# Town of Rensselaerville, New York

# Wind Power Committee Recommendations Report for Industrial Wind Power

# July 2010

**Website:** **http://www.rensselaerville.com/windstudy.php**
**Email:** **WindStudyCommittee@gmail.com**

**The Rensselaerville Wind Power Committee was tasked with making recommendations for Non-Commercial Wind Power and large scale Industrial Wind Power.**

**Phase I of our committee's work was completed last summer with the report: *"Town of Rensselaerville, New York Wind Study Committee Recommendations Report for Non-Commercial Wind Power - July 2009"* and the adoption and filing of Local Law No. 2 *"Non-Commercial Wind Power Facilities Law of 2009 of the Town of Rensselaerville"* soon after.**

**This *"Wind Power Committee Recommendations Report for Industrial Wind Power"* represents the completion of Phase II of our committee's research. Once local law for Industrial Wind Power becomes adopted our committee will have achieved its objectives and completed its responsibilities.**

# Rensselaerville Wind Power Committee Recommendations Report for Industrial Wind Power - July 2010

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    It is searchable by keyword and by categories through column sorting.

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# Introduction & Overview

## Formation of Wind Power Committee – Background & Rationale

**Background – How this committee was established:**

The primary impetus for the formation of the Wind Power Committee was Industrial Wind Developers' interest in installing wind facilities in the Hilltowns. In the Summer of 2008 one of these developers Shell Energy Services, through their Cinco marketing affiliate, started approaching landowners in the Hilltowns, including Rensselaerville, to sign wind power leases. This developer withdrew from the area in October 2008, citing strong and organized resistance as the reason. The Rensselaerville Town Board acted quickly and voted for a six-month moratorium on any wind power permits or construction in order to study the impact of wind turbine installations in the town. This moratorium began December 3rd, 2008 and was scheduled to end on June 3rd, 2009.

The Wind Power Committee was then established by Town Board resolution, effective December 3rd, 2008 (see next section of this report), and had its first meeting on February 17th, 2009. After a few weeks of work it became apparent that the three-and-a-half month working period remaining was insufficient to accomplish the goals of the resolution. It also became apparent that the challenge of crafting recommendations for large-scale Industrial Wind Power facilities was a more complex task than for Non-Commercial wind turbines. Accordingly, the committee recommended, and the town adopted, moratorium extensions of three months for Non-Commercial wind turbine installations (ending September 3rd 2009), and twelve months for Commercial wind turbine installations (ending June 3rd 2010). The Town Board then adopted an additional extension taking the moratorium end date to September 3rd, 2010.

This report represents the culmination of research, discussion and work done by the committee related to Industrial Wind Power in the Town of Rensselaerville. It also builds on the base of knowledge that our committee has done in Non-Commercial Wind Power.

The final products of this Phase II report on Industrial Wind Power are:

- Town of Rensselaerville Local Law for the year 2010 for Industrial Wind Power Facilities. (To be drafted).
- This report, which will be incorporated into that local law.

The information in this report is intended to provide a clear rationale and backup guidance for the Summary Recommendation that this committee is making and the local law that will be crafted. Also as resource guide for future Town Boards, Planning Boards, and Zoning Board of Appeals, Code Enforcement Officer, Highway Superintendent and others. It is also intended to provide forward guidance on what to be aware of if Industrial Wind Developers approach the Town in the future.

The Wind Power Committee serves only in an advisory role with no decision-making authority. As a committee we have experienced strong support (although not without questions and guidance) from various town agencies and persons with whom we have worked. We would like

to extend our appreciation (in no order of priority) to the Town Board, Planning Board, our two town attorneys, Zoning Review Committee members, Code Enforcement Officer, Town Appraiser, Town Clerk, and to the citizens who faithfully attended our meetings and enriched our process with their questions, comments, concerns, and their humor.

Within our committee there has been positive collaboration and great synergy. Each member of our committee has provided unique and special knowledge, skill sets, and points of view that blended together to produce this report.

In a world of radical change, this report should be viewed as a “work in progress”. As Industrial Wind technology evolves and the grid capacity and flexibility expands and refines, perhaps there will be a day when Industrial Wind Power will fit within the framework of the Town’s Comprehensive Plan. At this stage we view that time to be far into the future – if ever it comes to pass. The reason for this comment is that “the nature of the beast” – 400’ tall industrial wind plants might, by their nature, never align with our Town’s Comprehensive Plan.

# Town of RensselaervilleTown Board Resolution

**Adopted by Town Board 12/3/2008**

WHEREAS, the Town Board has authorized the creation of an advisory Wind Power Committee to assist the Town Board in developing regulations applicable to the siting and permitting of private and commercial wind power facilities as well as to provide recommendations on the use of wind power in the Town; and

WHEREAS, the Town Board has advertised and interviewed applicants for membership on said Committee; and

WHEREAS, the Town Board is prepared to make appointments to the Wind Power Committee and prior to the formation of the Committee it is necessary and prudent to provide the specific charge and responsibilities of the Wind Power Committee;

NOW, THEREFORE, BE IT RESOLVED as follows:

1. The Town of Rensselaerville Wind Power Committee is hereby officially created and shall have a maximum of 7 members.
2. The term of each member will end on December 31, 2009. The Chairperson of the Committee is Noel Abbott.
   (Note: This term was extended with the Moratorium Extensions.)
3. A quorum of the Committee shall be necessary for it to hold and conduct meetings and a majority of its membership shall constitute a quorum. All decisions or acts of the Committee shall be accomplished by vote of a majority of its membership.
4. The Committee may meet at a frequency and on particular days or nights as it will decide, but all meetings of the Committee must follow the Open Meetings Law and be duly noticed and open to the public.
5. In recognition of the current wind power facility moratorium in effect and due to expire on June 4, 2009, the first responsibility of the Committee is to develop draft zoning regulations for private and commercial wind power facilities and present such draft to the Zoning Review Committee for its review. The Zoning review Committee will then consult with the Town Attorneys and forward proposed regulations to the Town Board.
6. After completing the aforementioned task, the Wind Power Committee may then investigate, consider, and prepare recommendations regarding the overall use of wind power in the Town including but not limited to development of such facilities as a Town function, revenue sources from such types of facilities policies regarding wind power, and other relevant issues. The Committee may report directly to the Town Board as to its findings and recommendations.
7. The Committee shall have no decision-making authority that will bind the Town Board or the Town of Rensselaerville to any policy, act, or future action. The Committee's specific authority is to provide the Town Board with non-binding recommendations on the aforesaid topics.
8. The Committee, or any Committee member, is not authorized to contact or hold itself, himself, or herself out as an official of the Town, any vendor, contractor, or supplier of the Town or any governmental agency without the express authorization of the Town Board.

# Wind Study Committee Purpose and Goal Statement

**Adopted by Wind Study Committee 2/24/09/Revised 3/7/09**

*[Note: The Committee had chosen the name "Wind Study Committee" and used that name in its Non-Commercial report. The correct name of our committee is the Wind Power Committee as stated in the initial Town Board Resolution and the Moratoria. We are leaving this document intact with the old name.]*

To develop draft zoning regulations for private and commercial wind power facilities and present such draft to the Zoning Review Committee for its review.

To recommend policies, and procedures that will provide maximum long-term benefit to the Town.

The issue of what kinds of wind power will be permitted, encouraged, and disallowed by the Town could have a large impact upon our future quality of life including our:

- Rural atmosphere
- Viewsheds
- Taxes
- Economics
- Overall long-term community and environmental health

A well-constructed set of zoning regulations, policies and procedures will balance various factors in whether to allow and support different kinds of wind generation.

The recommendations that we make are intended to maximize the benefits of wind power for residents of the town and the town as a whole concerning both residential and commercial installations.

**Committee Goals and Outcomes:**

- Recommend zoning laws, policies, and procedures for both small-scale residential wind power and large-scale commercial installations. As these two kinds of installations are very different in scale, implementation, and effect, our recommendations will be unique to each one.

- To align our recommendations with the Town of Rensselaerville Comprehensive Plan finalized March 8, 2007.

- To research zoning laws we can provide to our Town attorney in crafting final zoning laws. The intended purpose: If necessary, our Town will be able to withstand challenges from large scale corporate wind developers and others, if their intended wind projects are not in the interest of our Town or the spirit of the Town of Rensselaerville Comprehensive Plan.

- Education and Citizen Input: To educate ourselves and our Town's residents to the various economic models for wind power installations, and the range of options and agreements, so that both property owners and the Town can enter viable arrangements with commercial developers should we choose to do so.

- To seek input and learn from many varied sources within our town and beyond. Within our town we'll interact with:
    - Our citizens!
    - Zoning Review Committee
    - Zoning Board of Appeals
    - Rensselaerville Town Board
    - Planning Board
    - Town Attorney
    - Town Code Enforcement Officer

# Core Principles that Guided Our Work

In performing our duties, our committee has been guided by these core principles. We consider them core principles because we believe them to be constant guidelines that will persevere even as technologies, practices, and laws change.

- To make recommendations that answer these questions:
  - What recommendations, on balance, will benefit our citizen's Public Interest & their quality of life?
  - Will our recommendations protect Rensselaerville's unique character and quality of life as laid out in the latest Comprehensive Plan adopted March 6, 2007.
  - Do our recommendations comply with the Town Board Resolution establishing the Wind Power Committee adopted 12/3/2008?
  - Will our recommendations align with a negative SEQRA declaration?
  - Do our recommendations provide appropriate controls for environmental protections, and public health and safety?

- To provide information and resources for the town to implement our recommendations, and to manage their outcome. The information, charts, and background contained in this report are intended to provide tools that our town agencies – especially the Town Board, Planning Board, and the Zoning Board of Appeals - can utilize in responding to industry initiatives at a local level.

- Draw knowledge and information from a wide range of resources beyond the arena of wind power and extract relevant principles to support our recommendations.

- Actively solicit ideas and feedback from a wide range of sources and resources.

- Communicate consistently and often with all town agencies and affected stakeholders to strengthen our knowledge, the quality of our recommendations and public support for these recommendations.

- Listen to all sides of an issue. Listen to all stakeholders, then make our recommendations.

- Extract "Best Practices" from other town's zoning laws, policies and experiences. Also work to understand the underlying rationale for those policies to determine if they apply to our town and situation.

- Provide recommendations based, as much as possible, upon objective inquiry and scientific research.

- Because Industrial Wind Power is a relatively new industry, consider the possibility that these recommendations could become "dated" or obsolete at some future point. However, these core principles should be the guiding framework for any policy changes at a local level.

# Research Methodology

Our committee's goal was to arrive at recommendations that were factually and/or scientifically based and aligned with our Town's Comprehensive Plan. For example, in research on the impacts of sound upon the human body, our research focus was broad, extending beyond the wind power arena. Our committee attempted to extract principles from diverse areas in crafting our recommendations.
We also paid close attention to the experiences and information coming from towns that had dealt with Industrial Wind turbine installations before us. That said, we did not blindly graft their experience upon ours but questioned whether their experience and conclusions were likely to be valid in our town.

The committee also consulted diverse resources from the internet, various towns, town and state officials, other consultants, and the experience and commentary of ordinary citizens in other geographical areas.

We consistently invited involvement and comments from various stakeholders and decision makers in our community including:

- Our citizens via email, by posting meeting minutes, and other documents on the web, holding a Public Information Session, and through inviting dialogue at all of our meetings.
- Various town agencies and officials including:
    - Our Town Board
    - Zoning Review Committee
    - Town Attorneys
    - Code Enforcement Officer
    - Town Assessors

We also consulted our town's Comprehensive Plan and researched NY State laws that had been introduced in the NY State Senate and the Assembly related to wind power. We also made contact with the New York State Attorney General's Office Public Integrity Division involving the Wind Industry's Code of Conduct and the lead attorney for New York State Energy Research and Development Authority (NYSERDA).

