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September 14, 2009

Corey R. Wiktor, Executive Director, and
Members of the Board of Directors:
Thomas E. Buffamante, Chairman
Joseph E. Higgins
Salvatore Marranca
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Cattaraugus County Industrial Development Authority
P.O. Box 1749
3 East Washington Street
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Re: Proposed Uniform Tax Exemption Policy (UTEP) for Wind Farms

Dear Mr. Wiktor and Members of the Board:

Respectfully, on behalf of Concerned Citizens of Cattaraugus County, Inc. (CCCC), please accept the following comments on the above-reference proposal.

CCCC includes about 600 dues-paying families throughout the county, including about 50 families in the Machias-Yorkshire-Ashford and Chipmonk (Town of Allegany) areas with serious concerns about the manner in which active wind farm proposals in their communities would be sited and financed. Siting and financing such projects are not easily separated, contrary to the position so far taken by CCIDA. Because these and other wind farm projects are waiting to see whether the lucrative tax exemptions that would be provided under the proposed UTEP will in fact become available, CCIDA cannot avoid the conclusion that its proposed policy will have the effect of facilitating these projects. As CCCC member Bradley Parker noted in comments he made at the September 10 public hearing on the UTEP proposal, CCIDA has gone as far as to provide to the Town of Ashford one or more model local ordinances regulating the siting of wind farms. Both the direct and indirect involvement of CCIDA in facilitating the siting of these projects should cause the Board to look closely at whether on balance, after generally considering siting issues, the proposed UTEP policy is in the public interest. It is to this question that these comments are primarily addressed.

In addition, CCCC has serious concerns about the proposed UTEP's design that divides developer payments into two parts, one CCIDA would deem payments-in-lieu-of-taxes (PILOT),

the other for which CCIDA would disavow responsibility and consider an arrangement made exclusively between the developer and the host town. Because the authority for UTEPs under General Municipal Law requires that all developer payments be deemed PILOT payments, we believe this aspect of the proposed UTEP may exceed CCIDA's authority.

Accordingly, these comments will address (1) the reasons why wind farm development has become controversial–there are good reasons to conclude that the balance of benefits and burdens is not in the public interest–and (2) questions about the legality of the specific approach to financing adopted in the proposed UTEP. Two appendices are provided that discuss in detail the poor performance of wind farms in New York, and the technical basis for concerns about noise and health impacts. A number of supporting documents are also provided as attachments.

I. CCIDA SHOULD LOOK CLOSELY AT THE BALANCE OF PUBLIC INTERESTS THAT WOULD BE AFFECTED BY FACILITATING WIND FARM DEVELOPMENT IN CATTARAUGUS COUNTY

Nobody wants to hear about the research into the poor performance of wind power and the intrusive effects of wind farms on rural residential communities. –Not the schools, not the county, not the towns and not CCIDA. But you need to hear because what you are proposing to do will alter the environment in the County for generations. And for what?

Wind farms do not provide any electricity to the community where they are located. The ability of wind energy to displace CO_2, according to the best research will be about 2 percent by 2030 if we achieve the full build-out of wind farms projected by the U.S. Department of Energy.[1]

And everywhere wind farms are sited in rural residential communities there are complaints.[2]

The most serious complaints are about chronic noise.[3] But there are also legitimate

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[1] *See* Appendix I, "The Poor Performance of Utility-Scale Wind Farms in New York."

[2] Compared to high wind resource coastal areas in sparsely populated in Northern Europe, opposition to wind farms "is more serious in the Mediterranean as it is densely populated and/or devoted to tourism so that local business or even residents are opposed to wind turbine sitting. . . . [L]ocal opposition has proved a particular obstacle to projects in the Mediterranean and coastal areas, leading to more inland installations in northern and eastern France where wind conditions are relatively worse." Nicolas Boccard, *The Social Cost of Wind Power* (June 2008), 8, draft privately printed, available at <http://www.idei.fr/doc/conf/eem/papers_2008/boccard.pdf>.

[3] *See* Appendix II, "Background on Wind Turbine Noise."

concerns about property devaluation, both on account of noise and account of the visual blight of the landscape, which occurs much farther away. This is what realtors call "viewscape," one of the prime factors that sells a home in the country.

People living near wind farms have sold their homes at a loss, sometimes abandoned them on account of the noise, and recently people have begun suing the wind developers and those who leased land to them.

What are the benefits of industrial wind power?

Wind power is justified by its ability to meet two goals:

(1) meaningfully reduce dependence on foreign oil, and

(2) displace greenhouse gas emissions from conventional power plants.

The first benefit is easy to dispel: generally, we don't burn oil for electricity in the United States.

The second benefit is more complicated, but it is also an illusion. We have good evidence that wind farms need conventional power plants to run in reserve when the wind dies down, and even when the wind is blowing wind farms perform poorly, generating very little electricity.

Because wind energy is intermittent, baseload power plants must be maintained in the background, with the capacity to supply nearly all the electricity wind farms could provide. When wind farms stop operating, these baseload plants must be asked by the grid operator to ramp up, and when the wind blows the grid operator asks baseload plants to ramp down. This adds inefficiency to the baseload plants' combustion of fossil fuel–usually natural gas, because coal plants cannot ramp up and down fast enough–and grid management costs. And inefficient burning of fossil fuels increases their emissions.[4] But clearly, the need for backup power plants means that wind power does not eliminate power plants.

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[4] *Cf.* Tyndall Centre for Climate Change Research, *Security assessment of future UK electricity scenarios,* July 2005, available at <http://www.tyndall.ac.uk/research/theme2/final_reports/t2_24.pdf>. ("Due to a relatively small capacity contribution of intermittent sources [in particular, wind energy sources] a considerable number of conventional plants might be running at low output levels over a significant proportion of their operational time to accommodate this intermittent energy. Consequently these plants will have to compromise on their efficiency resulting in increased levels of fuel consumption as well as emissions per unit of electricity produced.").

The wind industry likes to say wind farms operate at a 30% "capacity factor," a measure of what they can generate compared to their nameplate capacity. That's already rather poor performance because traditional power plants generally have a 90% capacity factor. However, the largest U.S. manufacturer of wind turbines GE Energy has reported that wind farms in New York will have an "effective capacity" of 10%.

When you consider that a typical wind farm has a 100 MW nameplate capacity, this means it will generate in fact only about 10 MW on average. A major conventional power plant has a 1,000 MW nameplate capacity and generates at close to that rate. It will therefore not be possible for wind to displace a meaningful amount of greenhouse gas emissions from conventional power plants.

What are the burdens of a wind farm?

The typical 100 MW wind farm requires 25 square miles.[5] Noise from the wind farm at nuisance levels will affect people about a mile away. Visual impacts will degrade the viewscape five miles away or more, depending on topography.[6] Habitat fragmentation caused by access roads to wind turbine sites and clear-cutting for transmission lines can be substantial.[7]

Let's look only at noise. The research shows (1) wind farm noise is significantly more annoying than other noise sources at the same decibel (loudness) level; and (2) wind farm noise

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[5] This is based on the effective project area for the proposed Noble Environmental Power 100.5 MW Allegany Wind Park in the western new York towns of Centerville and Rushford. Although the stated project area is 7,633 acres (about 12 square miles), the project area map shows this is broken up into numerous parcels within an area 8 mi. x 3.2 mi., or 25.6 sq. mi. *Cf.* Noble Environmental Power, Allegany FEIS, REVISED FIGURE 2.23-2, PROJECT FACILITIES MAP, available at <http://www.noblepower.com/our-windparks/allegany/AlleganyFEIS.html>.

[6] In addition, New York State Department of Health has linked shadow flicker from wind turbines to dilation of blood vessels in the eyes and associated headaches (neural oscillation) in healthy people. Letter from A. Kevin Gleason, Assistant Director, Bureau of Toxic Substance Assessment, NYSDOH, to James P. Sherron, Executive Director, Steuben County IDA (comments on Ecogen LLC, Prattsburgh/Italy Wind Farm proposal), June 7, 2005, p. 4 (on file with the Author).

[7] U.S. Fish and Wildlife Service (FWS), INTERIM GUIDELINES TO AVOID AND MINIMIZE WILDLIFE IMPACTS FROM WIND TURBINES, p. 4 (May 13, 2003), available from <http://www.fws.gov/habitatconservation/wind.html>. FWS must be consulted whenever a wind farm requires Clean Water Act Section 404 permit from the U.S. Army Corps of Engineers.

results in chronic sleep disturbance for a significant number of those who live within a mile away, and chronic sleep disturbance, in turn, results in serious health effects.

