate energy company approaching the Town of Bethany be required to provide information to the same extent as we have demanded from UPC, and that they be subject to the same stringent review by the WTSC and other Town officials.

- We are fortunate in that one Committee member (RJC) is a close friend of Mr. Joseph Kushner, who is the Supervisor of the Town of Eagle, where Noble Environmental is just now beginning the installation of a large wind farm. In view of the dynamic nature of wind-energy development, the potential negative impact of such development, and the fact that the Eagle project will provide us with an unparalleled opportunity to assess such development, we recommend our current moratorium be extended for six months.

Committee members as of Jan. 8, 2006:

Francis Ashley

Steven Breckenridge

Geoffery Briggs

Ramon Cipriano

Jim Hinkston

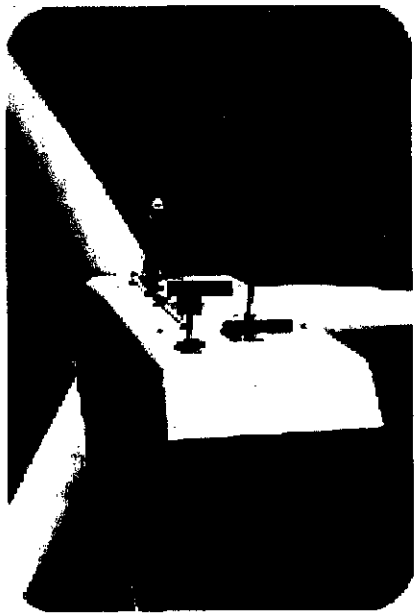
Loy Ellen Gross

Paul Lewis

Former members:

Dean Lapp
Jim Morris
Jack Woika

Mr. Joe Hughes
6320 State Route 540
Bellefontaine, OH 43311-9519



Wind Power Siting Issues Overview

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

Tom Hewson
Energy Ventures Analysis Inc
Arlington Virginia

April 21, 2008

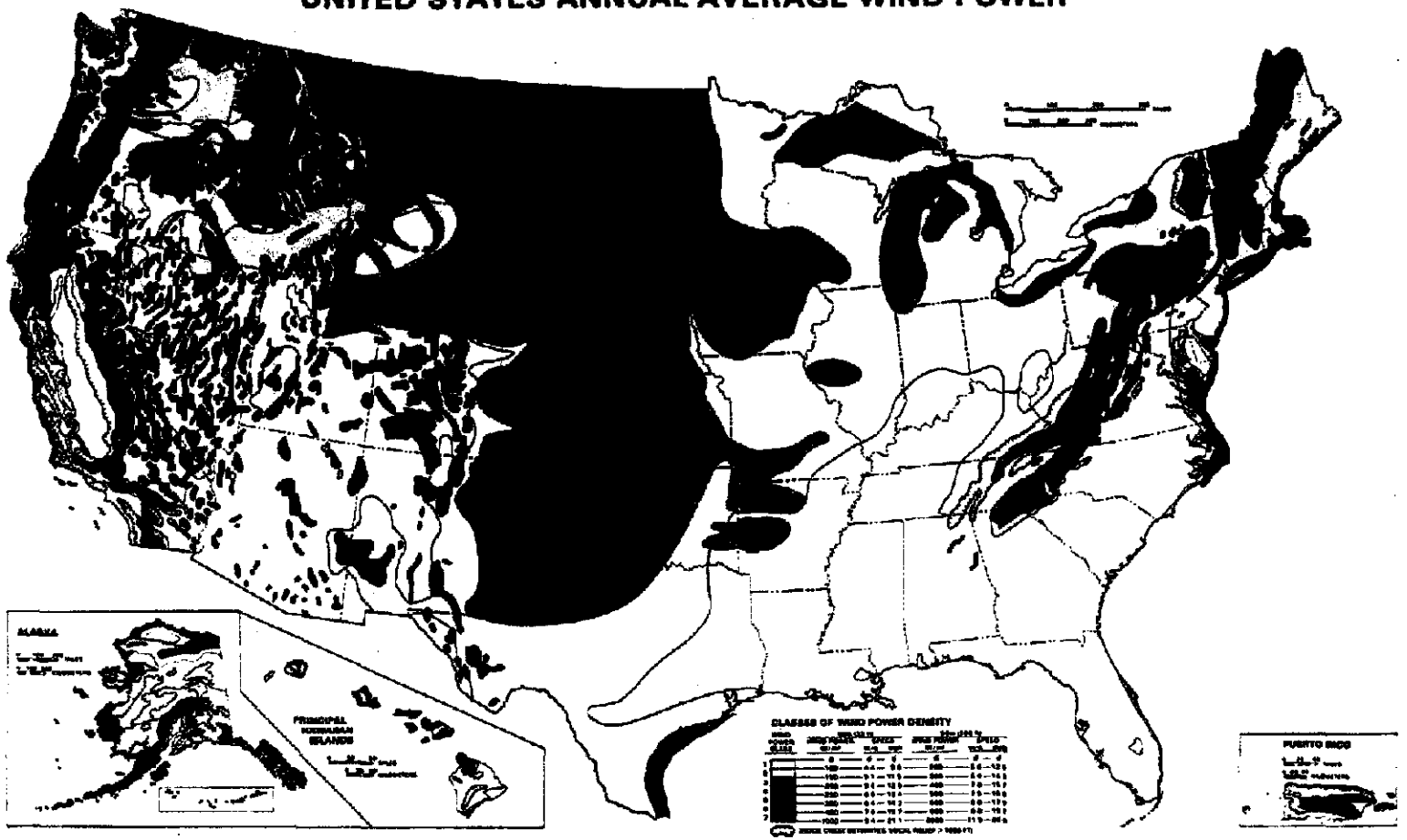
Wind Project Siting Issues

- 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)

UNITED STATES ANNUAL AVERAGE WIND POWER

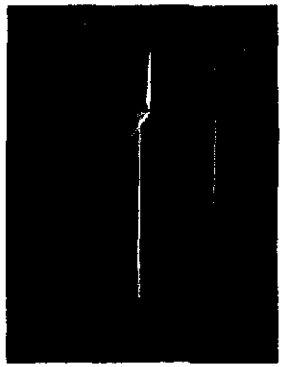


Source: *Wind Energy Atlas of the United States* (NREL)

Wind Project Development Issues

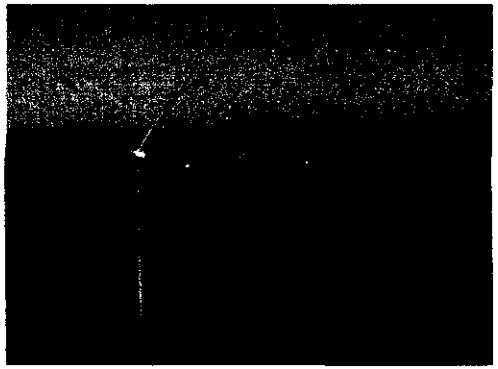
- **Large footprint, small power output**
  - Industry rule of thumb has been that a conventional 1.5 MW turbine design needs turbine spacing of roughly 40 acres of cleared land/turbine to avoid wind turbulence interference. AWEA believes 75 acres/turbine required for larger new turbine designs. To displace 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