The town is in the process of reviewing its zoning laws through a Zoning Review Committee (ZRC). A part of the Town Board's resolution for our committee was to present our findings to that body, which includes representatives from the Town Board, Planning Board, Zoning Board of Appeals, Town Attorney(s), and Code Enforcement Officer. We did present our Summary Recommendation and the reasons behind them and received feedback from members of that group.

During the tenure of our work, various members, or the full committee, made field trips to multiple wind tubine installations - Industrial and Non-Commercial - in our area and well beyond. These included:

- Tug Hill Commercial Wind Installation - 195 turbines in the Lewis County Towns of Lowville, Martinsburg, Harrisburg, and Watson
- Fenner & Madison Commercial Wind Installations, Madison County, New York.
- Jiminy Peak, Hancock, Massachusetts.
- Andy Freihofer's 10 kW Bergey Wind Turbine in Town of Knox.
- Woodstock Road 10 kW Bergey Wind Turbine 325' away from the home of the O'Connors (wind turbine removed last year).

Those visits gave us first hand experience in the reality of wind turbine installations and an additional dimension of experience that guided our recommendations.

We looked at the laws and experiences of other regions, and other countries with a longer track record in Industrial Wind Power, and vetted those experiences through our assessment of what is relevant to the character of our community and its Comprehensive Plan.

# Committee Members

**Noel Abbott** - Preston Hollow – chairperson

“I have a strong commitment to seeing well thought out wind power policies and zoning laws that serve our town, as they will likely have a large impact on our town's future.”

**Alan Wilson** – Rensselaerville

"As dramatic change is on our Town's doorstep, Wind Power will be of great interest to all in our community, whether for private or communal reasons. I desire to contribute to current efforts, as this community seeks to responsibly manage a new source of energy and its use."

**Melissa McGrath** – Rensselaerville

“I believe it is important to gather as much information as possible to permit informed consideration of alternatives and that the implementation of sound and reasoned policies, procedures and zoning regulations are necessary to balance competing interests, ensure maximum benefits to landowners and citizens of Rensselaerville, and preserve the town's rural atmosphere and quality of life.”

**Peter Sedlmeir** - Preston Hollow

“I joined the wind power committee to help research wind power so that up to date information can be presented to the Zoning Board and Town Board for the benefit of the people of the town of Rensselaerville.”

**Wind Power Committee Contact Information:**

Website Link: http://www.rensselaerville.com/windstudy.php
Email: WindStudyCommittee@gmail.com

# Acknowledgments

Within the Town of Rensselaerville government, our committee wishes to thank our Town Board, especially Marie Dermody, current Town Supervisor; Joe Catalano, Town Attorney; Zoning Review Committee (which encompasses multiple Town agencies); Jeff Pine, Assessor and Assistant Town Supervisor; Mark Overbaugh, Code Enforcement Officer; Jost Nickelsberg, Former Town Supervisor, for their information and support as our committee did its work.

Our committee also wishes to thank the following people who provided their ideas, suggestions, information and resources. The contributions both from within our Town government and those outside strengthened our process and the final product.

Note: Acknowledgement of any individuals does not mean that they share our perspective or agree with our conclusions.

Don Airey and Bob Neid, founders, Schoharie Valley Watch

Russell Cary, Town Supervisor, Town of Fenner, and Board of Supervisors, Madison County, New York.

Jim Cooke, Chairman, Town of Berne Comprehensive Planning Committee

Dan Driscoll, Certified Sound Engineer, and Town of Knox Planning Board

Roswell Eldridge, M.D., Medical Officer, Retired, National Institutes of Health

Andy Freihofer, private citizen, Town of Knox, New York

Andrew Hefner, Assistant Attorney General, New York State Attorney General's Office Public Integrity Bureau

Ron and Dawn Jordan, founders, Helderberg Wind Watch

Peter Keane, Associate Counsel, NYSERDA

Tim Lippert, member, Berne Planning Board, and Town of Berne Comprehensive Planning Committee

Leslie Lombardo, Senior Planner, Albany County Department of Planning

Bob Price, Chairman, Planning Board, Town of Knox

Victoria Roy, County Treasurer, Lewis County, New York

# How to Navigate and Use This Report

## Table of Contents Hyperlinks:

The Table of Contents contains *Hyperlinks* to each of the main sections and to significant sub-sections. To navigate directly to that location, simply click on that section hotlink in the Table of Contents.

## Main Sections Shaded:

The main sections and significant sub-sections of the report are formatted as shaded elements like this:

| Main Section |
|---|

| Sub-Section |
|---|

## Formatting Convention for Referencing Resources:

When referencing works or quoting text, you will see both quotations “ “, and *italics*.

## Source for Backup Documents:

For backup research documents, go to the Rensselaerville website/Wind Power Committee Section: **http://www.rensselaerville.com/windstudy.php**

## Glossary:

There is a glossary at the end of the report, and a separate glossary for the Health, Environmental and Safety section at the end of certain sub-sections as appropriate.

# General Discussion & Related Issues

## Industrial Wind Power: Definition and difference with Non-Commercial Wind Power:

We should start with a definition of the term "Industrial Wind Power" as used throughout this report:

Industrial Wind Power is any Wind Turbine installation that produces power for sale through the grid. There are two options at present: Supply power into the grid; or supply power to the structures on the property on which wind turbines are installed.

- The distinction between those two categories of wind power is simple:
  - Non-Commercial Wind Turbines are installed on a property to provide electricity to structures within that property's boundaries. Most are grid-connected, and any excess power produced can be sold back into the grid, however this excess power is minimal and incidental. NYSERDA currently limits the amount of excess power production to a maximum of ten percent more than a property's overall average power usage.
  - Industrial Wind Turbine installations are installed to produce electric power for sale through the grid. Most often this electricity is distributed to end users in locations remote to the Industrial Wind Turbines actual location but is not set up to feed the locality in which the power is produced.

## Why we have chosen to use the term "Industrial Wind Power"

We have chosen to use the term *Industrial Wind Power* with the understanding that it will be criticized as "biased". We would simply point out that the phrases "Wind Farms", "Harvest The Wind" and other terms adopted by wind developers are also biased, but in the direction that the wind industry would like to shape perception for the purpose of making Industrial-Commercial Wind Power seem more acceptable to the public. These terms mask the fact that Large-scale Wind Power installations are really **industrial** installations. While many of these installations have been placed on farmland, they are ***not*** farming operations. Four hundred foot towers with their necessary related infrastructure including sub-stations, four-hundred plus ton concrete foundations, 140' blades, ongoing disruptive noise, and large vehicle maintenance have all the elements of industrial operations. While heavy machinery and the noise and smells of farming operations have an industrial component, the size of Industrial Wind structures, the noise they produce (both audible and inaudible), shadow flicker events, and night lighting to meet FAA requirements leave a very different impact upon the quality of rural atmosphere. Unlike farming operations they impact, the environment, the view shed and the communities that host them. Also, installed electrical infrastructure can shift a farmer's access to their own lands and their ability to live in quiet enjoyment on their own property.

There is a clarity to the term "Industrial Wind Power" that the term "Commercial Wind Power" lacks. Commercial Wind Power can be misconstrued as a wind installation that provides power for a local business or commercial establishment. As stated, Industrial Wind turbines produce power that is fed into the grid for remote consumption.

## Relationship of this report to our recommendations:

The detailed nature of this report is intended to give backup rationale for our recommendations. As such it is our intention to have it incorporated into Local Law for Industrial Wind Power. We recognize that a future town board might choose to allow Industrial Wind Power within Rensselaerville's boundaries. If that happens, our intention is to provide a reference guide on what to be aware of in dealing with the many and complex issues introduced by Industrial Wind Power.

## Recommendations not a starting point to be negotiated down from:

The recommendations in this report are not a starting point to be negotiated down from. If the Town finds itself in the position of negotiating an agreement with a wind developer in the future these recommendations are intended to serve as the end point. They are structured to protect the town and its citizens. It is the developer who reaps huge rewards based upon multiple streams of tax breaks and incentives and strong financial income. It is the developer who should cover the costs of ensuring that the benefits the Town receives are not eroded – or in the worst case totally eliminated, leaving the town with a net financial burden.

## Neighboring Towns and Uniqueness of Circumstance:

We acknowledge that neighboring towns might arrive at different conclusions concerning Industrial Wind Power and therefore adopt different policies. Through Home Rule Law it is their legal right to do so. It is our right as a committee to make recommendations that we believe will support our town's specific circumstances, clearly align with our town's Comprehensive Plan, maintain the Historical Landmark status within certain portions of the Town, and support the town's long-term interests.

## Perception of Committee:

There has been an attempt, primarily by parties outside of our town to paint our committee as biased from the outset. We choose address that criticism. To let it pass unaddressed, might form the basis for an attempt to invalidate our committee's work and recommendations in the future.

At the start of our committee work in February 2009, each individual on the committee was either very positive about Industrial Wind Power, or open to where the research would lead. After only three weeks of an initial global scan of the literature and resources, our committee began to develop concerns about this technology at an industrial scale. In our fourth meeting, on March 10th, 2009, our committee discussed the need to extend the moratorium . http://www.rensselaerville.com/minutes/WindStudy/3-10-09_WindStudyMinutes-Approved.htm

- In following weeks our committee unanimously came to several conclusions:
    - That there were significant potential issues with Industrial Wind power that were not initially obvious.
    - That these issues required more in-depth study and research than our six-month moratorium would allow.

- That, in order to responsibly perform our duties, we needed more time, which led to extending the initial moratorium.
- That we would focus our research first on Non-Commercial Wind Power recommendations in order to develop a base of knowledge and experience dealing with this simpler and smaller scale issue.
- We concluded that with "experience under our belts" we would have a much better foundation to study and make recommendations on Industrial Wind Power.

Accordingly, our committee recommended, and our Town Board adopted, a first moratorium extension. In the first nine months our committee completed our work on Non-Commercial Wind Power, which resulted in the implementation of a local law for Non-Commercial Wind Power. This law is entitled: **"Local Law No. 2 for Non-Commercial Wind Power Facilities 2009".**

With this report we are now completing Phase II for Industrial Wind Power.

No one on the committee has any direct or indirect personal financial interest in either Non-Commercial or Industrial Wind power. Every one of us has a strong commitment to recommending policies that, in our opinion, are for the immediate and long-term health and viability of the Town of Rensselaerville and in keeping with our town's Comprehensive Plan adopted in March 2007. We hold our charge as a public trust. As such we have collectively invested at least a thousand hours of time, reviewed thousands of documents, articles, and other information. Our full committee and/or various members have made multiple field visits to Industrial and Non-Commercial installations, attended the New York State Energy Research and Development Authority's (NYSERDA) Stakeholder Conference, attended meetings run by Albany County Department of Economic Development, Conservation and Planning, presented at other town's meetings, and been in close touch with the lead attorney from NYSERDA who approves all wind permits in New York State, and with the Associate Counsel for the Attorney General's Office involved with the implementation of Wind Industry Code of Ethics.

Our information is drawn from multiple sources and resources and we have made efforts to hear all points of view while sorting through and analyzing the patterns of information that we receive.

## The Perfection Game - Perfect vs. Reasonable:

The decision to support, restrict, or disallow Industrial Wind Turbines in any town results from an assessment of many variables. It also looks at many areas of information including health, environmental and safety, social, financial, technological, legal, political, and others. In any such decision it would be inevitable that opposing views exist. Of strong concern are the objectivity of the views and positions held by Industrial Wind Developers and related parties who make money only when Industrial Wind facilities start up.

We could not possibly be perfect in all of our research and all of our conclusions. However, the questions we pose are:

- Are our recommendations reasonable given the large amount of evidence presented in this report?
- Are they protective of the Town?
- Have the benefits and concerns been weighed?
- Are our recommendations in line with the core of the Town's Comprehensive Plan?