These findings are consistent with DEC guidelines for assessing noise impacts. DEC's guidelines say an increase of 10 decibels is perceived as a doubling of loudness, an increase of 20 decibels quadruples loudness. DEC says an increase of 20 decibels should be considered "very noticeable to intolerable."

Existing sound levels have been measured in several rural communities targeted for a wind farm. These measurements consistently show sound levels about 25 dBA.

Instead of doing their homework, towns frequently rely on "model ordinances" available from state agencies based on wind industry recommendations. These ordinances generally allow wind turbine noise to reach 50 decibels at a person's home. This is an increase of 25 decibels, which DEC considers intolerable.

Local officials generally adopt the 50 decibel standard because they want the money, and they want to help those few in their community who have taken money from the developer.

Where does the money come from?

But where does the money come from? It is not earned, as you might think. It's almost all tax credits from the federal and state government, which come from taxpayer payments. A recent study finds that when all these tax credits are combined, wind projects have a -164% tax rate.[8] That is, they are paid 100% of the capital cost of the project plus another 64%.

The biggest chunk of public money is called the Production Tax Credit, two cents per kilowatt hour for electricity generated from a wind farm. If a wind farm generates 10 MW on average over the course of a year, that's 87.6 million KWhs or $1.75 million in tax credits per year for ten years. Wind farms are financed in large part by selling the right to those tax credits to investors who, unlike wind farms, have enough income to generate sufficient tax liability to take advantage of the credits. However, when enterprise incomes declined precipitously last fall, wind industry lobbyists complained to Congress that they could not finance wind projects, so the PTC should be converted into an outright grant. Congress agreed, and in the Stimulus Bill enacted into law last February a provision was added allowing wind farms to take a lump sum grant from the U.S. Treasury for 30% of the project cost in lieu of the PTC, so long as they construct the wind

[8] Gilbert E. Metcalf, *Taxing Energy in the United States: Which Fuels Does the Tax Code Favor?* MANHATTAN INST. (January 2009), p. 5, Table 2, available at <http://www.manhattan-institute.org/html/eper_04.htm>. Metcalfe is Professor of Economics at Tufts University.

farm by 2011.[9] In the first disbursement of the new grant benefit, the Cohocton wind farm in the Finger Lakes region last week got a check for over $74 million from Treasury.[10] It is estimated that this program, which unlike Cash-for-Clunkers has no cap, will cost taxpayers $10 billion over the next three years.[11]

In New York, additional revenue comes from NYSERDA, which awards grants to wind farms out of money it takes from electricity customers in what's called the Service Benefit Charge added to utility bills. This is a charge not for anything the customer gets. It's in addition to the charge for electricity and the delivery service.

Wind farms are exempt from local property taxes. Instead they offer to pay about 20% of the amount they would be taxed at their assessed value. This is a small fraction of the public money from tax credits and government grants that provide the primary source of revenue to a wind farm. This fraction is simply transferred from taxpayers to local governments.

Most of the money goes to foreign investors who have purchased the rights to the public money revenue stream that makes wind farms possible. This is not capitalism, because none of this money is an earning on investment. Maybe it's socialism, because almost all the money involved comes from government. Robert Bradley has written about the concept of deriving profits from tax credits, which originated with Ken Lay at Enron and survives in wind farm financing, and he calls it political capitalism.[12] Not market capitalism, because there is no market.

Wind farms are guaranteed the wholesale price for electricity. There is no competition. All that's required is that a wind developer make deals with local governments and an IDA, and the federal and state tax credits flow from deals wind industry lobbyists previously obtained from Congress and Albany. These tax credits are not used by the wind farm because with such poor performance they do not generate enough income to use them. Instead, they go the subsidiaries of the foreign investors, many of them involved in highly polluting enterprises.

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[9] *See generally* for the PTC, Jeffry S. Hinman, *The Green Economic Recovery: Wind Energy Tax Policy After Financial Crisis and the American Recovery and Reinvestment Act of 2009*, 25 J. ENVTL. LAW & LITIG. 35, at 55-68 (2009).

[10] U.S. Department of Energy (DOE), *Treasury, Energy Announce $500 Million in Awards for Clean Energy Projects,* September 1, 2009 (press release), available at <http://www.energy.gov/news2009/print2009/7851.htm>.

[11] Russell Gold, *Wind Farms Set Wall Street Aflutter*, WALL STREET JOURNAL, August 31, 2009.

[12] Robert Bradley, *Who Was Ken Lay? (The Senate should know the industry father of U.S.-side cap-and-trade)*, July 7, 2009, available at MasterResource: A free-market energy blog, <http://masterresource.org/?p=3644>.

Is this a good idea for Cattaraugus County?

There are right now a number of wind farm developers waiting for CCIDA to open the door to their projects. A handful of property owners, many of them living outside the County, are standing with them. They've been waiting for a couple years. Now that Congress has sweetened the pot with a new grant program, they want to make sure these projects can break ground by 2011.

CCIDA is not being honest if it takes the position that it does not know about these projects, and it has nothing to do with promoting them. Wind energy developers in New York commonly purchase land use rights a year or more in advance of the process of approaching local authorities.[13] Concerned Citizens of Cattaraugus County has obtained a list of recorded land use agreements from the county clerk and, on this basis, has a project area map for projects in Allegany, Machias, Yorkshire, Ashford, Freedom and Farmersville.

Often, local officials are asked to become "participating" landowners, raising ethics questions.[14] This allows the developer to secure a small but vocal band of pro-wind supporters who have been given an initial payment and a promise of annual payments for every turbine that can be sited on their land. The typical land use agreement includes provisions requiring the participating landowner to support the project, prohibiting any conduct criticizing the project, and prohibiting any release of information about the terms of the agreement.

Having made financial commitments for a wind project, the developer and its participants lobby CCIDA and each local government, offering money. No electricity, just money. From the town they ask for setbacks and noise limits that will accommodate the planned project area.

In advance of any local regulation the developer also often signs up with the New York Independent System Operator (NYISO) for approval of a grid interconnection request, and this puts them on a tight time frame: NYISO puts the request on a queue for processing, it takes about

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[13] This and the account in the next four paragraphs is based on my involvement in over a dozen wind farm controversies throughout New York over the last 18 months.

[14] This aspect of wind farm development has led to an ongoing investigation begun in 2008 by the New York State Office of Attorney General (NYSOAG) into improper dealings between wind farm companies and local government officials recently resulted in an agreement by most wind farm companies in New York to comply with a Code of Conduct drafted by the AG's office. Ken Belson, *Amid Talk of Hidden Deals, Wind Firms Agree to Code of Conduct*, NEW YORK TIMES, October 31, 2008; NYSOAG, *Attorney General Cuomo Announces New Ethics Code Adopted by Wind Industry Companies Across NY*, July 29, 2009. The NYSOAG press release last cited and the text of the recently revised Code of conduct are available at <http://www.oag.state.ny.us/media_center/2009/ july/july29a_09.html>.

36 months to come to the head of the queue for consideration,[15] but NYISO wants to see that most state and local approvals are in hand before they will consider a request that has gotten that far. If the local approvals have not been obtained, the developer's request is moved to the back of the queue and must wait to come to the head of the queue all over. If the developer's request is delayed in this way, its financial backers often pull out.

Feeling pressure from a vocal fraction of the community early on in the process of reviewing a project, responsible siting standards that might require a smaller project or no project at all often go out the door.[16]

The most charitable perspective on this whole situation is that big money is gaming a system that was supposed to have some public benefit but has very little.

A more critical perspective would conclude that this an investment scam, a ripoff of public money based on an Enron-like concept of profits from government tax credits.

Either way, the schools, the County, the towns and CCIDA should be considering whether promoting these projects in Cattaraugus County is in the public interest.

Do payments from a revenue stream derived almost entirely from public money raised from taxpayers outweigh the blight on the land from as many as ten 25 square-mile wind farms?

Do these payments outweigh the failure of wind energy to make a meaningful contribution to reducing our dependence on foreign oil and addressing climate change?