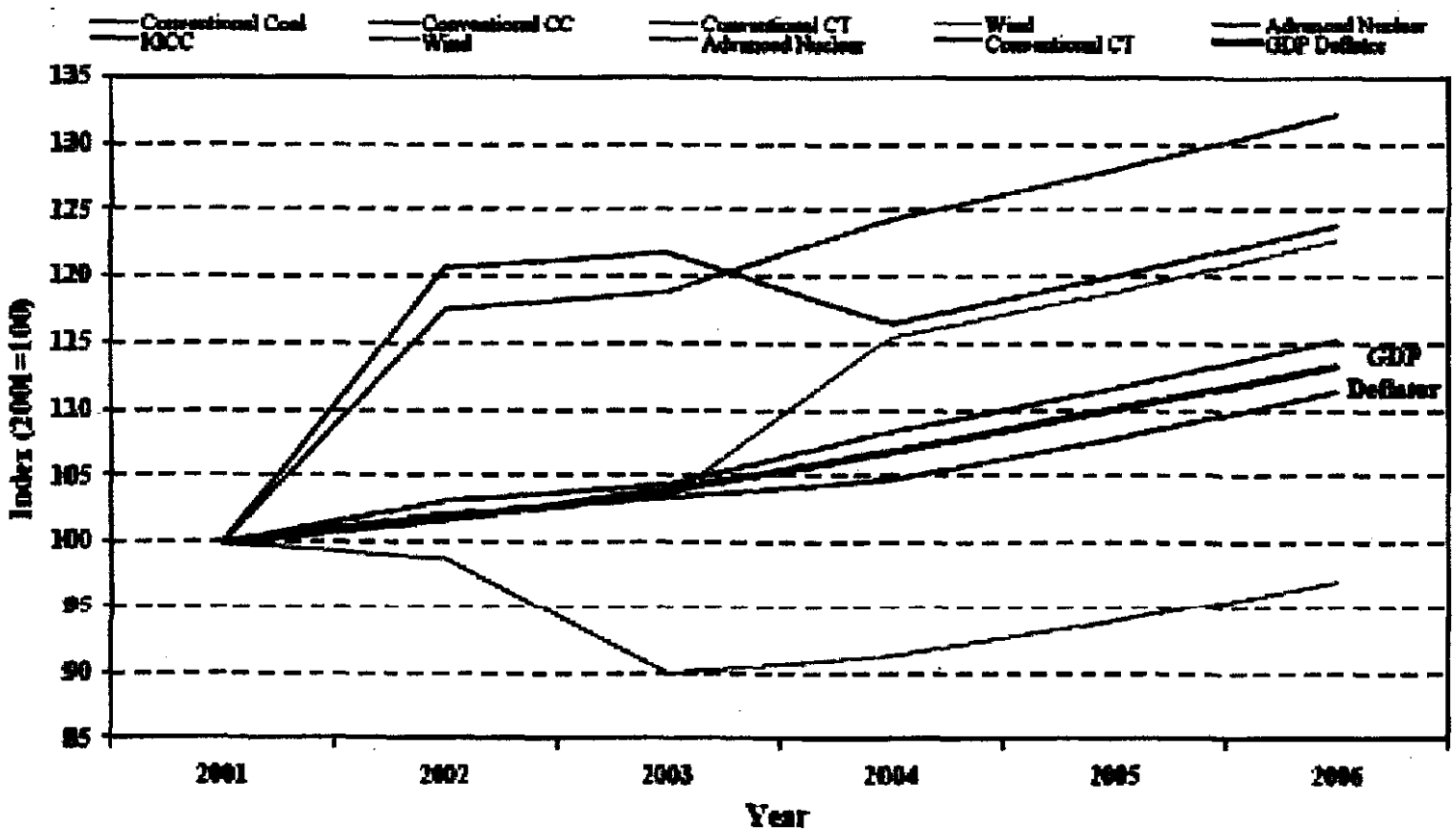
- **Wind power- Green but high cost power alternative**
  - High capital cost
  - Low capacity utilization
  - Little capacity credit towards reserve margin requirements
  - Heavily dependent upon large ratepayer & taxpayer subsidies and mandates to compete against conventional electrical power generation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

Wind- A High Cost Alternative

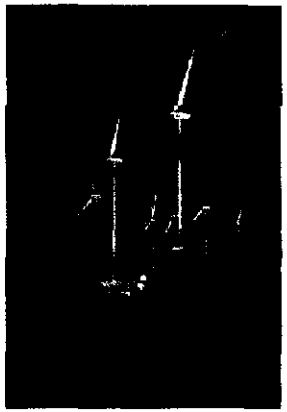


- High Capital Cost
  - Project capital costs have been rapidly escalating due to high turbine demand, weak dollar and rapid increases in labor, materials and supplies
  - Capital costs have escalated to $2,100-2,400/kW
- Poor Capacity Utilization
  - 29% in 2005 average for 83 reporting projects
- Low 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