- Have we considered the overall public interest of our citizens?
- If opposing views and arguments are presented, are the sources of this information disinterested parties with no financial profit at stake?

There are aspects of Industrial Wind Power that can be called “controversial”. One such question is whether Industrial Wind Power installations raise or lower real estate values (see analysis in section “Financial Impacts & Property Values”). There are some studies that indicate they do not. Some might point to one aspect of this report and attempt to use it to invalidate our overall conclusions by calling our committee “biased”. In fact we **are** biased, but biased towards policies that serve the best interests of this town. Our Summary Recommendation was arrived at after much consideration of all the factors and was based upon our readings, research, interviews, meetings, and discussions. While sincere people often disagree and one might find fault with some fact or detail in this report, we suggest that sometimes the source of the criticism might be prompted by a bias of another kind. That of the Wind Industry or their representatives whose livelihood is dependent upon only one outcome: The installation of Industrial Wind Turbines. Where they are the source of that criticism, their criticisms might have some validity, but we suggest that their points of view might be captive to their own financial interests.

## Industrial Wind Developer Practices:

As in any industry there are a range of practices ranging from highly ethical to strongly unethical. Especially in a new industry which has not had the benefit of history and hindsight, regulation can initially be lax.

We do not say that all Industrial Wind Developers operate unethically. Anecdotally, we heard that some wind developers work hard to meet the needs of the communities in which they operate, and are sensitive to setback distances, landowner concerns, maintaining town roads, and responding to citizen concerns.

However, the New York State Attorney General’s Office Public Integrity Division created The Wind Industry’s Code of Ethics (also called “Code of Conduct” – see section “Compliance with New York State Attorney General’s Code of Conduct.”). This was established in response to widespread complaints about Industrial Wind Industry practices.

The key is that the Industrial Wind Industry has enormous financial resources at their disposal, a targeted agenda, and wields power and influence to achieve their ends. The “so what” for a small town: Be educated, use caution, and craft your policies to achieve the ends of your town’s comprehensive plan, not that of the developers. While a wind developer can mount a lawsuit at will, they will be far less likely to do so if the town has adopted policies in line with a well crafted Comprehensive Plan and zoning laws aligned with its roadmap.

**Recommendations Considered:**

Our committee considered different basic options as seen in the chart below:

| Final Recommendation Option | Comments |
|---|---|
| Industrial Wind Turbines should not be permitted within the town. | This is the recommendation that our committee adopted because of Industrial Wind Power's incompatibility with the Town's Comprehensive Plan. While a cursory read of that plan might indicate some limited ambiguity on this point a deeper analysis clearly shows otherwise. (See discussion in "Detailed Recommendations…" under "Community Impacts". |
| Industrial Wind Turbines should not be permitted within the town, but provide back up zoning recommendations to protect the Town in case of Eminent Domain (at either State or Federal levels) and/or a wind developer successfully mounts a lawsuit against the Town. | Our committee did not believe it was appropriate to attempt to suggest zoning law, especially as our Town's Zoning Review Committee has been charged with this task. We have reported our Summary Recommendations directly to that committee. |
| Permit Industrial Wind Turbines but with clear zoning laws and policies that *might* protect the town. | While this approach might possibly be effective, it's very risky. A wind developer could much more easily challenge Zoning Laws than a prohibition based upon the Comprehensive Plan. If there were limited numbers of turbines allowed in restricted zoning areas their impact would still be out of alignment with the Town's Comprehensive Plan. |

## Common Misconceptions

We would like to offer some commonly held ideas that, under closer inspection, turn out to be at least partially flawed. We are strongly committed to seeing our country move to a Renewable Energy future, a reduction in oil usage, particularly imported foreign oil. Our purpose in this section is to challenge misconceptions that might stand in the way of our country's actually moving to a greener future, and, at the local level to indicate that Industrial Wind Power might not be as green as it seems.

**Claim:** Wind Power is a cheap source of Renewable Energy.

**For Your Consideration:** Industrial Wind Power is very capital intensive at the outset. Also, consumers are paying a 1¢ to 2¢ premium per Kilowatt Hour of energy purchased through Renewable Sources. At each stage of the way Industrial Wind Power has costs. Some of these costs are:

- The additional tariff of 2 to 2.5% assessed on every New York State electric consumer's energy bill, part of which goes to fund the installation of Industrial Wind Power projects.
- Double Declining Depreciation on their investment.
- Production Tax Credits given to Industrial Wind Power producers for the energy produced and sold into the grid. This is currently 2¢ per Kilowatt hour.
- Renewable Energy Credits – ultimately paid for by taxpayers and consumers (see section "Miscellaneous Matters" and interview notes with Central Hudson's Corporate Communications department.)

If Industrial Wind Power is truly cost efficient, then once the capital costs are paid down, the price of this energy to the consumer should be sharply reduced. We are skeptical that this will occur.

**Claim:** The installation of Industrial Wind Turbines will radically reduce our need for foreign oil.

**For Your Consideration:** Only 2.7% of foreign oil goes to produce power for the grid nationally. While incremental gains have clear value, Industrial Wind Power does not displace the need for this source, since the Independent Systems Operators that run the grid put on *standby* the two reliable sources of power: Coal and Nuclear. When coal plants are on standby they are still polluting, they just don't produce energy.

Conventional power plants are needed to back up wind power via either a strongly interconnected grid between countries, hydro, or other stable power source, storing the energy (by pumping the water into a high lake during excess periods of wind power production), thermal, or other technique.
"*Design and Operation of Power Systems with Large Amounts of Wind Power, first results of IEA collaboration*, presented at the Global Wind Power Conference September 18-21, 2006, Adelaide, Australia."
http://www.ieawind.org/AnnexXXV/Meetings/Oklahoma/IEA%20SysOp%20GWPC2006%20paper_final.pdf (IEA = International Energy Agency)

Also, due to the variability of the wind, conventional power plants are needed to smooth out power generation. China is building many new coal power plants to back up the wind turbines it has constructed. Part of the problem is the poor grid system, but part is also the need to provide a smooth supply of power. (Wall Street Journal, *China's Wind Farms Come With a Catch: Coal Plants*, Sept. 29, 2009 http://online.wsj.com/article/SB125409730711245037.html

**Claim:** Industrial Wind Power is a reliable source of Renewable Energy.

**For Your Consideration:** If the production cycle timing of wind power were matched to peak demand, wind power could be considered a reliable resource, but in fact it is not. Because wind blows in unpredictable, variable, and intermittent cycles grid operators (ISOs) need to keep peak power capacity available from the reliable sources of energy. In Denmark which has

been a prime mover internationally in wind power, can't utilize it's own wind power effectively because of the difficulty of storing this power:

> From: http://www.cepos.dk/fileadmin/user_upload/Arkiv/PDF/Wind_energy_-_the_case_of_Denmark.pdf
>
> *" Denmark generates the equivalent of about 19% of its electricity demand with wind turbines, but wind power contributes far less than 19% of the Nation's electricity demand.*
>
> *The claim that Denmark derives about 20% of its electricity from wind overstates matters. Being highly intermittent, wind power has recently (2006) met as little as 5% of Denmark's annual electricity consumption with an average over the last five years of 9.7%. In the absence of large-scale electricity storage, any modern electricity system must continuously balance electricity supply and demand, because even small variations in system voltage and frequency can cause damage to modern electronic equipment and other electrical equipment."*
>
> *"Denmark manages to keep the electricity systems balanced due to having the benefit of its particular neighbors and their electricity mix. Norway and Sweden provide Denmark, Germany and Netherlands access to significant amounts of fast, short term balancing reserve, via interconnectors. They effectively act as Denmark's "electricity storage batteries". Norwegian and Swedish hydropower can be rapidly turned up and down, and Norway's lakes effectively "store" some portion of Danish wind power.*
>
> *Over the last eight years West Denmark has exported (couldn't use), on average, 57% of the wind power it generated and East Denmark an average of 45%.The correlation between high wind output and net outflows makes the case that there is a large component of wind energy in the outflow indisputable."*

Along the same line of thinking is Glenn Schleede's report:
http://alleghenytreasures.wordpress.com/2010/02/04/glenn-schleede-"the-true-cost-of-electricity-from-wind-is-always-underestimated-and-its-value-is-always-overestimated"/

**Claim:** Industrial Wind Power can provide an unlimited amount of our energy needs into the future.

**For Your Consideration:** Because wind power is an unpredictable, variable, and unreliable source of power for electric energy production, grid operators (ISOs) need to keep peak power capacity available from other reliable sources of energy – like coal and nuclear. Electricity can not be easily or reliably stored on a large scale. Two of the most likely storage sources are battery storage and using wind power to pump water into holding tanks to later be released as hydro power. The original function of Windmills in Holland, where many of them are still working today, was to replace animal power in grinding of grain, to drain marsh lands, and to pump irrigation water -- not to provide electric power. Also, even a country like Denmark would need to undergo a vastly expensive retooling of it's electric grid to prevent instability. The current problem is that because electric power can't be stored, the grid in its current form, can be destabilized by high levels of wind power. The Governor's Executive Order 111, in 2002, that requires State facilities to operate with 20 percent renewables by 2010 has not been achieved. And perhaps it is not currently a technological possibility: There was a study done concerning California's electric grid that is applicable in New York State. It makes the case that "*hour-to-hour variations in wind energy (speed) will create large hourly energy deficits that require installation of other, more predictable, compensation generation capacity and*

*infrastructure*." This same article states that in California, a 15% grid capacity supplied by wind power will destabilize the grid as it exists today. The "so what" is that NY State's 20% target faces the same challenges.
http://arxiv.org/pdf/1002.2243

**Claim:** Industrial Wind Power is a totally green resource reliable upon an inexhaustible source of energy – the wind.

**For Your Consideration:** Each Industrial Wind Turbine requires about four hundred tons of concrete in the base, plus approximately another 80 tons for the tower and nacelle and blades. Because of the size and scale of these machines and the length of blades (often in the range of 130'), at least two to four acres of cleared land is necessary around each wind turbine, in addition to the transportation infrastructure to service them, and the electrical infrastructure to transport electricity to the grid. This requires heavy, long equipment, which is used in the initial construction stage and in ongoing maintenance. There are approximately 200 gallons of various fluids needed for lubrication and if an Industrial Wind Turbine collapses these fluids would fall around three hundred feet to the ground and can potentially cause environmental damage.

## Wind Speed in Albany County

The wind speed in Albany County is not sufficient to support an Industrial Wind Power project based upon the criterion of power produced alone.

The U.S. Department of Energy's wind map for New York State shows the Resource Potential to be "Marginal" – just above the lowest category of "Poor". There are three areas of New York State classified as either "Excellent", "Outstanding" or "Superb" – the three top categories. They are the areas South and East of Lake Ontario, Lake Erie, and Long Island, not Albany County.
http://www.windpoweringamerica.gov/maps_template.asp?stateab=ny

NYSERDA's own current evaluation of New York State counties that have viable wind omits Albany County as well. While it is true that in October 2002, Albany County was listed as an upstate county with *potentially* developable wind resources
http://text.nyserda.org/programs/pdfs/windguide.pdf
a more recent evaluation indicates that Albany County does not have viable wind resources.
http://www.powernaturally.org/programs/Wind/Wind%20Energy%20Toolkit.pdf
(page 5 of report, or page 11 of .PDF document)

This is a significant point. Because other portions of New York State are viable for wind development, and Albany County is not, our recommendation that Industrial Wind Power should not be permitted is in alignment with a negative SEQRA declaration. If the wind power in Albany County were classified in the top categories, potentially a recommendation to disallow Industrial Wind projects could be perceived as having a negative effect upon the environment through the necessity to provide more electric through coal fired power plants, with their subsequent negative impact upon the environment.

# Wind Power Committee Industrial Wind Power
# Summary Recommendation and Related Rationale

Overall Recommendation:
Industrial Wind Power installations within the town of Rensselaerville should not be permitted.