Do these payments outweigh the likely property devaluation that would occur in and around each wind farm? –A town board member from Attica, where they recently banned wind farms, like over a dozen other towns in New York, did an analysis of the effect on an owner of a $100K home near a wind farm. Property value loss of up to 50% has been reported for such homes. But if the homeowner suffers a 20% loss in the value of her home, he concluded that

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[15] New York State Energy Planning Board, DRAFT NEW YORK STATE ENERGY PLAN 2009, "Siting New Energy Infrastructure" (August 2009) at 4, available at <http://www.nysenergyplan.com/Issue_Briefs/Siting New Energy Infrastructure - IB.pdf> ("NYISO has indicated that its entire interconnection process may take anywhere from 27 to 52 months, with most projects taking between 36 and 38 months.").

[16] As discussed in detail in Appendix II, the issues raised by wind farms are complex and technical. For example, highly elevated wind turbines do not emit noise the way acoustic models for construction and road noise assume, as there is no ground absorption of noise over distance. Low frequency noise is a significant component of wind turbine noise but not most other industrial noise sources.

under the typical host benefit fee paid by wind farms to towns, nearly eliminating town taxes, it would still take 36 years to come out even.

Do wind farm payments outweigh the impact of constant noise on residents for many nights, and the health effects many of them will suffer?

Should CCIDA not only join but encourage all the other affect tax jurisdictions–the school districts, the County and the towns–to feed at the trough of public money at the expense of citizens who live here and stay here for the environmental amenities, for peace and quiet–not to be guinea pigs in an industrial experiment?

Conclusion

The wind farm controversy[17] is like the landfill siting disputes of the 1990s. In the landfill disputes citizens in about two dozen towns in western and central New York where regional landfills were proposed did a considerable amount of research and public education. They found:

- all landfills eventually leak
- landfills cannot be contained
- waste hauling truck accidents and road damage are likely
- land gas pollution is certain
- water pollution could have catastrophic effects on water supplies

Once local government officials started to listen–and it took some time–they adopted restrictive local laws that stopped new landfills, or adopted outright bans on landfills.

It's the same today with wind farms. The issues are different, but like citizens concerned about landfills, those voicing concerns about wind farms have done their homework and found that a campaign of misinformation has been waged by the developers.[18] If citizens have

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[17] *See* Bob Vila, *Green Backlash: The Wind Farm Controversy*, available at <http://www.bobvila.com/HowTo_Library/Green_Backlash_The_Wind_Turbine_Controversy-Subject_Green_Building-A3923.html>. Bob Vila is the television show host for *This Old House*, *Bob Vila's Home Again* and *Bob Vila*. *See also below*, under "Selected Documents."

[18] Among the most troubling misinformation tactics is the use of nameplate (or 100% design) capacity to calculate the benefits of wind energy, and the assertion that wind turbine noise is unnoticeable. These claims are addressed at length in Appendix I and II, below. However, it is worth noting that based on data from the International Energy Agency, the global average capacity factor for wind farms is just under 20%, and the best sites can achieve capacity factors approaching 40% in places only like the North African desert. For a down-to-earth explanation of "capacity factor," *see* the British internet energy blog LIGHTBUCKET, "The

legitimate concerns, based on research and reasonable skepticism that the benefits of industrial wind energy outweigh the burdens, they are not selfish NIMBYs.

It is the people who have been paid by wind developers, and are motivated by promises of future payments, and the wind developers themselves who want to take advantage of cash-strapped rural towns and counties who are selfish. If there are virtually no benefits from utility-scale wind farms, and its all about money at the expense of one's neighbors and the local environment, then it is the proponents of big wind who are selfish, not the unpaid volunteers in citizens groups who have done their homework.

Participating in an outside investment scheme that provides few permanent jobs and threatens large portions of the local environment is not on balance in the county's interest. A nearly unanimous County Legislature took this same position when in the 1990s it spent hundreds of thousands of dollars fighting the Farmersville landfill proposal. CCIDA should reach a similar conclusion about this UTEP proposal. The result will be that local governments asked to host wind farms will more likely take a hard look at the environmental issues with the benefit of appropriate public participation.

The practical ability of concerned citizens in each community where these projects are considered to meaningfully participate in siting decisions will be diminished if CCIDA adopts the proposed UTEP because it will be assumed that a County policy to invite wind farm development has been established. By deferring to town boards and planning boards for consideration of the important environmental impact issues, CCIDA will be fostering the view that these issues are less important than the financial issues. The effect of the UTEP, however inadvertent, will be to divert attention from the burdens of wind farm development and further marginalize those with legitimate concerns.

II. THE LEGALITY OF THE PROPOSED UTEP IS QUESTIONABLE

In its introductory remarks at three public hearings on the proposed UTEP, counsel for CCIDA discussed litigation challenging a Steuben County IDA policy to disburse payments from wind farm developers so that schools and the County get less because a portion of the payments were planned to go to the host town, outside the formal PILOT agreement with the developer. My comments below show that CCIDA's policy is not different from Steuben County IDA's.[19]

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capacity factor of wind power," available at <http://lightbucket.wordpress.com/2008/03/13/the-capacity-factor-of-wind-power/>.

[19] The Jefferson County IDA has specifically rejected this split payment approach. Nancy Madsen, *JCIDA crafts tax-exemption formula*, WATERTOWN DAILY TIMES, September 6, 2009.

Split payments under CCIDA's UTEP are not authorized

Instead of taking in the full amount wind developers are willing to pay–about $8,500 per megawatt, or $850 million for a typical 100-MW wind farm–IDA is proposing the fiction that it would take in $5,000, leaving the balance for the host town. In other words, wind developers are offering IDA $8,500, but IDA is proposing to disburse $5,000 of this amount through a PILOT agreement for 15 years and to allow the host town to "negotiate" the remaining $3,500 per MW. But with whom is the town negotiating? Not with the wind developer, because IDA has with its proposal already decided that $3,500 will be carved out of the developer's money.

IDA's proposal would result in revenue split among the school district, the County and the host town roughly 50%-40%-10%, respectively, or about $2,500 per MW to the school, $2,000 to the County and $500 to the town. The town also gets $3,000 per MW in addition to the disbursement from the PILOT payment.

Assuming a 100 MW project, this is the result:

Annual payments under CCIDA wind farm UTEP proposal[20]

school district(s)[21]	$ 250,000
County	$ 200,000
town(s)	$ 50,000 + 300,000

However, under the statute that authorizes the IDA to administer PILOT payments, (GML § 858[15]), IDA is required to allocate all revenues associated with a project it sponsors unless all the affected tax jurisdictions agree to some other arrangement. CCIDA's proposal violates the statute because the affected tax jurisdictions have not agreed to split the payments from the developer so that $3,500 per MW is left out of the PILOT disbursement. If the $3,500 per MW were included in the proposal, as the law requires, for a 100 MW project this is the result:

[20] Under CCIDA's proposal, these payments would increase by 5% each year during the 15-year term of the PILOT agreement with the developer.

[21] Since wind farms require a project area about 25 square miles, more than one school district or town may become affected tax jurisdictions among which PILOT payments must be disbursed.

Annual payments under GML § 858[15][22]

school district(s)	$ 425,000
County	$ 340,000
town(s)	$ 85,000

Specifically, under the CCIDA proposal for the 15-year term of PILOT payments, the County is forgoing $2.1 million it would otherwise receive, and school districts are forgoing more than $2.6 million.

No school districts has agreed to the lesser amount it would receive under the IDA tax exemption/PILOT proposal. Nor has the County or any town. Therefore, the proposal would illegally divert funds that would normally be disbursed under the law.

Tax jurisdictions that have "opted out" of the tax exemption for wind farms under Real Property Tax Law Section 487 get no benefit from their decision under CCIDA's UTEP

Most school districts, many towns and the County have opted out of Section 487 of the Real Property Tax Law, which would otherwise exempt these projects from local property taxes. They did so believing they would have leverage in negotiating a deal with a developer should a wind farm be proposed. But this section of Real Property Tax Law has no effect when IDA sponsorship makes a project tax exempt under *General Municipal Law*. By sponsoring a wind farm, IDA pulls the rug out from under tax jurisdictions that had hoped to maximize their benefits by negotiating their own deal. Once IDA sponsorship exempts the project from property taxes, there is nothing left to opt out of under Real Property Tax Law. Those tax jurisdictions that opted out are left with no leverage to negotiate a better deal.

This complicated and potentially conflict-ridden situation was supposed to be avoided by CCIDA's proposal. However, it is likely to have the opposite result. This is what happened in the Naples School District case. In that case, the Steuben County IDA adopted a similar split in the payments obtained from a wind developer, allowing a portion of the payments to go the host town in a side agreement, outside the PILOT agreement. The school district filed a complaint in court, taking the position that all the money paid out by the developer must be disbursed proportionally to each tax jurisdiction, regardless of whether money is or is not administered through a PILOT agreement.