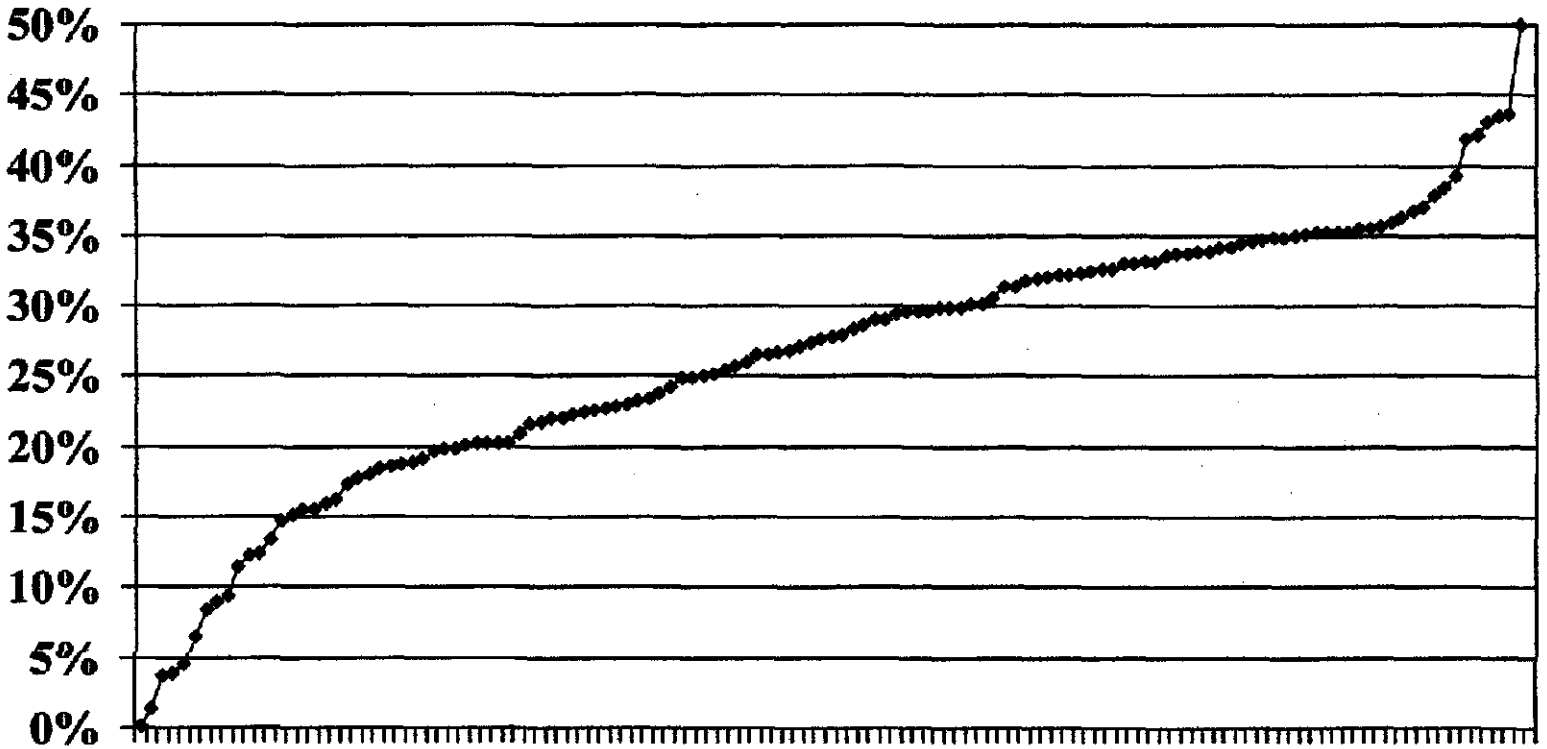


Sources: Data collected from the U.S. Energy Information Administration, *Assumptions to the Annual Energy Outlook 2002 to 2007* and from the U.S. Bureau of Economic Analysis.