Note: See full *"Town of Rensselaerville, New York, Wind Power Committee Recommendations Report for Industrial Wind Power July 2010"* for detailed research and rationale leading to these recommendations.

The key reasons for these recommendations:

1. Industrial Wind Power is strongly out of alignment with the Town of Rensselaerville's Comprehensive Plan.
   Note: This reason alone would be enough to justify a strong recommendation prohibiting them.

2. There are significant health, environmental, and safety concerns associated with Industrial Wind Power.

3. Albany County does not have the sustained high level of wind speed to make Industrial Wind Power viable for consistent energy production.

4. Citizen's property values would be negatively affected.

5. On a cost-benefit basis, the income to the town would be minimal, while the costs to the quality of life would be disproportionately large. Also, the total costs to the Town in terms of time spent by the Town Board, town committees, town attorneys, Highway Superintendent, Code Enforcement Officer, and other town employee's time would be large, and is often uncounted in the project's life cycle costs.

6. Irreversible decision: Once Industrial Wind Turbines are installed, it would be practically impossible to remove them. Industrial Wind leases and easements give developers long term property control through long initial terms and option extensions: Shell Oil's contract provides the developer with control for as long as 67 years from contract signing. Flat Rock Wind Power's Amended and Restated lease for Tug Hill provides the developer with control for as long as 46 years. That would commit the town to these industrial installations for the equivalent of three generations.

7. The Town would likely lose control of its ability to independently negotiate with Wind Developers.

8. Even if the Town attempted to restrict Industrial Wind Power zoning to a small portion of the town, Wind Developers could challenge that zoning and quite possibly be successful in overturning it. It would be easier for a wind developer to successfully challenge a zoning restriction than a total prohibition based upon the comprehensive plan.

## Detailed Recommendations, Rationale, & Backup Research

# Community Impacts
## Relationship to Comprehensive Plan and Historical Impact

## Rensselaerville's Comprehensive Plan Does not Support Industrial Wind Power Installations

- In New York State, all town land use laws must be in accordance with the town's Comprehensive Plan (New York State Town Law Section 272-a)

- *In Rensselaerville, protection of rural character and the Town's environment is a primary goal of this Comprehensive Plan* – See Town of Rensselaerville Comprehensive Plan dated March 8, 2007 ("Comprehensive Plan") at page 5.

- *Public input has strongly indicated that large-scale industrial uses are not desired…* See Comprehensive Plan at page 22.

### I. The Overall Vision for the Town of Rensselaerville as set forth in its Comprehensive Plan is Incompatible with Industrial Wind Power Installations.

- *Our Quality of life is the guidepost we use to direct our community decision- making process, as defined by the valued attributes of rural character; active, sustainable agriculture; scenic beauty; cultural and historic richness; a healthy environment; diverse housing resources; and economic opportunity.* Comprehensive Plan at page 11.
- *The Town of Rensselaerville is treasured by its residents as a place where landscape, history, and community are tightly entwined.* Comprehensive Plan at page 11.
- *We accomplish this vision in a fiscally responsible manner, limiting costs to our citizens, and encouraging growth that is both fiscally and aesthetically beneficial to our town*. Comprehensive Plan at page 12.
- *The Town understands that its quality of life is the critical factor in attracting and retaining desirable businesses and appropriately growing our local economy.* Comprehensive Plan at page 12.
- *New businesses are designed to fit into the town's aesthetic character and are protective of the environment. Small, "one of a kind" businesses are the norm. As a result, their environmental impact has been kept low and their visual appeal is consistent with the town's historic, rural character.* Comprehensive Plan at page 12.

### II. The Goals of the Town of Rensselaerville are Incompatible with Industrial Wind Power Installations.

Industrial wind power installations in the Town would be in direct opposition to the following goals set forth in the Comprehensive Plan:

- *Goal 1: To encourage appropriate types of rural land use in an orderly manner to support safety, health and quality of life.*
    - *Objective 1: Land use and growth patterns will be based on the lands environmental ability to accommodate such uses …and on the desire of the community to retain our rural character.*
- *Goal 2: To protect important natural resources in the town such as water bodies and wetlands, water supply and recharge areas, important wildlife areas, natural habitats, stream corridors and scenic views which are an essential part of the rural character, quality of life and economic viability.*
- *Goal 3: To promote and encourage a business environment in and around the hamlets and other designated areas that serve to encourage the kind of economic activity that best benefits its citizens, is protective of the environment, and is consistent with the rural and historic character of the town.*
    - *Objective 4: To maintain a viable agricultural economy in the Town as both a source of economic activity and means of preserving the traditional landscape of the Town.*
- *Goal 6: To encourage the growth and economic viability of agriculture as both a source of economic activity and as a means of preserving the important components of the Town's rural character.*
    - *Objective 1: Develop a supportive business environment for agriculture and help maintain the economic viability of farming and preserve the traditional landscape of the town.*

See Comprehensive Plan Section IV- Goals, beginning on page 16 of the Comprehensive Plan.

## III. Industrial Wind Power Installations would threaten the Town of Rensselaerville's Natural Resources.

*Our natural resources are an essential part of our rural character, quality of life, and economic viability. Protection and wise stewardship of those natural resources through preservation of natural habitats, careful management of land/water resources, and conservation of existing agricultural lands is a high priority for the Town.* See Comprehensive Plan at page 14.

- The Comprehensive Plan includes various recommendations regarding the identification, mapping and developing special zoning to protect intact patches of natural vegetation and rare landscape habitats as well as promoting conservation easements to protect important wildlife areas and the formation of a Town Conservation Advisory Board. Until these recommendations are fully implemented, it is impossible to determine the full extent of the effect of a industrial wind power installation on Town, county and state natural resources. See Comprehensive Plan- Programs and Policy Initiation – Subsection 6. Natural Resources beginning on page 58 of the Comprehensive Plan.

- The Comprehensive Plan includes recommendations related to zoning and land use laws that further recognize the need to protect natural resources. Among those recommendations include:

- *Strengthen current zoning requirements for Erosion and Sediment Control… Prohibit disturbance of any kind on areas of 20% slope or greater.* See Comprehensive Plan at page 39.
- *Prohibit development on slopes greater than 20%.* See Comprehensive Plan at page 39

**IV. Industrial Wind Power Installations would threaten the Town's Historic Resources.**

- The historic nature of the Town is one of its most valuable resources. See *Town of Rensselaerville Comprehensive Plan – Considerations Relating to Historic Preservation*, below.

- Town has chosen to protect its historic resources by enacting the Historic District Overlay zoning in 2007

- The Hamlet of Rensselaerville Historic District was named a 2010 recipient of the New York State Society for Historic Preservation "Seven to Save".

- See Historic Character beginning on page 14 of the Plan.

  "*The residents, through many of their civic/volunteer organization, work hard to retain our community's historic character because we recognize, as did our predecessors, the importance of our rich, rural, agricultural heritage. We value the special beauty and splendid, historic landscapes; all of which continue to attract people to our town and contribute to the value of our property and to our quality of life."*

  *"The Town's extraordinary number of historic buildings – some on State and National Registers of Historic Places – scenic roadways, places of worship, burial grounds, stone walls, and streams are integral to its beauty, sense of place, sense of community, economy, and attraction as a visitor destination and residential home market."*

- 2009 – 2013 New York State Historic Preservation Plan -State Historic Preservation Plan Memorandum #2 – *Key Themes & Threats Identified During the Planning Process* (included at page 110 of the pre-publication final plan) summarizes information and comments from personal interviews and public outreach meetings.
  - List of needs for proactive development of guidelines and standards includes siting of wind turbines and wind farms (pg. 112 of the pre-publication final plan).
  - Listing of 17 Threats including (p. 120 of the pre-publication final plan):
    - Lack of awareness about cultural resources or political will to protect them
    - Wind farm location
    - Failure of communities to comply fully with SEQRA

http://nysparks.state.ny.us/publications/documents/NewYorkStateHistoricPreservationPlan.pdf.

- See Item 7.3 Historic Character of Section D. Programs and Policy Initiation on page 62 of the Comprehensive Plan.

*7.3 The Planning Board and Zoning Board of Appeals should use the historic inventory and maps to assist in determining new project impacts on historic resources as required by the New York State Environmental Quality Review Act (SEQRA). Both boards should carefully*

*evaluate the impacts of proposed products on historical resources by conducting thorough SEQRA procedures that give full emphasis to historic resources.*
The attached chart shows all references to Wind Power specific to the Comprehensive Plan.

Given the nature of Industrial Wind Turbine installations and their clear incompatibility the Town of Rensselaerville's Comprehensive Plan, we recommend that Town Law include the provision that no variance for Industrial Wind Power facilities or any of their infrastructure be given.

## SEE RELATED DOCUMENT "Town of Rensselaerville Comprehensive Plan and Industrial Wind Power – Chart"

This document directly extracts every relevant reference to Wind Power or Renewable, or Alternative Energy in the Town's Comprehensive Plan and comments accordingly. It is an integral part of this section, but was not included because it's in landscape format.

# Health, Environmental and Safety Considerations
# Summary of Observations

SUMMARY OF OBSERVATIONS: (A more detailed discussion and listing of some of the reports and studies used in arriving at this summary is included below.)

NOISE AND SOUND

- Noise and sound produced by industrial wind turbines is a major issue. The wind farm developer will assume the cost of an independent sound engineer, selected by the town and paid by the wind farm developer through the town, who will generate a contour map of the area showing expected sound level measurements at property lines. The program generating this map must take into account not only topology but also prevailing winds, temperature, air density, ground cover, and other effects which contribute to the distance the sound can travel.
- The sound level of the wind turbines at the closest property line should not exceed $L_{A90}$ + 5dBA with a maximum (10 minute average $L_{Aeq}$) of 35dBA. The C weighted sound level of the wind turbines at the property line should not exceed $L_{C90}$ + 5dBC. The difference between these wind turbine sound levels (dBA-dBC) must not be greater than 20dB. The $L_{A90}$ and $L_{C90}$ are the pre-construction background sound levels. This 20dB restriction prevents the possibility of complaints about rumble or other low frequency problems. The maximum C weighted sound pressure limit at the nearest property line is 55$L_{Ceq}$. The manufacturer must be required to supply measurements of A weighted and C weighted sound level measurements.
- A bond or some other means of guaranteeing that the wind farm developer/operator will work with those affected by noise to minimize the effects must be in force. The operator must respond in a satisfactory manner in a time period set down by the town or be fined for non-compliance.

SHADOW FLICKER

- Setback: Determine appropriate setbacks for Shadow Flicker, using computer modeling by an independent contractor chosen by the town and paid for by the wind farm developer through the town. Because of the Town's hilly terrain, shadow patterns affect setback distances. . The distance of the shadow cast by the turbine varies greatly according to a number of variables (detailed later in this section, but could be approximately 0.5 miles for certain turbines, although a British study would indicate about 1 mile.

  Maximum Exposure Periods: German regulations state that under no circumstances is the shadow flicker to exceed 30 hours per year and 30 minutes maximum per day. Shadow flicker is determined primarily by blade width, tower height, and sun's elevation and azimuth, although topography must be taken into account. Shadow flicker can trigger photosensitive epilepsy in susceptible individuals

ICE THROW

- Ice/debris throw for each turbine must be calculated because of the dependence on height, blade length, and rotational speed. Probability of being injured by thrown ice is low and setbacks for sound would be greater than this. The distance ice could be thrown could be approximately 0.5 miles for a common turbine.

GROUND VIBRATION

- A comprehensive study should be done by an independent contractor chosen by the town and paid for by the wind farm developer through the town to calculate the vibrational coupling between the concrete tower bases and the surrounding land, especially as it relates to the nearest residences and the effect on any caves or other underground features.
- The wind farm developer/operator should post a bond or some other binding means of guaranteeing that the developer will remediate conditions that cause ground vibration for those so affected to minimize the effects. The operator must respond in a satisfactory manner in a time period set down by the town or be fined for non-compliance.