[22] This section of the statute provides that the disbursement of payments in lieu of taxes must be proportionate to the taxing authority of each affected tax jurisdiction. Section 17 (discussed below) provides that *all* payments to an affected tax jurisdiction are "payments in lieu of taxes."

Naples School District relied on GML § 858[17], which states that proportional disbursement must be applied to "*any* payment made to an agency, or affected tax jurisdiction." Since the side-agreement for extra host benefit fees to the town was a payment to an affected tax jurisdiction, the statute directs IDA to disburse that money proportionately to the school, County and town. By disbursing only a portion of the payments, as Steuben County IDA tried to do, CCIDA will reduce payments to the schools and the County and thereby violate the law.

CCIDA is thus exposing itself to the same kind of lawsuit that Naples School District brought against its county IDA. If any school district in Cattaraugus County decides it is not fair or appropriate to give a gift of an extra $3,000 per MW to the town where a wind farm is located, they may bring the same kind of lawsuit against CCIDA as was brought against Steuben County IDA.[23]

Conclusion

Because wind farms are not financially viable without the tax exemption offered by IDA involvement, by deciding to become involved in wind farm projects CCIDA is clearly facilitating their development. In public informational meetings held last June, CCIDA acknowledged that several such projects are being developed in the County. These projects are waiting for CCIDA to adopt a policy for disbursing project payments before finalizing their plans. Under these circumstances it is clear that CCIDA's involvement in these projects is necessary before they can go forward.

Given the environmental issues raised by such projects and questions about CCIDA's authority to disburse less than all payments from the developers under a PILOT agreement, CCCC believes the better approach is for CCIDA not to sponsor any wind projects and instead to allow the terms of local payments to be negotiated directly with the developers by the affected tax jurisdictions.

It is inappropriate for CCIDA to adopt a policy facilitating wind farm development in Cattaraugus County without having taken a hard look at the potential environmental consequences of doing so. However, there are no state or federal siting standards that could guide CCIDA should it wish to look at environmental impacts of its proposed action. It would therefore be more appropriate to step away and allow each host community's local government to review the potential for such impacts, and to develop siting standards based on the outcome of that review.

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[23] As was argued in the Naples School District case, school districts may have six years to bring a lawsuit seeking a declaratory judgment regarding the interpretation of the relevant sections of General Municipal Law governing IDAs.

I would happy to meet with you and the CCIDA Board to discuss this matter further.

Respectfully submitted,

Gary A. Abraham
Attorney for Concerned Citizens of Cattaraugus County, Inc.

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encs.

ATTACHMENTS

Appendix I The Poor Performance of Utility-Scale Wind Farms in New York

Appendix II Background on Wind Turbine Noise

Selected Documents:

Performance of Utility-Scale Wind Energy Facilities

GE Energy, THE EFFECTS OF INTEGRATING WIND POWER ON TRANSMISSION SYSTEM PLANNING, RELIABILITY, AND OPERATIONS (REPORT ON PHASE 2), prepared for New York State Energy Research and Development Authority (NYSERDA) (March 4, 2005), p. 7.16, available at <http://www.nyserda.org/publications/wind_integration_report.pdf> (excerpt).

Anselm Waldermann, *Wind Turbines in Europe Do Nothing for Emissions-Reduction Goals*, SPIEGEL ONLINE, February 20, 2009.

Tax Financing

Gilbert E. Metcalf, *Taxing Energy in the United States: Which Fuels Does the Tax Code Favor?* MANHATTAN INST. (January 2009), p. 5, Table 2, available at <http://www.manhattan-institute.org/html/eper_04.htm> (excerpt).

Nancy Madsen, *[Stimulus] Bill has help for energy projects*, WATERTOWN DAILY TIMES, March 2, 2009.

Jason Cox, *Windmills a sound investment?*, CORNING LEADER, April 6, 2009.

Teresa Hansen, *International Investors Still Drawn to U.S. Renewable Energy Market*, ELECTRIC LIGHT & POWER, July 1, 2007, available at <http://www.elp.com>.

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Appendix I

The Poor Performance of Utility-Scale Wind Farms in New York

Americans' support for utility-scale wind energy development is nearly unanimous.[1] Most probably look askance at "wind opponents," and would believe claims that wind energy (1) will meaningfully reduce dependence on foreign oil and (2) displace greenhouse gas emissions from conventional power plants.[2] However, there is little evidence that wind power can achieve these two goals.

Wind energy does not meaningfully effect our dependence on foreign oil

Almost all emissions from combustion of oil products comes from the transportation sector.[3] Only about one percent of electric power comes from oil combustion nationally, and about three percent in New York.[4] Some of that oil is produced domestically.

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[1] Yale Center for Environmental Law & Policy, SURVEY ON AMERICAN ATTITUDES ON THE ENVIRONMENT, "Key Findings" (2007) at 6, available at <http://envirocenter.research.yale.edu/uploads/epoll/YaleEnvironmentalPoll2007Keyfindings.pdf>).

[2] *See* Comment, *Addressing the Impacts of Large Wind Turbine Projects to Encourage Utilization of Wind Energy Resources*, 27 TEMP. J. SCI. TECH. & ENVTL. L. 123, 133 (2008) (development of industrial wind energy facilities is justified by "concerns regarding anthropogenic climate change and United States dependence on foreign fossil fuel supplies") (citing Pew Center on Global Climate Change, <http://www.pewclimate.org/global-warming-basics/basic science>; Charles Komanoff, *Wind Power's Displacement of Fossil Fuels*, April 21, 2009, privately printed and available at <http://www.komanoff.net/wind_power/Wind_Power's_Displacement_of_Fossil_Fuels.pdf> (claiming that each megawatt of wind power displaces a megawatt of fossil-fuel power plant emissions); Charles Komanoff, *In the Wind*, ALBANY TIMES UNION, September 18, 2005, available at <http://www.komanoff.net/wind_power/in_the_wind.php> ("what good is a windmill-free sanctuary if the whole Earth is ravaged by ruinous climate change that the windmills could have helped avert?").

[3] U.S. Energy Information Administration (EIA), *U.S. Primary Energy Consumption by Source and Sector, 2008*, available at <http://www.eia.doe.gov/emeu/aer/pecss_diagram.html> (95% of U.S. oil consumption occurs in the transportation sector).

[4] EIA, *Electric Power Monthly*, January 2009, Table 1.2, available at <http://www.eia.doe.gov/cneaf/electricity/epm/epm_sum.html> (in 2006, only about one percent of the electricity generated in the United States was produced using oil); EIA, *State Energy Profiles: New York*, available at <http://tonto.eia.doe.gov/state/

Wind energy does not meaningfully reduce greenhouse gas emissions

Because electricity storage is not practical, electricity is consumed the instant it is generated. Intermittent sources like wind and solar avoid carbon emissions only when they are generating, so their nameplate or "installed" capacity in MW has no relation to their ability to displace carbon emissions from other sources.[5]

Utility-scale wind power plants operate at very low capacity

The actual capacity of wind farms to generate electricity is far lower than their nameplate capacity. GE Energy reported to NYSERDA in 2005 that, while the *capacity factor* of utility-scale wind turbines is about 30%, the "effective capacity" of these turbines *in New York* is closer to 10% annualized, "due to both the seasonal and daily patterns of the wind generation being largely out of phase with the NYISO load patterns."[6] That is, most electricity from wind power is generated during cold winter nights, but electricity load (demand) is greatest during warm summer days. As a result, the use of up to two-thirds of wind-generated electricity is transmitted to the grid at times when it is not needed. Thus, wind farms in New York can be expected to effectively generate 10% of their nameplate capacity to displace fossil-fuel-generated electricity.

Wind resources in New York are poor

it is difficult to find adequate wind resources for land-based wind farms. The best wind

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state_energy_profiles.cfm?sid=NY> (2.5% of New York's oil consumption is used for electricity generation).

[5] This is obscured by wind project sponsors who emphasize the installed capacity of their projects can provide enough electricity to serve so many thousands of homes. The average home consumes about one MWh per month, but could not rely on wind power to do so because of its intermittency.