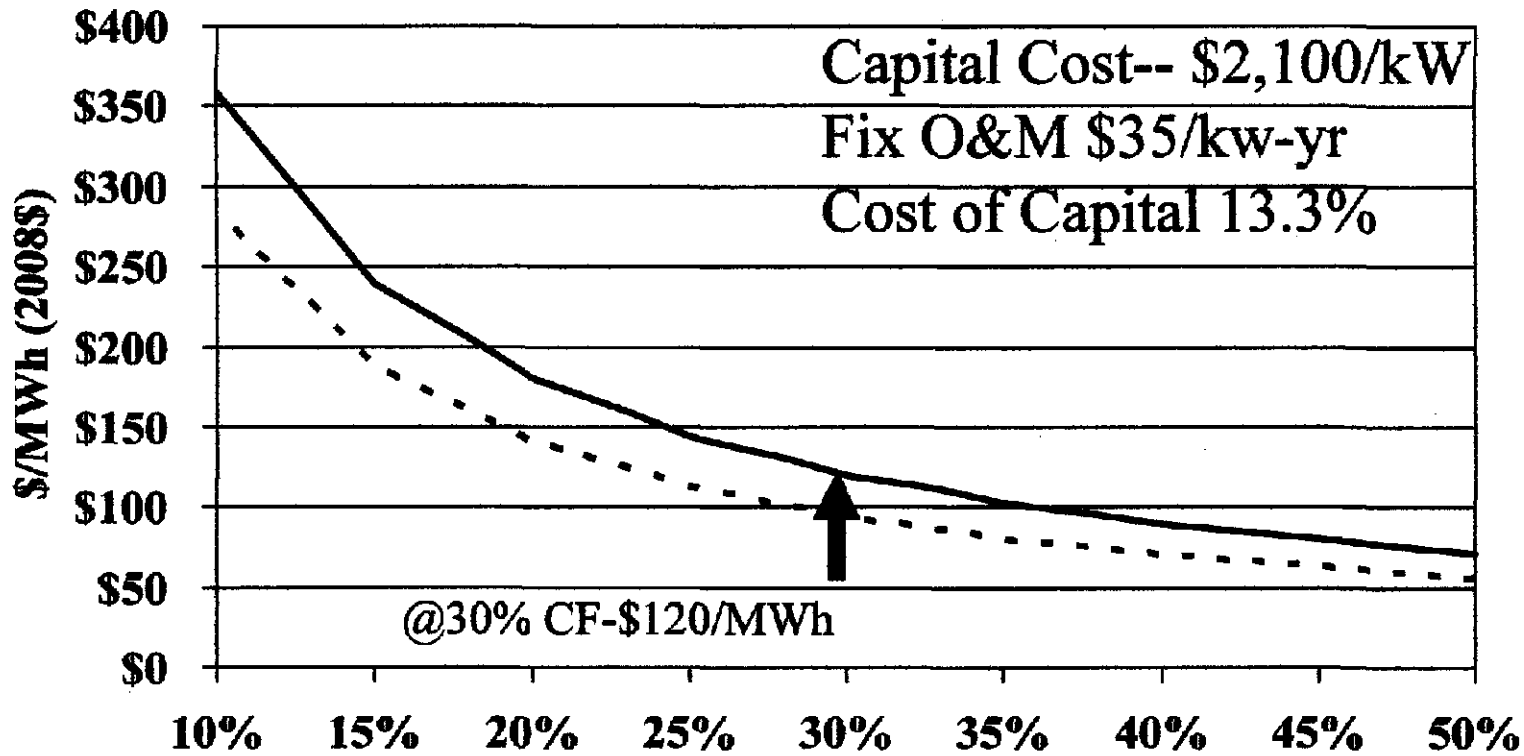
2004 US Wind Project Capacity Factors

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

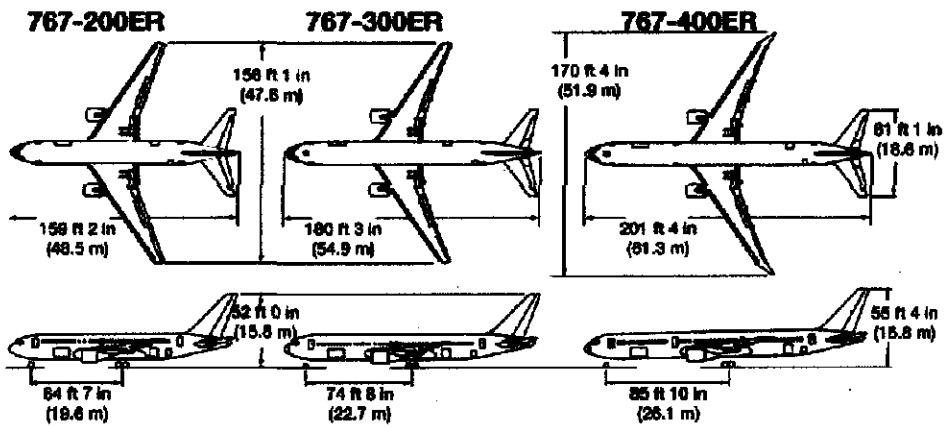
- Federal Production Tax Credit- $20/MWh for 2007 (10 years-must be online by 12/31/07).
- Accelerated 5 year depreciation (Federal)

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

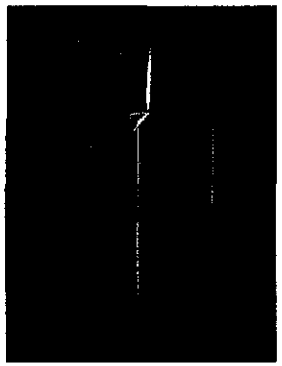
Wind Project Issues

- **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



Energy Ventures Analysis Inc

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

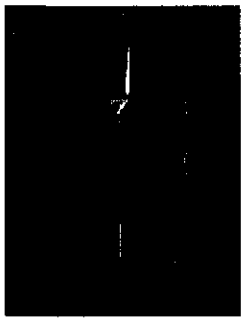
- *Impact of wind farms on the value of residential property and agricultural land: An RICS survey* (November 2004) Khatri, 2004 Survey by Royal Institution of Chartered Surveyors found 60% of respondents thought a wind farm would decrease value of residential properties within its view. Only 28% of 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