CONSTRUCTION TECHNIQUES

- The wind farm developer must submit detailed drawings of the construction technique used for each turbine. The technique used will determine how much cement is to be used and how it is to be configured. Methods of crossing streams with cables must also be detailed by the wind farm developer to show that they will not interfere with the natural flow of the streams.
- Soil studies should be done by an independent contractor chosen by the town and paid for by the wind farm developer through the town on a tower-by-tower basis. This is necessary because the soil composition (structure?) can change in distances as small as 50ft necessitating different construction procedures
- Decommissioning procedures and standards must be in place and apply to the wind farm developer and to their successors.

AQUIFER

- Before developing a site the town should mandate that a comprehensive study be done by an independent contractor chosen by the town and paid for by the wind farm developer through the town on the geology and hydrogeology of the area, the effects of microseismic vibrations on caves and in general on the aquifers potentially affected by each tower since there is little published independent study done on these areas.
- Studies should be done on the effects of the hardening chemicals used in the cement which can leach into the aquifer.

WILDLIFE IMPACT – BIRDS, BATS, OTHER WILDLIFE

- Before developing a site the town should mandate that a study be done by an independent contractor chosen by the town and paid by the wind farm developer through the town on the effects of ground vibration, noise, and blade rotation as it relates to the local wildlife. This must be undertaken since some local caves, especially Hailes Cave in Thatcher Park, rank high on a biodiversity scale.

EFFECTS ON ROADS AND INFRASTRUCTURE

- A bond, or other financial instrument, must be posted before construction of the wind turbines is to begin. This will be used to repair any damage to town roads, bridges, culverts, and other infrastructure. It should also be used to repair any damage to the property of citizens in the event that roads are to be widened or other undesired incursion of vehicles or components of construction destroy their property. This bond should remain in effect for the life of the project. Even though the highest level of activity will be during the construction phase, there is still ongoing maintenance on turbines, blades, electrical infrastructure, and parts replacement including blades. The heavy-duty nature of the equipment points to the need for the developer, not the town, to bear the

financial burden of keeping roads used for such purpose in good condition, and the authority to determine remediation methods should reside with the town.
- A separate road maintenance contract should be drawn between the developer/operator and the town.

FIREFIGHTING

- Wind farm developers must demonstrate that they have installed fire detection and suppression systems throughout each of their turbines. Fire fighting plans must be detailed and realistic. Water sources near each turbine must be indicated. Payment for fires which spread from the turbines to the surrounding forests is to be guaranteed by the developer and their successors. Each tower must have a means of being easily identified by local firefighters, such as an address locator.
- In the event of a fire or turbine collapse or other disasters, Town Officials shall be given the same access as the developer or their representatives throughout the response and remediation process.

# Health, Environmental and Safety Considerations Rationale for these Recommendations

*N.B. References that follow are just a few of the total number of references used in the preparation of this report. For a more complete listing of references, see the separate document titled: "Wind Power Committee Resources".*

## NOISE AND SOUND

As stated before noise and sound produced by industrial wind turbines is a major issue. One of the most thorough peer reviewed studies on the noise produced by wind turbines is *The "How to" Guide to Siting Wind Turbines to Prevent Health Risks from Sound* by Kamperman, G, and James, R. This study refers to IEC 61400-11 and other reference standards as documents which serve to provide uniform methodology and sound level standards.

Noise can cause problems in several areas including, but not limited to, sleep deprivation, inability to concentrate, irritability, and other physical symptoms. The World Health Organization (WHO) recommends that the sound level for continuous sounds should be less than 30dBA during sleep periods to protect children's health. (World Health Organization guidelines for community noise especially para. 4.2.1-4.2.8) http://www.ruidos.org/Noise/WHO_Noise_guidelines_4.html#2.3) The WHO also states that when prominent low frequency components of noise are present, measures based on A-weighting are inappropriate. However if the difference between dBC and dBA measurements is more than 10dB it is recommended that a frequency analysis of the noise be performed. (Para. 4.3) Differences of 20 dB and above between the $L_{A90}$ and $L_{C90}$ measurements result in a rumbling sound. It is for this reason that this 20dB difference is not to be exceeded. It is interesting to note that no wind turbine manufacturer's measurements of A weighted or C weighted sound levels could be found on the internet. They do give sound power levels at the hub for wind speeds at which the turbines generate electricity. It is not easy to convert this measurement into sound pressure levels that could be understood by the public.

Because of the attenuation (lowering the loudness) of higher frequency sound (greater than 200Hz) by the walls of a home (typically 10dBA to 15dBA) the WHO states that a 45dBA measurement outside the house will probably be measured as about 30dBA inside the home. However, low frequency noise (20Hz-200Hz) is only attenuated 6dBC to 7dBC by the structure. This could cause sleep problems. Frequencies below 20Hz can cause parts of the house to vibrate, especially windows, which would result in audible noise. Lower frequencies will cause human internal organs to resonate. (*Influence of Low Frequency Noise on Health and Well-Being*, Martin van den Berg, Ministry of Environment, Netherland, 2005) The International Standards Organization recommends a 25dBA maximum night time limit in rural communities. (ISO 1996-1971). An independent study *Measuring Background noise with an attended, mobile survey during nights with stable atmospheric conditions* by Schneider 2008, measured a night time, stable atmosphere noise as 25.7 to 26.7dBA at Cape Vincent. This measurement correlates well with that which is measured in the Helderberg area and is considered typical of the Rensselaerville area. (*Regulation of Noise in Rural and Quiet Suburban Areas*, Daniel A. Driscoll, PE, Ph D, Board Certified in Noise Control Engineering)

There is a penalty recommended for prominent amplitude modulated sound, impulsive sound, or sound with a tonal character. Research has shown that such sounds are much more annoying and noticeable than other sounds without those qualities.

If wind turbine noise has a low enough frequency, the individual may not hear them but yet still be affected by them. (*Low Frequency Noise: Technical Research Support for DEFRA Noise Programme*, prepared by Casella Stanger; *Wind Turbines and Infrasound*, prepared by Howe Gastmeier Chapnik Limited for CANWEA) An analogous example of this would be the effects of light which is not visible (ultraviolet) on the skin (sunburn). While one wouldn't be sunburned by sound, the body will still be physically affected by it, often appearing as unexplainable symptoms such as annoyance, stress, irritation, fatigue, headache, nausea and disturbed sleep. Another result of low frequency sound is that it is able to cause parts of a home to vibrate, for example windows, which can cause difficulty sleeping.

A CANWEA study on infrasound generated by wind turbines states that it is no worse than those found in nature. (http://www.canwea.ca/images/uploads/File/CanWEA_Infrasound_Study_Final.pdf This is true in some cases, however who would want the continuous rumble of thunder pervading their home?

It is important to keep in mind that the "sound pressure level" or the "sound level" of the turbine at a given distance (reference distance) is the sound level measured at the test site with the turbine operating minus the background noise. The units of these measurements are usually "dBA". The equation then used is:

$$SPL = 20 \log_{10} (10^{SPLt\&b/20} - 10^{SPLb/20})$$

where:

SPL is the Sound Pressure Level of the turbine in dBA
SPLt&b is the Sound Pressure Level of the turbine plus the background noise
SPLb is the Sound Pressure Level of the background noise

The background sound ($L_{A90}$) refers to the sound level present at least 90% of the time. Background sounds are those heard during lulls in the ambient sound environment, that is, when transient sounds from flora, fauna, and wind are not present. Background sound levels vary during different times of the day and night. Because wind turbines operate 24/7 the background sound levels of interest are those during the quieter periods which are often the evening and night. Sounds from the wind turbine of interest, near-by birds and animals or people must be excluded from the background sound test data. Nearby electrical noise from

streetlights, transformers, and cycling AC units and pumps, etc. must also be excluded from the background sound test data.

Background sound level (dBA and dBC (both as $L_{A90}$ and $L_{C90}$)) is the sound level present 90% of the time during a period of observation that is representative of the quiet time for the soundscape under evaluation and with duration of ten (10) continuous minutes. Several contiguous ten (10) minute tests may be performed for one (1) hour to determine the statistical stability of the sound environment. Measurement periods such as at dusk when bird and insect activity is high or the early morning hours when the “dawn chorus” is present are not acceptable measurement times. Background $L_{A90}$ sound levels documenting the pre-construction baseline conditions should be determined when the maximum wind speed is less than 2m/sec (4.5 mph) near ground level during the ten (10) minute measurement period. The anemometer used shall be orientated to record the maximum wind velocity within 5 meters (16.4 feet) of the measuring microphone.

Longer term sound level averaging tests, such as 24 hours or multiple days are not at all appropriate since the purpose is to define the quiet time background sound level. It is defined by the $L_{A90}$ and the $L_{C90}$ descriptors. It may be considered as the quietest one (1) minute during a ten (10) minute test. $L_{A90}$ results are valid only when $L_{A10}$ results are no more than 10dB above $L_{A90}$ for the same period. Likewise, $L_{C10}$ less $L_{C90}$ are not to exceed 10db to be valid.

The background noise environment consists of a multitude of distant sources of sound. When a new nearby source is introduced the new background noise level would be increased. The addition of a new source with a noise level 10 dB below the existing background would increase the new background 0.4dB. If a new source has the same noise level as the existing background then the new background is increased 3.0dB. Neither of these two situations would result in a noticeable audible increase in sound. Lastly, if the new source is 5dB above the exiting background then the new background would have increased a little more than 6dB, a factor which must be considered in compliance measurements.

The sound level of the wind turbines at the closest property line should not exceed $L_{A90}$ + 5dBA with a maximum ten-minute average $L_{Aeq}$ of 35dBA. The C weighted sound level of the wind turbines at the property line should not exceed $L_{C90}$ + 5dBC with that level not to be different from $L_{A90}$ + 5dBA by more than 20dB. This prevents the possibility of complaints about rumble or other low frequency problems. The maximum limit at the nearest property line is 55$L_{Ceq}$.

The wind industry measures the turbine sound at a height of 10m (33ft) above the ground. At this height there is enough wind to mask the noise of the turbines while at ground level there is little to no wind. This is especially true at night. This condition is responsible for noise complaints within 3km (1.86miles) of a wind farm. (This and the previous information on sound measurements and limits is from *The “How to” Guide to Siting Wind Turbines to Prevent Health Risks from Sound* by Kamperman, G, and James, R.) Other detailed information can be obtained in a dissertation from the University of Groningen *The sound of high winds: the effect of atmospheric stability on wind turbine sound and microphone noise* by Godefridus Petrus van den Berg.

Some non-wind turbine related studies on low frequency sound and infrasound have also been done. Many of these have tested for the short term effects of very loud low frequency noise or infrasound, generally above 95dBA. Most do not show any lasting effects of the sound even though the sound levels were high. Only a few studies, mostly done in work situations where people spent much time, determined that low level low frequency noise or infrasound were responsible for workers becoming ill. One such study (*Indoor Air '96*, proceedings 7th International Conference on Indoor Air Quality and Climate, held July 21-26, 1996, Nagoya, Japan, Volume 1, pp 1025-1030, 13 figs, 10 refs., Burt T) indicates that low frequency noise centered around 7Hz from an office building ventilation system caused

symptoms typical of sick building syndrome in workers even though it was not audible. Another study (Radneva, R. 1997. *Studying the effect of acoustic conditions in the living environment of multifamily buildings on inhabitants*. Khig. Zdraveopazvane 40 (3-4):40-44.) reaches the same conclusion as does a 1980 study (INTERNATIONAL PROGRAMME ON CHEMICAL SAFETY Environmental Health Criteria 12 section on Noise para. 1.1.3.3 to 1.1.4 http://www.inchem.org/documents/ehc/ehc/ehc012.htm), viz., that people exposed to low level low frequency sound and infrasound for long periods of time develop psychosomatic complaints such as fatigue and weakness in addition to sleep deprivation. A DEFRA (Department of Environment, Food and Rural Affairs) report (*A Review of Published Research on Low Frequency Noise and its Effects*, Report for DEFRA by Dr Geoff Leventhall, Assisted by Dr Peter Pelmear and Dr Stephen Benton) points out that A weighted sound measurements underestimate annoyance in the frequency range below 200Hz.