[6] GE Energy, THE EFFECTS OF INTEGRATING WIND POWER ON TRANSMISSION SYSTEM PLANNING, RELIABILITY, AND OPERATIONS (REPORT ON PHASE 2), prepared for The New York State Energy Research and Development Authority (NYSERDA) (March 4, 2005), p. 7.16, available at <http://www.nyserda.org/publications/wind_integration_report.pdf>. Early "wind resource performance data has tended to validate the use of the [2005] GE study." New York State Reliability Council, L.L.C., INSTALLED CAPACITY SUBCOMMITTEE MEETING #76, May 4, 2007, at 5, available at <http://www.nysrc.org/pdf/ICSMeetingMinutes/20070504 ICS Minutes_Final.pdf>.The GE study findings are generally consistent with the capacity factors assigned to upstate land-based wind farms by NYISO, 10% summer, 30% winter. *See* NYISO, 2007 GOLDBOOK, pp. 45, 58 available at <http://www.nyiso.com/public/webdocs/services/planning/planning_data_reference_documents/2007_GoldBook_PUBLIC.pdf>.

resources are off shore. The wind industry acknowledges that Class 4 winds or better (in a classification from 1 to 7, with 7 the best) are required to make utility-scale wind projects viable. Midwestern states have abundant winds in those classes but New York does not.[7] The only large land-based area with sustained Class 4 winds in New York (mean wind speed of 16.8 mph at 262 feet above ground surface) is the Tug Hill Plateau, the site of the 195-turbine Maple Ridge Wind Farm, but Maple Ridge reports of actual generation rates to the Federal Energy Regulatory Commission (FERC) show that it barely exceeds a 20% generation rate compared to nameplate maximum capacity.[8] No other wind farm in New York has achieved a 20% generation rate, and as GE Energy found, because most of that electricity will be generated on winter nights, the effective capacity will be less.

Wind farms require a substantial amount of what they can generate to be operated in reserve by other electric utilities

European grid operator (and wind farm developer) E.On Netz reports that "wind farms can only replace traditional power station capacities to a limited degree," specifically about four percent.[9] There is very little empirical evidence to assess how much emissions displacement this would mean. Certainly some emissions displacement results from wind farms, and the failure to retire fossil-fuel-fired power plants despite substantial reliance on wind in Europe can be accounted for partly by rising electricity demand, which wind energy has been unable match. These facts are not enough, however, to support claims of a 1-to-1 displacement of traditional power plant electric generation.[10]

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[7] *Cf.* NAS, 65-66 ("Wind energy will contribute proportionately less to electricity generation in the mid-Atlantic region than in the United States as a whole, because a smaller portion of the region has high-quality wind resources than the portion of high-quality wind resources in the United States as a whole.").

[8] *Cf.* FERC, *Electric Quarterly Reports (EQRs)*, Download Spreadsheets utility (by quarter and name of company), available at <http://www.ferc.gov/docs-filing/eqr/data.asp>.

[9] E.ON Netz GmbH, WIND REPORT 2005, p. 10, available at <http://www.eon-netz.com/pages/ene_en/EEG__KWK-G/Renewable_Energy_Sources_Act_/EEG_plants/Facts_and_figures_relating_to_wind_power/index.htm> ("In order to also guarantee reliable electricity supplies when wind farms produce little or no power, e.g. during periods of calm or storm-related shutdowns, traditional power station capacities must be available as a reserve. This means that wind farms can only replace traditional power station capacities to a limited degree. . . . In concrete terms, this means that in 2020, with a forecast wind power capacity of over 48,000MW (Source: dena grid study), 2,000MW of traditional power production can be replaced by these wind farms.")

[10] The claim that wind results in a 1-to-1 displacement of fossil fuel power plants is made by Komanoff, *above*, footnote 2.

Wind energy proponents claim that greater reliance on wind energy does not require greater reliance on back-up or reserve sources of electricity, most of which will burn fossil fuels. This view is not shared by many energy analysts. The most comprehensive effort to estimate the potential for wind farms to displace greenhouse gas emissions in the foreseeable future, provided by the National Academy of Sciences, finds that a substantial amount of wind power needs to be backed-up by other generators, depending on the distinctive features of the transmission system into which wind power is integrated:

> . . . the cost of [wind energy's] intermittency (in terms of back-up or reserve requirements) will be less if the generation mix is dominated by power plants with fast ramp rates (gas, hydropower) than if it is dominated by coal or nuclear plants, which have high capital costs and slow ramp rates. . . . Denmark, for example, has access to substantial hydroelectric capacity, which it relies on to balance the intermittent output from wind-energy installations.[11]

In New York, the largest wind farm, Maple Ridge in Lewis County, "has been forced to shut down even with a brisk wind blowing" at times because existing transmission infrastructure is inadequate to handle a surge in load, and there are no plans to add more transmission capacity.[12] U.S. Energy Secretary Chu has estimated the cost of a national transmission system capable of utilizing wind resources (primarily in the midwest) will be as much as $1 trillion.[13] Planning for such expenditures in the U.S. has not yet begun.

Power plants kept operating in reserve generate more greenhouse gas than when operating efficiently

The increased need for reserve power resulting from greater reliance on wind energy increases the per-energy-unit emission rate of a natural gas-fired plant that would be directed to

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[11] National Academy of Sciences, ENVIRONMENTAL IMPACTS OF WIND-ENERGY PROJECTS (2007), p. 35, available at <http://www.nap.edu/openbook.php?isbn=0309108349> (hereafter cited as "NAS").

[12] Matthew L. Wald, "Wind Energy Bumps Into Power Grid's Limits," THE NEW YORK TIMES, August 27, 2008. At last December's meeting of the Governor's Energy Planning Board, which I attended, the Board acknowledged it was not considering transmission development needs.

[13] *Steven Chu Reacts to the Citizen's Briefing Book*, YOUTUBE (January 15, 2009), a 14-minute video available at <http://www.youtube.com/watch?v=i5_spDNuA4Q>, at 4:40ff., especially at 8:10.

ramp up and down more frequently.[14] Even if a more integrated "smart" transmission grid in the future allows intermittent sources to be better managed, this comes at the cost of a greater per-energy-unit emission rate, diminishing the offsets that can be expected from intermittent sources like wind energy.[15]

The highest emitting sources of greenhouse gas are not powered down when wind farms operate

However small, emissions reductions for the amount of electricity generated by grid connected wind power should come first from baseload coal-fired power plants because combustion of coal accounts for most CO_2 emissions.[16] But grid operators do not turn first to coal-fired power plants to accommodate intermittent power sources.[17] Instead, natural gas-fired plants are ordered by the grid operator to ramp up or down first because their ability to do so is much greater than that of coal-fired plants.[18] Little or no emissions reductions from coal

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[14] *See* Michael J. Trebilcock (Professor of Law and Economics, University of Toronto), *Wind power is a complete disaster*, NATIONAL POST (Canada), April 8, 2009, available at <http://network.nationalpost.com/np/blogs/fpcomment/archive/2009/04/08/wind-power-is-a-complete-disaster.aspx> ("recent academic research shows that wind power may actually increase greenhouse gas emissions in some cases, depending on the carbon-intensity of back-up generation required because of its intermittent character.").

[15] Tyndall Centre for Climate Change Research, *Security assessment of future UK electricity scenarios*, July 2005, pp. 5, available at <http://www.tyndall.ac.uk/research/theme2/final_reports/t2_24.pdf> ("Due to a relatively small capacity contribution of intermittent sources [in particular, wind energy sources] a considerable number of conventional plants might be running at low output levels over a significant proportion of their operational time to accommodate this intermittent energy. Consequently these plants will have to compromise on their efficiency resulting in increased levels of fuel consumption as well as emissions per unit of electricity produced."). *See also id.*, 24, 46.

[16] Komanoff, *above*, footnote 2, text at note 10.

[17] See NAS, 33 ("In general, coal-fired EGUs cannot be ramped up and down very easily, and their variable dispatch capacity is limited. Thus, they are more suited to baseload production (i.e., long periods of continuous power production) rather than to providing variable production to balance short term variation in load and demand."); D. Blakeway and C.B. White, *Tapping the Power of Wind: FERC Initiatives to Facilitate Transmission of Wind Power*, 26 ENERGY L. J. 393, 412 (2005) (compared to other conventional electric generators, nuclear and coal-fired power plants have "long ramp-up and ramp-down times").