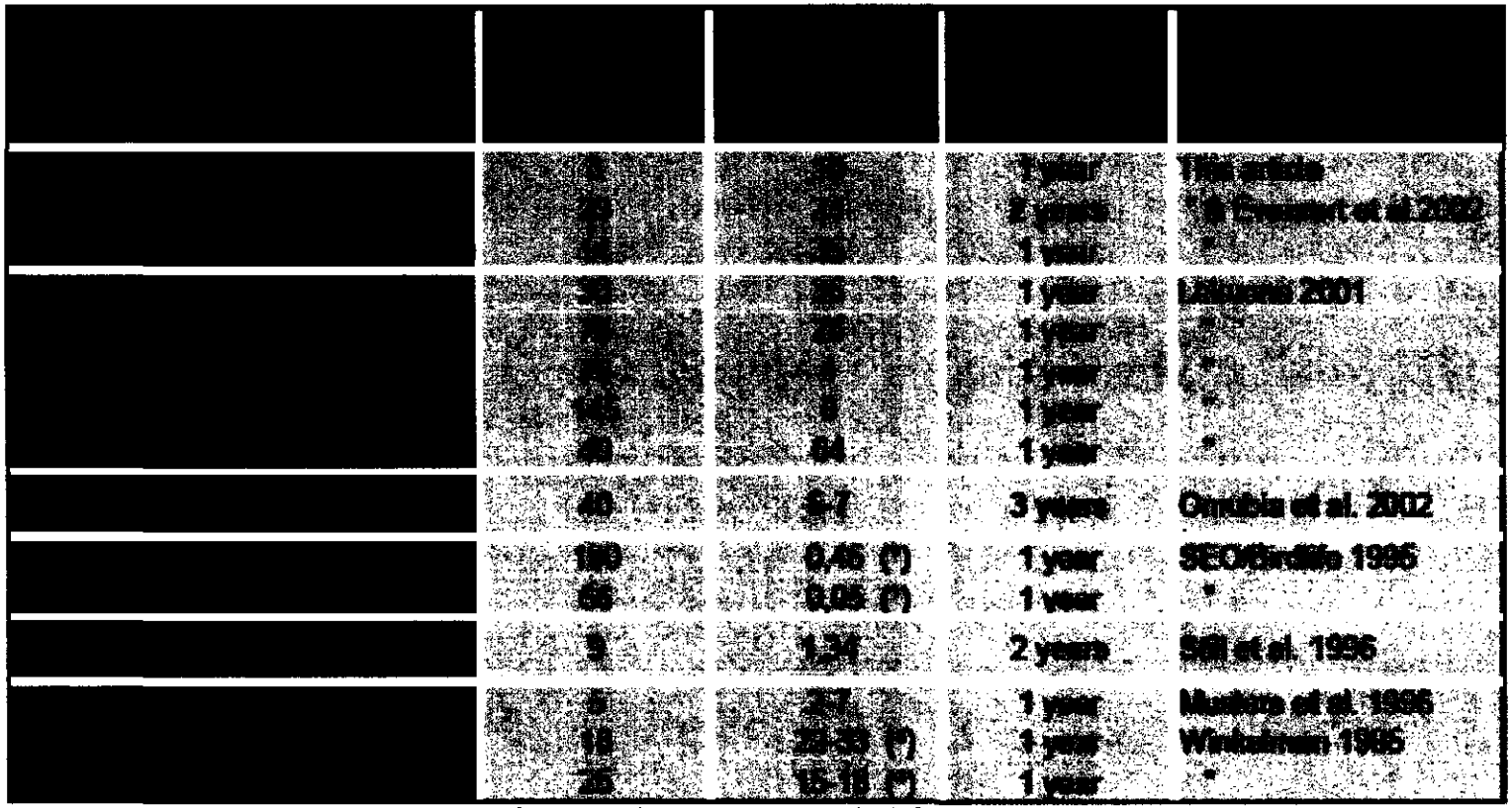


Table 4. Mean avian mortality rates from collision at some wind farms in Europe. These studies used correction factors (predator removal and search efficiency rates) to adjust the figures. (1) This is only the number of large sized birds. Small sized birds are not included because they weren't surveyed. (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.

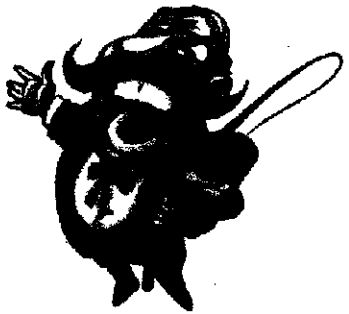
WIND TURBINES AND BIRDS IN FLANDERS:
PRELIMINARY STUDY RESULTS AND RECOMMENDATIONS