A book called "Wind Turbine Syndrome" by Nina Pierpont, M.D. published in 2009 takes a case study approach with people who have developed a series of related symptoms that are impacted by Industrial Wind Turbine exposure. Her conclusions point to the constellation of symptoms that can be medically defined as a syndrome and while not a double-blind study her interviews indicate that symptoms that began after the installation of Industrial Wind Turbine installations abated, and in some cases completely disappeared, when those same subjects moved away. She has also collected evidence that when those subjects returned their symptoms also returned. While not a fully conclusive body of work because of the small sample size and the fact that not all subjects within the same family were affected to the same extent, Dr. Pierpont's thoughtful work indicates a need for continuing research. It also points to a need for much larger setback distances than currently in use, and clear caution in the siting of these installations.

## DEFINITIONS FOR THE SECTION ON NOISE

**Amplitude modulated low frequency sound**: Sound with energy in the lower frequency range of 20 Hz to 200 Hz which varies in loudness and other characteristics in a rhythmic pattern.

**Annoyance:** A technical term meaning a significant degradation in the quality of life and health. The WHO defines health as meaning total physical and mental well-being, as well as the absence of disease. The term annoyance used in noise studies does **not** mean an inconsequential disturbance.

**Impulsive sound**: A sound of short duration or an abrupt change in sound level which may either increase or decrease the level of background sounds.

$\mathbf{L_{Aeq}}$ is the A weighted equivalent sound level, or "average" noise level, is defined as the steady sound level that contains the same amount of acoustical energy as the corresponding time-varying sound. The $L_{Aeq}$ is determined by summing the total sound energy, then dividing the total energy by the total time.

$\mathbf{L_{A90}}$ or $\mathbf{L_{C90}}$ refers to the sound level measurements that are exceeded for 90% of each sample period. This would represent the lower sound levels in the environment.

$\mathbf{L_{A10}}$ or $L_{C10}$ refers to the sound level measurements that are exceeded for 10% of each sample period. This would represent the higher sound levels in the environment.

**Tonal sound** is a sound for which the sound pressure is periodic function of the time, and characterized by a single frequency. Tonal sound may have a simple or complex wave shape.

## SHADOW FLICKER

A field trip taken by the wind committee to the Maple Ridge Wind Farm in Tug Hill, New York in January 2010 demonstrated that even though one turbine may be turning at a

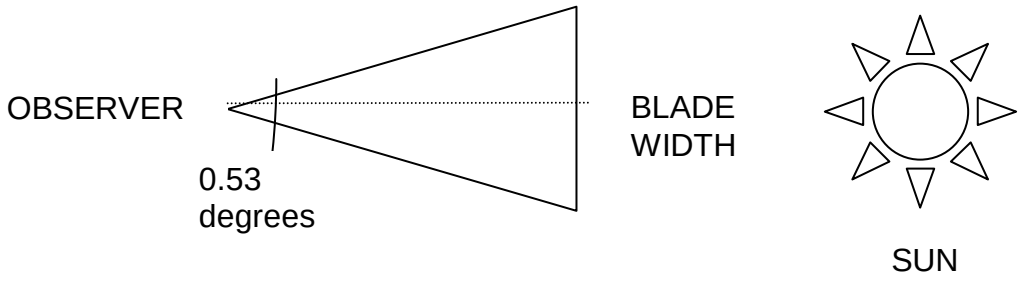
frequency less than that needed to trigger photosensitive epilepsy, the combination of two of them may cause an different sensation. This effect was experienced when two turbines were turning at about the same rotational velocity but were slightly out of phase with each other. The result was a flicker which was twice that of one turbine but still less than the frequency needed to trigger photosensitive epilepsy. Standing at the site for a few minutes caused a disorienting, dizzying sensation in at least two of the team members.

Below is a calculation for shadow flicker which does not round off the angular displacement of the sun's disk. The results given are for the blade blocking off the center of the sun's disk which would be the worst case for distance from blade to observer. This calculation does not round off the angular width of the sun's disk as had been done in the previous residential calculations.

**BACKUP FOR CALCULATION TO DETERMINE SHADOW FLICKER**

Shadow = (0.5 times average Blade width)/ tan 0.053degrees

Shadow = 540 times average Blade width

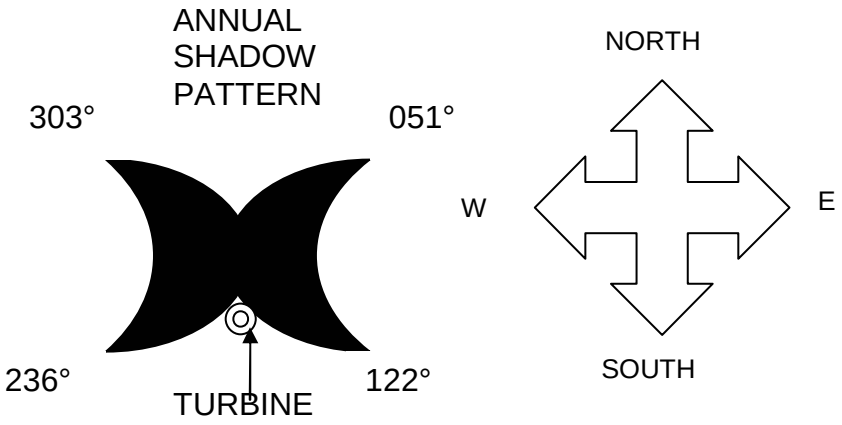



In the equation the 0.5 comes from the use of half the blade width to determine the straight line distance (the line splitting the triangle in half). The "tan 0.053 degrees" comes from using half the angle when 20% of the sun's disk is covered, or 0.5 times 0.2 (or 20%) times 0.53 degrees. For this 20% blockage of the sun's disk, an elevation of 0.8 degrees, and an estimated average blade width of 5 feet, the distance from observer to the tower's base would be about 2700 feet.

The equation comes from a determination of the shadow cast by the blade. A German wind study (referenced in "*Enbridge Ontario Wind Power Project Shadow Flicker Assessment*" and also at http://www.douglasma.org/selectmen/windfarm/files/090216-shadow.pdf) indicating that the disturbing effects of the shadow flicker may affect people with photosensitive epilepsy up to a point when 20% of the sun's disk is occluded. In other words, if the observer is in a position such that the blade blocks off anywhere from 20% to 100% of the sun's disk which has an angular measurement of approximately 32arcminutes, or about 0.53 degrees, then the shadow will be dark enough to cause a seizure provided the frequency of rotation of the turbine rotor is great enough to cause more than 3 shadows per second. This would imply the rotation of a three bladed horizontal axis turbine (like a propeller) would be about 60 rpm. The maximum rotational speed for a Vestas 3MW turbine is 19rpm, or about 1 shadow per second. A British study indicated that only 10% of the sun's disk need be covered. (*Wind Turbines, Flicker and Photosensitive epilepsy: Characterising the Flashing that May Precipitate Seizures and Optimising Guidelines to Prevent Them*, by Harding, Harding, Wilkins, http://www.mfe.govt.nz/rma/call-in-turitea/submissions/186changeappendix3.pdf) The 20% figure is used here. More scientific studies need to be done on this topic to safeguard

individual health, although the distance needed to assure safety from the noise of the turbines is greater than the shadow flicker distance.

Shadows plotted throughout the year can vary significantly and are greatly affected by the surface contours of the land. In this area, those who would not be affected by the shadow throughout the year would live south of the turbine between bearing angles of approximately 236degrees (sunrise) and 122degrees (sunset) (summer maxima). For seasonal residents south of the turbine the winter bearing angles would be approximately 303 degrees (sunrise) and 051degrees (sunset) in order not to have any shadows. For flat terrain the shadow cast for the entire year takes on the rough shape of a butterfly with the turbine at the lowest central part of the butterfly as shown roughly below. (Shadow pattern from Danish Wind Industry Association http://www.talentfactory.dk/en/tour/env/shadow/shadow2.htm)




According to the Epilepsy Foundation approximately 90,000 Americans suffer from photosensitive epilepsy. (http://www.epilepsyfoundation.org/about/photosensitivity/)
Most people discover they have it between the ages of 7 to 20. The frequency range which can cause a seizure is in the 3-30 HZ range with very few people sensitive to the extremes of the range.
((http://www.epilepsysociety.org.uk/AboutEpilepsy/Whatisepilepsy/Triggers/Photosensitiveepilepsy)

German guidelines for shadow flicker affecting a particular residence is that it may not exceed 30 hours per year and 30 minutes on the day of maximum shadow. There are computer programs which calculate the shadow pattern and distance, given the topography, latitude, and longitude. (*AIM PowerGen Plateau Wind Generation Project, Shadow Flicker Report*,
http://www.iprcanada.com/Plateau/PLATEAU%20FINAL%20ESR%20JUNE%2011%2009/AppendixK_Shadow-Flicker-rpt.pdf)

## ICE THROW

The distance that ice or other debris, such as blade parts, can be thrown is very much determined by the hub height, blade diameter, and rotational speed. One turbine used is the Vestas 90 which can be used as either a 1.8MW or 3MW machine. The difference between the two is the operating wind speed and rotational speed. The Vestas 90 1.8MW turbine has a revolution rate of 8.8-14.9rpm at a rated wind speed of 11meters/sec (24.6miles/hour) while the 3MW turbine has a revolution rate of 9-19rpm at a rated wind speed of 15meters/sec (33.5 miles/hour). Rotational speed of the turbine is computer controlled and is accomplished by varying the angle of the blades with respect to the direction of the wind, a process called “feathering”. In our trip to the Maple Ridge Wind Farm in January we passed several turbines

which were not rotating due to “feathering”. Tip speed for the 3MW machine at 19rpm (hub height =262ft, blade length = 148ft.) would be about 200mph and the calculated distance of a throw using the equation below neglecting air resistance is approximately 2800 ft. or a little over 0.5 miles. Air resistance is neglected in the equation because the density of the air would be dependent on the air temperature, humidity, barometric pressure, and altitude. The mass and shape of the debris also is important in determining the throw. In addition to this, and of more significance, is the concept that should a piece of ice be thrown from the tip of the blade, its shape could be that of the blade and the aerodynamics of the debris could allow the wind to increase or decrease the distance of flight. Even if the debris were not the shape of the blade, the wind would most likely have a significant effect on the distance thrown. Air turbulence produced by the blades would also contribute to the distance thrown.

During a field trip to the Maple Ridge Wind Farm at Tug Hill in January, 2010, ice was seen on the blades by the committee members. The thickness of the ice was difficult to estimate, however it was clearly visible on the operating turbines at a distance from the base of the turbine of about 600 ft. The guess was that the ice had to be at least 2-3 inches thick at the time for it to be visible. The temperature was 4 degrees F as measured by the car’s thermometer. We did not see ice being thrown from the blades, however we did observe chunks of ice missing from portions of some of the blades, implying that some of the ice had been thrown off at some previous time.