[18] In response to my request for information about the basis for the U.S. Department of Energy National Renewable Energy Laboratory's (NREL) conclusion that 1,000 MW of new wind power in New York can be expected to reduce CO_2 emissions annually by 2.5 million tons,

combustion can therefore be realized as a result of greater penetration of wind energy. As a result, the National Academy of Sciences estimates that by 2020 wind-generated energy could displace about 8% of the capacity of more polluting sources, could displace no more than 2.25% of U.S. anthropogenic CO_2 emissions, and increases rather than decreases the need for reserve power, further reducing wind power's net displacement of CO_2.[19]

Manufacture and development of wind farms generates substantial amounts of greenhouse gas

Finally, "life-cycle effects [on greenhouse gas emissions], those effects caused by the development, manufacture, resource extraction, and other activities affiliated with all energy sources," will need to be accounted for in any assessment of wind energy's potential for emissions displacement.[20] For example, wherever they are sited wind farms require large amounts of concrete, production of which is one of the greatest industrial sources of CO_2 emissions. Taking into account the CO_2 generated by concrete production, industrial wind energy

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(*see* NREL, *Economic Benefits, Carbon Dioxide (CO2) Emissions Reductions, and Water Conservation Benefits from 1,000 Megawatts (MW) of New Wind Power in New York*, available at <http://www.windpoweringamerica.gov/filter_detail.asp?itemid=1950>), I received this reply on April 23, 2009 from NREL Markets and Policy Analyst Eric Lantz:

> The calculation is based on the average, non-baseload, CO2 emissions rate for US based electric power producers in the Northeast Power Coordinating Council (NPCC), approximately 1500 lbs/MWh. The emissions rates are from the U.S. EPA's eGRID database. *We assume wind power is a direct offset of non-baseload power producers but that it does not offset baseload generators.* The assumed capacity factor for wind power in New York is 37%.
>
> An example calculation is here:
>
> .37*1000 MW* 8760 = MWh of wind power generated per year; MWh wind per year * 1500lbs per MWh /2000 lbs per ton = 2.5 million tons

Email on file with the author (emphases added).

[19] NAS, 35, 52, 63-64. *But see below*, note 20.

[20] NAS, 4 (noting the NAS assessment was unable to take life cycle effects into account). According to industry lobby group Alliance for Clean Energy New York, "[t]here are over 8,000 components in a turbine." Alliance for Clean Energy New York, *New York and Wind Power: Linking Economic Development, Environmental Protection, and Energy Security*, Buffalo Niagara Wind Component Manufacturing Symposium, Buffalo, NY, July 15, 2009, 22 (listing components).

emits comparable volumes of greenhouse emissions as biomass, and not significantly less than natural gas by some estimates.[21]

The National Academy of Sciences was able to find only one analysis that compares the life cycle effects on global warming of hydroelectric, wind, solar, coal, and natural gas power plants, and this analysis was limited to the arid southwest U.S., finding that in that region wind and hydroelectric have lower global warming potential than the other three types of plants.[22]

Integrating substantial amounts of wind energy into the grid will likely disrupt service.

If investment in a "smart" grid is delayed, more and more wind power will result in electricity system disruption.[23]

To maintain transmission system reliability with substantial reliance on wind energy is costly. In Britain, the European nation with the greatest wind resource and a well developed transmission infrastructure, the cost of achieving only 1.3% of its electricity with wind energy was over $1 billion in fiscal year 2007-2008, causing electricity prices to rise almost 30% in one year.[24] Currently in the U.S., wind farms obtain between 130% and 164% of project costs from public money, including tax credits.[25] As noted above, in the future about $1 trillion must be

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[21] Richard Wilson, *Sustainable nuclear energy: some reasons for optimism*, 28 INT. J. GLOBAL ENERGY ISSUES 138-160, 148, Fig. 4 (2007) (citing J. Spadaro, REPORT TO INTERNATIONAL ATOMIC ENERGY AGENCY (Vienna, Austria), March 29, 2001.

[22] NAS, 32 (citing S. Pacca and A. Horvath, *Greenhouse gas emissions from building and operating electric power plants in the Upper Colorado River Basin*, 36 ENVIRON. SCI. TECHNOL. 3194-3200 (2002)).

[23] After investing heavily in wind power in a high wind resource region, the Canadian province of Alberta is reverting back to conventional fossil fuel power plants because, as a wind developer explained, "the greater percentage of the system depends on wind, the more vulnerable to disruption the system becomes when the wind stops blowing." Claudia Cattaneo, *Alberta turns to natural gas after wind lessens reliability*, FINANCIAL POST (Toronto, CN), April 20, 2007, <http://www.financialpost.com/story.html?id=f7ef4e6d-29f0-4a5e-95c3-084ff5eac8c0&k=3367>.

[24] Peter Glover and Michael J. Economides, *Wind Power Exposed: the Renewable Energy Source is Expensive, Unreliable and Won't Save Natural Gas*, ENERGY TRIBUNE (November 25, 2008), available at <http://www.energytribune.com/articles.cfm?aid=1029#>.

[25] Currently, the federal tax code pays wind farms 100% of the cost of the project through a five-year double-declining-balance for wind (and solar), and 30% through the Production Tax Credit. *See generally* Gilbert E. Metcalf, *Taxing Energy in the United States: Which Fuels Does*

spent to upgrade transmission capacity to utilize high wind resource areas in the U.S. midwest.[26]

New York's land base is insufficient to rely in wind

To install enough wind to make a difference, how much land is needed?

To generate 1,000 MW, the equivalent of one major traditional power plant, and applying GE Energy's 10% effective capacity to each 25 square mile 100 MW wind farm, about 250 squares will be needed. However, one study has concluded that because viable wind farm sites are limited to lands close to existing transmission lines with adequate wind resources, and half the land with adequate wind resources is located in the Catskills and Adirondacks, which are generally off-limits to wind farm development, only 0.3% of New York's land area, or 164 square miles is available.[27]

Conclusion

Regardless of the time it will take to plan and implement enhanced transmission systems that could accommodate significant reliance on wind, there is no question that megawatts of wind power do not displace megawatts (MW) of other sources on a 1-to-1 basis.

Perhaps the most important problem wind energy has yet to address is whether the cost required to implement it will squander financial and intellectual resources that could and should be devoted to more meaningful alternatives to fossil fuels. In addition to a $1 trillion cost for transmission upgrades that have yet to be planned, the U.S. is currently spending or forgoing billions in revenue on utility-scale wind turbines that have so far not demonstrated any potential to make a meaningful contribution to greenhouse gas reductions.[28] If the claims wind energy

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the Tax Code Favor? MANHATTAN INST. (January 2009), p. 5, Table 2, available at <http://www.manhattan- institute.org/html/eper_04.htm> (finding effective tax rate for wind energy is -164%). Metcalfe is Professor of Economics at Tufts University.

[26] *See above*, note 13.

[27] AWS Truewind, LLC, NEW YORK STATE WIND RESOURCE REPORT, TOWN OF ITALY AREA WIND RESOURCE REPORT, September 25, 2007, Appendix D to *Final Generic Environmental Impact Statement, Comprehensive Plan Amendment and Wind Energy Facilities Law, Town Of Italy* (December 2, 2008), pp. 3-4 (on file with the Author). The total land area of New York is 54,555 sq mi.

[28] Ironically, in light of the aesthetic objections to wind farms in communities that would host them, the motivation within state and federal government offices responsible for these expenditures appears to be primarily aesthetic. This may be well understood by the wind

proponents make about the potential to displace greenhouse gas emissions are wrong, we will have passed most of the climate change tipping points before real solutions are ready. By over reliance on grid-connected land-intensive renewables (wind, biofuels, solar), we will have also have caused serious environmental harm.

Until these questions are addressed, skeptics will continue to ask whether the level of intrusion by wind farms into rural residential communities in New York can be justified by their benefits.

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industry, which has worked hard to make the image of the industrial wind turbine in public media ubiquitous.

APPENDIX II

Background on Wind Turbine Noise

Research into wind turbine noise is relatively new and complex. This research has established two significant conclusions relevant to siting wind farms in rural residential communities:

1. wind farm noise is distinctively annoying;

2. wind farm noise results in chronic sleep disturbance for a significant number of those who live within a mile away, and chronic sleep disturbance, in turn, results in serious health effects.

1. Wind farm noise is distinctively annoying

A number of reports find that, at the same sound pressure (decibel) level or less, wind turbine noise is experienced as more annoying than airport, truck traffic or railroad noise. Pedersen (2007, p. 24, reviewing literature).