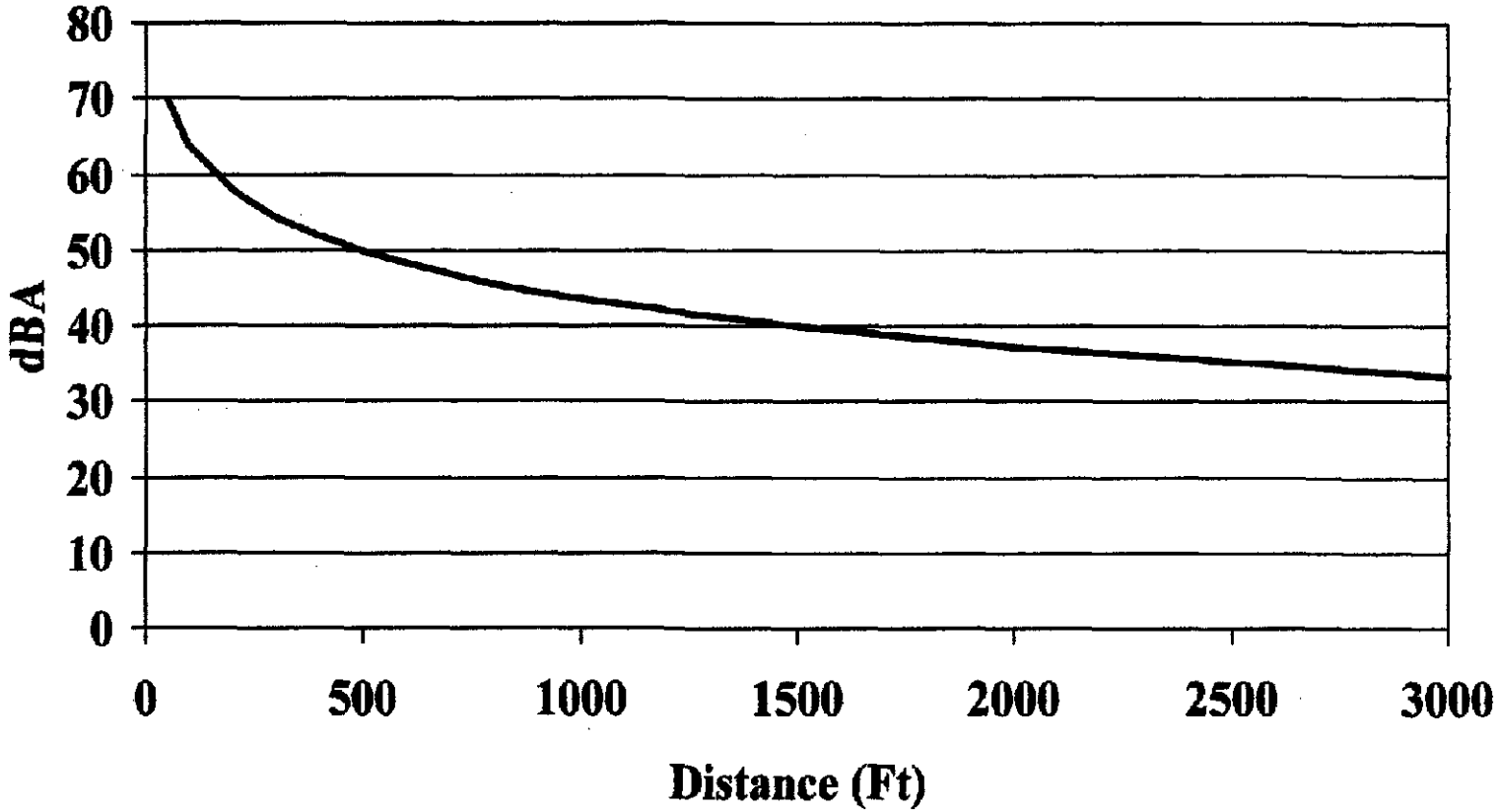
JORIS EVERAERT

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

Single Wind Turbine Noise Level

Model: NM-82 WTG

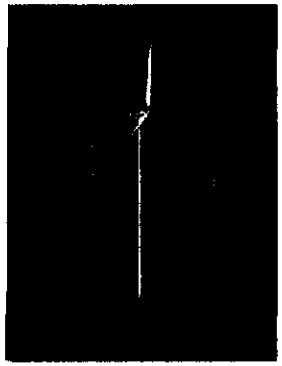




Wind Speed- 8m/s, relative humidity 80%, 50 degrees F, no attenuation from trees, terrain or barriers

Energy Ventures Analysis Inc

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 though 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

  [redacted]

  - **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

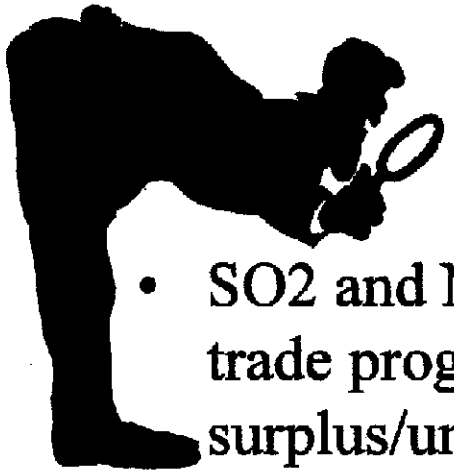
- **No air emissions**
  - SO2/NOx emissions maybe displaced **but are not avoided**. Displaced generation can sell/transfer their emission credit to other stations/units. As environmental limitations continue to tighten, the amount of displaced emissions will continue to decrease.
  - Projects will 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 NOx 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.