The simplified general equation for calculating the ice throw is:

$$x= -0.5((1.414r – (r\omega)^2/g) + sqrt[(1.414r - (r\omega)^2/g)^2 – 4\{-(y + 1.414r) ((r\omega)^2/g) + 0.5r^2\}]) - 0.7r$$

where:

x is the horizontal distance from the base of the tower to the landing point in feet
r is the blade length in feet
ω is the angular frequency of rotation in radians/second
g is the acceleration due to gravity = 32feet/second$^2$
y is the hub height in feet
sqrt means that the square root of the following expression is taken

Since most manufacturers give the angular frequency of rotation in revolutions/minute the equation used to convert to radians/ second is:

ω = ( π times angular frequency in revolutions/minute)/30

or approximately

ω = 0.105 times revolutions/minute

The Excel file uses the appropriate conversions to calculate the ice throw in feet. (N.B. the original equation in the residential turbine report did not have the last term (-0.7r). It compensates for the horizontal distance of the ice from the tower at the moment of release. For residential turbines the distance is small compared to the throw distance. For industrial turbines the distance would be larger.)

A slightly different way of calculating the ice throw giving essentially the same results as the Excel program and the rationale for not considering the effects of air resistance can be found at the following website written by Prof. Terry Matilsky of Rutgers. (http://www.physics.rutgers.edu/~matilsky/windmills/throw.html) In this article he also discusses difficulties in the ice throw models and studies of the wind developers.

Risk assessment papers such as *Risk Analysis of Ice Throw from Wind Turbines* by Henry Seifert, Annette Westerhellweg, Jürgen Kröning DEWI, Deutsches Windenergie-Institut

GmbH Ebertstr. 96, D-26382 Wilhelmshaven, Germany DEWI-OCC Offshore and Certification Centre GmbH Am Seedeich 9, D-27472 Cuxhaven, Germany and *Assessment of Safety Risks Arising from Wind Turbine Icing* by Colin Morgan*, Ervin Bossanyi*, Mr Henry Seifert** http://www.renewwisconsin.org/wind/Toolbox-Fact%20Sheets/Assessment%20of%20risk%20due%20to%20ice.pdf determine a safe distance of 1.5 times the total height of the turbine (hub height plus blade length) would give an acceptable risk of $10^{-6}$hits/$m^2$/year at a distance of 400m (1312ft) from the turbine. This number is considered acceptable because it is taken from a British study for an estimate of the risk of getting hit by a bolt of lightening in Britain. The authors do state that different turbines would have to be evaluated. Note that the above studies only dealt with turbines with a radius of about 24meters (78ft) and hub height of about 85meters (about 279ft) or a total height of 357ft. Rotational speed of these turbines in the study was not given. If a distance of 1.5 times the total height of the turbine is used, the safe distance according to these studies is approx 545 ft. The distance calculated using the equation for this turbine is 893ft. at an angular velocity of 19rev/min. The Vestas V82 turbine (a 1.65MW turbine) has a diameter of 82meters (41meter radius= 134ft). Considering that the tangential velocity of the tip of the blade is dependent on the radius, assuming the angular velocity remains constant, doubling the radius doubles the tangential velocity. For example for a turbine (hub height 279ft) turning at 19rev/minute the tip speed of the 134 ft blade is about 180mph ( which would result in a throw of 2350ft) whereas the tip speed for a blade length of 78ft would be about 105mph ( resulting in a throw of 890ft). The authors of the above studies estimate the weight of a typical piece of ice would be about 1.8kg (about 4lb). Another consideration is that the blade mass would be larger for a larger blade and would require more ice build up to slow it down or cause vibrations which would shut down the turbine. From this it can be concluded that the distance of debris throw from a larger turbine would be larger than the 1.5 times the total height due to the mass of the blades and higher tip speed (tangential velocity).

At a Town of Berne Planning Board meeting on 3/18/10, Joseph Swaha, a representative for Sustainable Energy Developments, Inc., in speaking about residential wind turbines, said that he had not seen ice thrown any great distances but had seen a blade thrown about 400 feet. Neither the height nor make of the turbine was stated but many residential turbines are no higher than 150ft, so the distance of the blade throw is considerably greater than the recommended 1.5 times the total tower and blade height.

## GROUND VIBRATION

A New Zealand study on seismic effects of wind turbines done in the Tararua region to determine the cause of resident's complaints that they could hear the sound of the turbines through their pillows did not come up with definitive causes of the problem although the noise itself and the seismic vibrations were measureable. One hypothesis is that the rock formation forms a type of sound lens which focuses the vibrations, both acoustic and seismic, into the area of the residence which is 2 km away from the wind farm. Standing waves are also considered because one residence may experience the vibration, while the one next to it may not. "The question, therefore, is not whether turbines actually generate seismic energy, but whether this signal can be significant for nearby residents. In the present instance, the turbines are well coupled into the mechanically competent 'old' rocks of the ranges by their concrete bases, which will ensure good coupling of whatever seismic energy they generate into the ground." The authors of the study suggest more research be done. An interesting comment is that the turbine towers in the area themselves produce a seismic vibration through the base of about 0.3Hz. This of course would vary with the size and power generation of the turbines. (Third International Meeting on Wind Turbine Noise, Aalbour, Denmark, June 17-19,2009: *Seismic Effect on Residents from 3MW Wind Turbines*, by Bakker (Massey University, NZ), Bennett

(Kea Petroleum Limited, NZ), Rapley (Atkinson&Rapley Consulting, NZ), Thorne (Noise Measurement Services, NZ)) It is interesting to note that most of the studies done on the seismic effects of wind turbines were done to determine the effects on facilities that monitor seismic events such as earthquakes, bomb testing, etc. The amount of vibration measured was small in the seismic monitoring site at Eskdalemuir, Scotland, near the Scottish border however the measurements were taken 80km from the wind farm. Another consideration might be the effects of the ground vibration of wind turbines would have in an area which has many caves used by bats. To our knowledge there are no studies that have addressed this problem.

The Eskdalemuir study states that "Wind turbines are large vibrating cylindrical towers, strongly coupled to the ground with massive concrete foundation, through which vibrations are transmitted to the surroundings and with rotating turbine blades generating low-frequency acoustic signals which may couple acoustically into the ground. This may occur in several ways: 1. As a cantilever carrying the nacelle/blade mass with frequencies typically less than 1 Hz, depending on the height of the tower. 2. As a torsional oscillator at low frequencies. 3. As a complex distributed system at higher frequencies. Additionally, the blade tower interaction is a source of pulses at a low repetition rate, which contain components in the infrasound region." (*Microseismic and Infrasound Monitoring of Low Frequency Noise and Vibrations from Windfarms: Recommendations on the Siting of Windfarms in the Vicinity of Eskadalemuir, Scotland* by Professor Peter Styles, Dr. Ian Stimpson, S. Toon, R. England, M. Wright Applied and Environmental Geophysics Research Group, School of Physical and Geographical Sciences Keele University) This study included measurements of seismic effects from fixed and variable speed industrial wind turbines.

## CONSTRUCTION TECHNIQUES

An article regarding the construction of a wind turbine for a ski resort near Vancouver, Canada describes the use of 150 cubic meters (about 196 cubic yards) of cement, and 15,000 kg (over 33,000 lbs or 16.5 tons) of steel. The foundation is anchored by "32 seismic anchor rods, which are 63mm in diameter and drilled 50 feet into the bedrock." (*Construction nears completion on mountaintop wind turbine near Vancouver*, Richard Gilbert, Journal of Commerce, Feb, 23, 2010, http://www.journalofcommerce.com/article/id36416/concrete)

The publication Wind Turbine Technology Overview prepared by Global Energy Concepts (www.powernaturally.org) points to two base construction techniques that are commonly used, an inverted "T" design and "the patented concrete cylinder design." Dimensions of these two forms of bases were not given. The cylindrical design does use anchor bolts that run the entire length of the cylinder. Another article indicates the amount of cement in the base as more than 450 cu. yards. (*Construction starts on Thub's farm*, Amy Payne, Saginaw Bay Watershed Watch, July 16, 2008) The type of soil is not given in the article. http://blog.mlive.com/watershedwatch/2008/07/construction_starts_on_thumbs.html The number given in the first paragraph (196 cu yds) does not agree with that in this article. Perhaps it is because the mountain construction was anchored in the bedrock and did not need as much cement.

Another construction company which builds the foundations for wind turbines, Advanced Development Systems, Inc. states that there are three techniques for wind turbine foundations. The list them as:

1. Tube-Style (P&H) Foundation which involves drilling a 40 ft deep hole 18-20ft in diameter, inserting concentric steel tubes into which bedrock anchors and steel reinforcing are installed, communications and electrical lines are brought in, the space between the two cylinders is filled with concrete, the center of the tube is backfilled, and a concrete cap is placed on top.
2. Gravity Foundation is shaped like an "upside-down mushroom" which keeps the turbine upright through sheer weight and leverage.

3. Rock-Anchored Foundation used when the turbine is to be set on solid, non-fracturing rock involves drilling a series of anchors into the base stone and then tied to a foundation cap on the surface. (http://advanceddevelopmentsite.com/structural-engineering.php)

A proposal for construction of a wind farm in New Zealand (*Mount Stuart Wind Farm Proposal* by NZ Windfarms Limited, October 2008) indicates that the worst case removal of earth in the project including access roads, crane pads, gravity pad turbine foundations and "miscellaneous operations" would be approximately 530 $m^3$ (690 $yards^3$) per turbine (600kW) and would be spread evenly around the site and re-grassed. No definitions were given for the two possible foundations, the gravity pad and the augured pile.

The town must assure that the wind farm developer presents detailed plans of all aspects of the construction of the wind farm. This would include but not be limited to: type of foundation to be used at each turbine, the amount of earth removed for each turbine, what will be done with the removed earth, details of erosion prevention and scheduled inspections, detailed study by an independent contractor involving the type of rock to be used as an anchor and its suitability over the long term especially related to fracturing and other bedrock related weaknesses if the rock-anchoring technique is used, details related to how much of the original vegetation and types will be removed, what will be done with removed vegetation and what will replace it.

## AQUIFERS

The Helderberg Escarpment region is known to be karst terrain. "Karst or karst terrain refers to a type of topography formed in limestone, dolomite, or gypsum by dissolution of these rocks by rain and underground water, and is characterized by closed depressions or sinkholes, and underground drainage." (Water Fact Sheet, U.S. Geological Survey, Department of the Interior, Hydrologic Hazards in Karst Terrain) In karst areas, soils are generally thin, and surface water easily flows via sinkholes or rock crevasses into underground rock conduits and caves, which allow groundwater to flow quickly and unimpeded by soils. As a result, the water does not have the benefit of being filtered and purified by soil. (*Helderberg Escarpment Planning Guide*: Karst Hydrology http://www.mohawkhudson.org/Library/iii-Exec%20Summary.pdf ) "Underground streams flow at velocities commonly between 0.1 and 5 miles per day" and for this reason contaminants may move in a shorter period of time than contaminants in aquifers that are unaffected by karst development. (*Water Fact Sheet*, U.S. Geological Survey, Department of the Interior, Hydrologic Hazards in Karst Terrain) For this reason any forms of chemical spills, such as the spilling of oils or coolants in wind turbines could greatly affect the aquifer of the region.

Oils and fluids used in turbines are substantial. The relatively small 1.5MW wind turbines used in the Kittitas Valley Wind Power Project (1.5MW) included the following fluids: 1)generator cooling system approx. 50gallons of glycol-water mix 2) Hydraulic systems ( blades, variable pitch; brake; yaw; and other uses – hydraulic oil approx. 85 gallons 3) gearbox lubrication – lubricating oil approx. 105 gallons (*Kittitas Valley Wind Power Project EFSEC Application* – Jan. 12, 2003) The oil is changed anywhere from every year to once every 5 years. From available information at the Kittitas Valley Project oil is manually lowered to the ground in buckets via a small maintenance crane in the nacelle. (http://www.efsec.wa.gov/kittitaswind/appl/2.3%20Construction%20On%20Site.pdf)

Depending on the outcome of the comprehensive geologic study the developer may have to tap into the aquifer for lightning protection. "To establish adequate lightning protection for wind farms developed on rocky ground where there is no soil mantle, it may be necessary to drill one or more wells into which a current-conducting metal rod is inserted to extend the grounding path to the nearest aquifer. Moreover, the aquifer must be continuous over a large area rather than perched to provide reliable protection. In some western states within the study area, the nearest appropriate aquifer may be thousands of feet below a candidate wind site.