It is not clear whether the distinctive **rhythmic, impulsive or modulating character of wind turbine noise** (all synonyms for "thump" or "swoosh" or "beating" sounds), its characteristic low frequency component (both audible and inaudible, and also impulsive), health effects of chronic exposure to wind turbine noise, especially at night (*see below*, page 2), in-phase modulation among several turbines in a wind farm (this can triple the impulse sound level when impulses of three or more turbines become synchronized), (Bowdler 2008, p. 5), or some combination of these factors explains the annoyance. One or more of these characteristics are likely present depending on atmospheric and topographic conditions, especially at night. Van den Berg (2006). Nevertheless, reports based on surveys of those living near wind farms consistently find that, compared to surveys of those living near other sources of industrial noise, annoyance is significantly higher for comparable sound levels among wind farm residents. This provides objective evidence that a substantial number of those living near wind projects will complain that the noise level they experience is annoying. Pedersen (2007); Bajek (2007); Kamperman and James (2008); James (2009b); Minnesota Department of Health (2009), pp. 19-20.[1]

[1] To compensate for the added annoyance of fluctuating or impulsive sound, the convention is to add a penalty of 5 dBA to modeled sound or to subtract an equivalent amount from the allowable numerical sound level. Van den Berg (2006), p. 106; Minnesota Department of Public Health (2009), p. 21. *See also* Pedersen (2007, p. 24) ("Amplitude-modulated sound has also been found to be more annoying than sound without modulations.").

The impulsive character of wind turbine noise is caused by **air turbulence around the turbine blades**. Van den Berg (2006, pp. 35-36); Bowdler (2008). There are a number of explanations for this fact, and more than one may apply at any specific wind farm site. For example, eddies in the wind, wind shear (different wind speeds at the higher reach of the blades compared to the lower reach), slightly different wind directions across the plane of the blades, interaction among turbines, and the interaction of the blades of a turbine with the tower have each been identified as causes of modulating wind turbine noise. Bowdler (2008).

Impulsive sound was considered more problematic for older turbines that had rotors mounted downwind from the tower. Rogers (2006, p. 10). The sound was reduced by mounting the rotor upwind of the tower, common now on all modern turbines. *Id.*, pp. 13, 16; Van den Berg (2006), p. 36. However, in a landmark study now referred to in all serious discussions of wind turbine noise, Van den Berg (2006, p. 36) found the impulsive swishing sound increases with size because larger modern turbines are subject to "wind shear" during times of ground level "atmospheric stability," resulting in sound fluctuating 5 dBA between beats, up to 9 dBA. *Id.*, pp. 81, 85, 142. *See also* Bajek (2007); Kamperman and James (2008); Cummings (2009, p. 7) ("While overall noise levels per unit of energy output are dropping, today's turbines are far larger than older ones, so total noise output is not necessarily decreasing, and is now mostly generated by the sound of the turbine arms swinging through huge arcs in the air."). *Cf.* Rogers (2006, p. 12) (blade tip noise at that time was "not fully understood").

The phenomenon of wind shear coupled with ground level atmospheric stability refers to the boundary between calm air at ground level and turbulent air at a higher altitude. "A high wind shear at night is very common and must be regarded a standard feature of the night time atmosphere in the temperate zone and over land." Van den Berg (2006, p. 104). *See also* Cummings (2009).

Based on a full year of measurements every half-hour at a wind farm in Germany, Van den Berg found:

> the wind velocity at 10 m[eters] follows the popular notion that wind picks up after sunrise and abates after sundown. This is obviously a 'near-ground' notion as the reverse is true at altitudes above 80 m. . . . after sunrise low altitude winds are coupled to high altitude winds due to the vertical air movements caused by the developing thermal turbulence. As a result low altitude winds are accelerated by high altitude winds that in turn are slowed down. At sunset this process is reversed. (Van den Berg 2006, p. 90)

In other words, when ground-level wind speed calms after sunset, wind speed at typical hub height for large wind turbines (80 meters, or 262 feet) commonly increases. As a result, turbines can be expected to operate, generating noise, while there is no masking effect from wind-related noise where people live. "The contrast between wind turbine and ambient sound levels is therefore at night more pronounced." *Id.*, p. 60. Such calm or stable atmosphere at near-ground

altitude accompanied by wind shear near turbine hub height occurred in the Van den Berg measurements 47% of the time over the course a year on average, and most often at night. Van den Berg 2006, p. 96.

In addition, as the turbines sweep from top to bottom under such conditions the blade tip encounters slightly different wind velocities creating unexpected turbulence that results in rhythmic swishing noise. *Id.*, p. 61. *Cf. also* Minnesota Department of Public Health (2009), pp. 12-13 and Fig. 5.

The level of annoyance by noise also increases substantially for **low frequency sound**, compared to more audible mid-frequency sounds. Sound measured as dBA is biased toward 4,000 Hz, the center of the most audible frequency range of sound pressure. Low frequency sound is in the range below 500 Hz and is measured as dBC. Sound below 20 Hz, termed **infrasound**, is generally not audible. *See* Leventhall (2003, pp. 31-37); Minnesota Department of Public Health (2009, p. 10); Kamperman and James (2008, pp. 23-24).

Wind turbine noise includes a significant low-frequency component, including inaudible infrasound that "can penetrate the home's walls and roof with very little low frequency noise reduction." Kamperman and James (2008), p. 3. Acoustic modeling for low frequency sound emissions of ten 2.5 MW turbines indicates "that the one mile low frequency results are only 6.3 dB below the 1,000 foot one turbine example." *Id.*, p. 12.

Apart from the distinctive characteristics of wind turbine noise, including its low frequency component, state environmental guidelines indicate the level of industrial sound wind turbines would generate in very quiet rural residential settings is unacceptable. The New York State Department of Environmental Conservation (NYSDEC) has issued guidelines on how to assess noise impacts that is very useful because it was written for DEC staff who lack a background in acoustics but are often called upon to evaluate noise assessments. The DEC guidance states:

(1) "In non-industrial settings the SPL [sound pressure level] should probably not exceed ambient [pre-construction] noise by more than 6 dB(A) at the receptor." NYSDEC (2001, p. 14).

(2) "An increase of 10 dB(A) deserves consideration of avoidance and mitigation measures in most cases." *Id.*

(3) Among the accepted mitigation measures is: "Increasing the setback distance." *Id.*, p. 24.

(4) "SPL increases approaching 10 dB result in a perceived doubling of SPL." *Id.*, p. 14.

(5) An SPL increase over 20 dB will be experienced as: "Very objectionable to intolerable." *Id.*, p. 15.

(6) "The amplitude (loudness), frequency (pitch), impulse patterns and duration of sound all affect the potential for a sound to be a noise." *Id.*, p. 3.

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

(8) "$L_{(90)}$ is often used to designate the background noise level." *Id.*, p. 12. *See also* James (2009b, p. 2) ("ANSI/ASA standards for measurement of the long term background sound levels" call for the use of the L_{90} measure).

The first, second and fourth conclusions of DEC's guidelines justify a limit of 10 dBA above existing background sound levels. DEC's fifth conclusion indicates that allowing 50 dBA at residences, as recommended by the wind industry, would be "intolerable" if background levels are characteristically about 25 dBA.[2] DEC's fourth and sixth conclusions support the view that a sound source that quadruples the existing loudness in the background acoustic environment, and includes low frequency impulsive sounds that will be generated throughout the night will be experienced as particularly annoying.

It is important to recognize that an increase of 6 dBA above pre-construction sound levels (representing over 50% increase in loudness) is enough to cause project sounds to be heard, but not enough to cause any damage to hearing. Kamperman and James (2008, p. 5). The annoyance of such a relatively small change in the acoustic environment is due to the modulating and low frequency character of the noise, together with its constancy during night times, not its absolute sound pressure level. *Id.*

Wind developers commonly assume wind speed at ground level sufficient to create masking noise when wind speed at hub height is operating the turbines, but as Van den Berg's

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[2] *Cf.* Kamperman and James (2008, p. 2) (background sound levels at night are in "range of 20 dBA to 30 dBA"); Cummings (2009, p. 6) ("night-time ambient noise levels in rural areas are often 35dB or lower"). Baseline sound levels at four locations in the vicinity of a proposed wind project in Machias, NY, using the L90 measure (DEC's eighth conclusion), were found between 24 and 31 dBA and, for low frequency sound, between 47.4 and 49 dBC. James (2009b, p. 4, table). Baseline sound levels at three locations in the vicinity of another proposed wind project in Italy, NY, using the L90 measure, were found between 21.6 and 24.7 dBA. FINAL GENERIC ENVIRONMENTAL IMPACT STATEMENT, COMPREHENSIVE PLAN AMENDMENT AND WIND ENERGY FACILITIES LAW, TOWN OF ITALY, December 2, 2008, p. 88, Table 2.12-1 (on file with the Author). Baseline sound levels at two locations in the vicinity of another proposed wind project in Cape Vincent, NY, using the L90 measure, were found at or below 25 dBA during seven nights measured. Schomer and Associates, Inc., BACKGROUND SOUND MEASUREMENTS AND ANALYSIS IN THE VICINITY OF CAPE VINCENT, NEW YORK, May 11, 2009, p. 33 (on file with the Author).

research into the effect of wind shear shows this is frequently not the case. *Cf.* Rogers (2006), p. 23 (assuming 8 m/s ground wind speed will be accompanied by 45 dBA background sound level). *Compare* Van den Berg (2006), p. 56 (when wind velocities are low at a height of 10 meters, the wind velocity at turbine hub height at night is "up to 2.6 times higher than expected").

In addition, developers include "such things as local traffic, industrial sounds, farm machinery, barking dogs, lawnmowers, children playing and the interaction of the wind with ground cover, buildings, trees, power lines, etc." in their measurement of pre-construction baseline sound levels, (*id.*, p. 20), but this approach departs from acoustics standards. Kamperman and James (2008), p. 4; James (2009b), p. 2 (current standards specify that "the proper metric for describing the pre-operational sound levels is Long-Term Background sound level usually measured using a statistical process to identify the quietest one minute of a 10 minute sample taken during the time when the new noise source is most likely to generate complaints").

As other standard setting agencies have indicated, setbacks of at least one kilometer (3,280 feet) would be necessary to avoid sound levels more than 6 dBA above background. Kamperman and James (2008), pp. 13-14 (recommending setbacks at least 1 km, and attaching a model wind facility ordinance); Davis (2007), p. 12 (supporting French National Academy of Medicine standard for setbacks 2 km or more). *See also* Minnesota Department of Public Health (2009), p. 25 ("if a turbine is subject to aerodynamic modulation because of shear caused by terrain (mountains, trees, buildings) or different wind conditions through the rotor plane, turbine noise may be heard at greater distances" than one-half mile, or 2,640 feet). This is consistent with the Van den Berg study:

> in quiet nights the wind farm can be heard at distances of up to several kilometers when the turbines rotate at high speed. In these nights, certainly at distances from 500 to 1000 m [1,640 to 3,280 feet] from the wind farm, one can hear a low pitched thumping sound with a repetition rate of about once a second (coinciding with the frequency of blades passing a turbine mast), not unlike distant pile driving, superimposed on a constant broad band "noisy" sound. A resident living at 1 km from the nearest turbine says it is the rhythmic character of the sound that attracts attention: beats are clearly audible for some time, then fade away to come back again a little later. A resident living at 2.3 km from the wind farm describes the sound as "an endless train". In daytime these pulses are usually not audible and the sound from the wind farm is less intrusive or even inaudible (especially in strong winds because of the then high ambient sound level). (Van den Berg 2006, p. 42)

At these distances, the mid-frequency range sounds diminish because they are more readily absorbed by the air, but the low frequency ranges do not. Wind turbines at such distances will generate "a louder and more low frequency 'thumping' sound and less the swishing sound that is

observed close to a daytime wind turbine." *Id.*, p. 65.

Thus, the annoyance of wind turbine noise is the result of its rhythmic or modulating character, its low frequency component, and its presence during times of calm surface atmosphere, most commonly at night when sound travels farthest.

2. Wind farm noise results in chronic sleep disturbance for a significant number of those who live within a mile away.

It is important to distinguish recent studies that link low frequency noise impacts to impairment of the vestibular system or other organs[3] from well-established findings that wind farm noise is a cause of sleeplessness, and the health effects of chronic sleeplessness.[4] The discussion in this section is limited to sleeplessness and health problems associated with sleeplessness.

The World Health Organization (WHO) considers sleep disturbance to be an adverse health impact. WHO (1999), pp. 44-46. Chronic sleeplessness, in turn, causes a variety of health effects, including "primary physiological effects . . . induced by noise during sleep, including increased blood pressure; increased heart rate; increased finger pulse amplitude; vasoconstriction; changes in respiration; cardiac arrhythmia; and an increase in body movements." *Id.*, p. 44. "Exposure to night-time noise also induces secondary effects, or so-called after effects . . . includ[ing] reduced perceived sleep quality; increased fatigue; depressed mood or well-being; and decreased performance." *Id.*, pp. 44-45. Waking up in response to nighttime noise decreases as people get habituated to the noise; however, "habituation has been shown for awakenings, but not for heart rate and after effects such as perceived sleep quality, mood and performance." *Id.*, p. 45.

In 2007 WHO issued Night Time Noise Guidelines (NNGL) to preserve the ability to sleep, recommending that to avoid adverse health effects outdoor sound levels in rural areas at night not exceed 30 dBA. WHO (2007), pp. 24-25 (and recommending an interim limit of 40 dBA in communities "where the NNGL cannot be achieved in a short period for various reasons,

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[3] *See* Alves-Pereira and Branco 2007; Pierpont 2009 (linking the low-frequency component of wind turbine noise is linked to abnormal growth of collagen and elastin in the blood vessels, cardiac structures, trachea, lungs, and kidneys of humans and animals exposed to infrasound (0–20 Hz) and low-frequency noise (20–500 Hz), in the absence of an inflammatory process). *See also* Minnesota Department of Public Health (2009), pp. 7-8.

[4] *Cf.* Van den Berg (2008) (study results show prevalent sleep disturbance at 45 decibels or higher); Kamperman and James (2008, p. 3) ("the International Standards Organization (ISO) in ISO 1996-1971 recommends 25 dBA as the maximum night-time limit for rural communities").

and where policy-makers choose to adopt a stepwise approach at the local or national levels."). *See also* James (2009b, pp. 5-6) (discussing WHO's NNGL); Cummings (2009, p. 6) ("if temperature inversions or other atmospheric stability effects that cause excessive noise occur just 10% of the nights, that means that nearby residents may find their sleep disturbed 35 nights a year").[5]

Because background sound levels in rural residential areas in New York are commonly about 25 dBA at night, (*cf. above*, footnote 2), WHO's NNGL goal can be met with properly crafted legislation that protects all residents from intolerable noise pollution.

3. Wind industry approach to noise assessment

Wind developers commonly adopt an approach to noise assessment that achieves results supporting conclusions that background sound levels are around 45 dBA, wind sound will mask turbine noise, and total noise impacts will be insignificant for nearly everyone within one mile of a wind farm project. Each of these conclusions relies on a novel approach to acoustics and cannot be sustained on professional grounds.

Background sound level as the baseline against which project impact sound should be assessed requires that transient sounds be excluded from the measurements used to calculate L_{A90}. James (2009b, p.2). This is in contrast to L_{Aeq}, an average sound level favored by wind energy facility developers, "which may include the effects of near-by and short term sounds." *Id.*, p. 5. The relevant consideration is the need to capture the quietest period of time that will be commonly experienced, because that is the time complaints can be expected about an intrusive noise source. Using a different measure for background, ambient or pre-construction baseline sound will underpredict complaints. *Id.*

For example, commenting on the developer's method of adding to background sound levels "masking noise" created by the sound of the wind in ground-level vegetation, in an attempt to show that wind project noise will result in an insignificant increase in the community's sound level, James (2009a, p. 4) states:

> This interpretation is contrary to the generally accepted understanding of a community's "background sound level." This is a defined term in acoustics. To alter its meaning to be the noisiest conditions and not the quiet conditions as generally accepted for land use planning and evaluating a community's reaction to a new noise source is truly novel. It is clearly at odds with ANSI standards and procedures for assessing background sound levels and for assessing the impact of

[5] This modifies the finding of Rogers (2006, p. 21) ("At the present time, there are no common international noise standards or regulations for sound pressure levels.").

a new noise source on a community.[6]

Wind industry recommendations for noise standards offered in model local ordinances prepared by the industry, (*see id.*, pp. 2-3), worked for some years before research became available addressing the high level of complaints about noise levels exceeding the modeling results provided by wind developers at the pre-construction phase of many projects in Europe and U.S. However, now that such research is available and provides confirmation that Hessler's approach seriously underestimates wind turbine noise, there can be no excuse for failing to consult this literature.

[6] As noted in his report, (James 2009b, p.1.n.1), Mr. James was a member of the committee that developed the ANSI standards applicable to noise assessments.

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