Installation of such grounding wells will increase costs, not only costs directly related to well installation, but also costs to support the hydrogeologic studies that may be required to identify appropriate aquifers." Properly designed and installed "grounding wells" have no potential to adversely impact groundwater quality. This is found in the document paragraph D.5.6. of Appendix D of the Wind Energy Technology Overview of the *Wind Energy Final Programmatic Environmental Impact Statement* prepared by the U.S. Department of the Interior, Bureau of Land Management (http://windeis.anl.gov/documents/fpeis/maintext/Vol2/appendices/appendix_d/Vol2AppD_1.pdf )

While some areas of the Town of Rensselaerville may have karst terrain because of its proximity to the Helderberg area, the rest of the town has various types of terrain. It is difficult to determine which part of the town has a specific type of soil and terrain. Although a study has been done on the soil in the area (*Soil Survey of Albany County, New York*, published by the National Cooperative Soil Survey, June 1992) For this reason a comprehensive study must be done by an independent contractor chosen by the town and paid by the developer through the town on the geology and hydrogeology of the area, the effects of microseismic vibrations on caves and in general on the aquifer for each tower since there is little published independent study done on these areas.

## WILDLIFE IMPACT

For a general idea on how wildlife studies related to the effects of industrial wind turbines are to be conducted see: *Guidelines for Conducting Bird and Bat Studies at Commercial Wind Energy Projects* Prepared by New York State Department of Environmental Conservation, Division of Fish, Wildlife and Marine Resources, January 2009.

BIRDS

Studies on bird collisions vary widely on the number of bird fatalities resulting from collisions with wind turbines due to siting and methodology of the studies. The numbers vary from 0 fatalities/turbine/year to almost 4 fatalities/turbine/year (Journal of Wildlife Management, 2007, *Wind Energy Development and Wildlife Conservation:Challenges and Opportunities* by William P. Kuvlesky, Jr, Caesar Kleberg Wildlife Research Institute, TX 78363, USA ;Leonard A. Brennan, Caesar Kleberg Wildlife Research Institute, TX 78363, USA; Michael L. Morrison, Department of Wildlife and Fisheries Sciences, , TX 77843, USA; Kathy K. Boydston, Texas Parks and Wildlife Department, Austin, TX 78744, USA; Bart M. Ballard, Caesar Kleberg Wildlife Research Institute, TX 78363, USA; Fred C. Bryant, Caesar Kleberg Wildlife Research Institute, TX 78363, USA) The same study indicates that the issue of bat fatalities has not been studied to the extent that bird fatalities have. It states that estimates range from 1 bat fatality/turbine/year to 44 fatalities/turbine/year.

BATS

Another consequence of the Helderberg Escarpment region being karst terrain is that the caves are the hibernacula of the several species of bats. Species of bats are known to occur on the Helderberg Escarpment, including the endangered Indiana bat (*Myotis sodalis*), Eastern small-footed bat (*Myotis leibii)*, northern long-eared bat (*Myotis septentrinalis*), little brown bat (*Myotis lucifugus*), Red bat (*Lasiurus borealis*), Hoary bat (*Lasiurus cinereus*), Big brown bat (*Eptesicus fuscus*)and eastern pipistrelle (*Pipistrellus subflavus*). (from *Significant Habitats and Habitat Complexes of the New York Bight Watershed: Helderberg Escarpment Complex #35* http://library.fws.gov/pubs5/web_link/text/heldberg.htm)

Studies of bat fatalities due to wind turbines both in the United States and Europe point to increased fatalities in the late summer and autumn of bat species which roost in tall trees. It is speculated by the authors of these studies that these species seek out the tallest trees and mistake the turbines as tall trees. Bats are not killed so much by contact with blades of turbines (as are birds) but rather are killed by hemorrhaging in the lungs due to more pliable lungs than birds. The rapid change in pressure associated with the wind turbine blades causes the hemorrhaging. (Current Biology Vol 18 No 16 R696 *Barotrauma is a significant cause of bat fatalities at wind turbines* Erin F. Baerwald, Genevieve H. D'Amours, Brandon J. Klug and Robert M.R. Barclay) Tree bats killed by turbines in North America include the hoary bat (*Lasiurus cinereus*), eastern red bat (*Lasiurus borealis*), and silver-haired bat (*Lasionycteris noctivagans*); (Johnson 2005, Kunz et al. 2007, Arnett et al. 2008) (cited in *Mating Behavior as a Possible Cause of Bat Fatalities at Wind Turbines,* Paul M. Cryan, United States Geological Survey, Fort Collins Science Center, Fort Collins, CO 80526, USA) .

Note that the red bat (*Lasiurus borealis*) and the hoary bat (*Lasiurus cinereus*) are found in this area and are tree roosting bats. The big brown bat (*Eptesicus fuscus*) and the little brown bat (*Myotis lucifugus*) roost in trees or man-made objects.The latter also hibernates in caves in the winter. The Indiana bat (*Myotis sodalis*) uses caves for its winter hibernacula with Hailes Cave in Thacher State Park being a prime hibernaculum in this region. The Eastern small-footed bat (*Myotis leibii)* uses buildings, rocky bluffs and tunnels to roost and hibernates in caves in the winter. The Northern long-eared bat (*Myotis septentrinalis*) and the eastern pipistrelle (*Pipistrellus subflavus*) migrate to caves to hibernate in the winter. A vast majority of these bat species have been affected by White Nose Syndrome which has killed thousands of bats. Further stress due to blasting to construct the turbines, ground vibration from the operating turbines (see reference in the Ground Vibration section of this report), and the apparent attraction of certain species to the turbines can cause significant harm to the bat population in the area.

"The New York State Natural Heritage Program, in conjunction with The Nature Conservancy, recognizes the Hailes Cave site within the Helderberg Escarpment habitat complex as a "Priority Site for Biodiversity" with a rank of B3 (high biodiversity significance). Hailes Cave has a large hibernaculum with over 27,000 bats in 1994."
(Southern New England - New York Bight Coastal Ecosystems Program. "Significant habitats and habitat complexes of the New York bight watershed". US Fish and Wildlife Service. http://library.fws.gov/pubs5/web_link/text/heldberg.htm ) There is no study for the Rensselaerville area done by the U.S. Fish and Wildlife Service comparable to that done for the Helderberg area because the Helderberg is considered a biodiverse area.

The Huyck Preserve in Rensselaerville lists four species documented there, the little brown bat, big brown bat, red bat and Keene's Myotis. All four of these bats to some extent roost in trees or man made objects and hibernate in caves in the winter. However, the area overlaps the range of the Indiana bat, Eastern pipistrelle, silver-haired bat and hoary bat of the Helderberg Escarpment so that it would not be surprising to find them in the Rensselaerville area.

OTHER ANIMALS

There also does not seem to be a consensus on how the wind turbine noise affects animals other than birds and bats. From the dearth of available reliable information on line few scientific studies have been done. Much is anecdotal. A Department of Energy report states they expect no change in deer and other game animals (Department of Energy *Record of Decision for the Electrical Interconnection of the Arlington CEP Wind Project, January 2005* http://www.bpa.gov/corporate/pubs/rods/2005/EFW/Arlington-Wind-Interconnection-ROD-1-14-05.pdf ) for a proposed project in Oregon. A report done for the U.S. military (*Effects of military noise on wildlife: a literature review*, Ronald P. Larkin, Center for Wildlife Ecology, Illinois

Natural History Survey, 607 E. Peabody Drive, Champaign, Illinois, USA 61820) indicates that different species react differently to low frequency noise. Although the review examined low frequencies produced by helicopters and heavy equipment, the general conclusion is the same, that is, one would need to study the specific animal with the specific noise source. AWEA (American Wind Energy Association) says that "Wind is one of the healthiest energy options, and the most compatible with animals and humans. Wind has some minor wildlife impacts (breaking up uninterrupted forest or grassland habitat at some locations, avian and bat collisions, noise disturbance during construction), but they are small compared to other electric generation choices." http://www.awea.org/pubs/factsheets/050629_Wind_Wildlife_FAQ.pdf

The Wyoming Game and Fish Commission in a 2009 study states that the same amount of study into the effects on wildlife, including large game animals, should be done for wind turbines as has had to be done on other sources of energy, such as oil and gas pipelines, strip mining, etc. (page 7, *Recommendations for Wind Energy Development in Crucial and Important Wildlife Habitat, October 2009 (10/26/09) Draft*.) http://gf.state.wy.us/downloads/pdf/Finalpublicwindenergyrecommendationsdraft10.pdf

## EFFECTS ON LOCAL ROADS AND INFRASTRUCTURE

Transportation of the various components of the wind turbine to the tower is done by truck. In some cases the roads may have to be widened and curves straightened. Studies must be done to assure that the roads are capable of supporting the vehicles. The weights of the components depends on the size of the wind turbine erected. For the sake of getting a sense of the weights being transported the following information about a Vestas 2MW wind turbine is given: Blade approx. 7 tons, nacelle approx. 76 tons, hub approx. 20 tons, 80meter tall tower (which is shipped in sections) approx. 170 tons. (*V80-2.0MW* brochure, Vestas)

Another consideration is the crane which needs a special level area next to the tower to raise the sections of the tower individually and the blade/hub assembly. From a proposal (*Mount Stuart Wind Farm Proposal* by NZ Windfarms Limited, October 2008) each turbine would need a "lay-down" area (a large flat area for assembly of the turbine components and the main erection crane) of about 18m x 15m (59ft x 49ft) or about 270 $m^2$ (2900 $ft^2$)

As can be seen, the weights of each of the components is substantial. The town roads should be able to safely carry a 20 ton load during the dry months of June, July and August. (Gary Zeh, Highway Superintendent, Town of Rensselaerville) County roads should be able to handle greater loads. The town would have to assure that a bond is posted before construction and would have to be valid should developers/owners of the wind farm change.

Some important considerations for the town to require of the wind farm developer: an estimate of how many two way trips trucks would have to make and their approximate weight; a bond for the repair of roads after a certain period determined by the town and developer to assure that deep road cracks which may surface after a few months will be repaired; how many and which roads will be used and what modifications, such as widening, will have to be made to them by the developer; what form of protection will be in place for the people whose property will be affected if road widening is necessary; what methods will be used to control dust from dirt roads used during the construction phase; what type of trucks, weight per axle, frequency etc, will be using the roads after construction for the maintenance of the turbines. This is not a complete list but the town will have to recognize that some of the problems in the local roads and infrastructure will not be obvious at first and the town and citizens must be protected.

## FIRE FIGHTING

In their on-line brochure, Firetrace, a company which sells automatic fire suppression systems, the following is found: "Wind turbines manufactured today incorporate the highest quality and safety standards, but the potential for a fire always exists when electronics, flammable oils and hydraulic fluids exist in the same enclosure. Electrical fires can also result from both shorts in equipment and surges due to lightning strikes. Additionally, secondary wind-driven brush fires originating from wind turbine fires can result in significant additional damage." http://www.firetrace.com/windturbines.html

Another manufacturer of fire suppression systems also says "It is very difficult to protect wind turbines against fire, since they are difficult to reach due to their height and remote location, and often the fire brigade has to stay on the ground to secure the area." http://www.tycoemea.com/english/pdf/datasht/fire/psf165tfis.pdf The *Emergency Management Guidelines for Wind Farms* written by the Country Fire Authority (CFA) in Victoria, Australia also points to the difficulty of fighting wind turbine fires. It points out the need for water sources nearby and a close watch to ensure that vegetation does not grow beyond a specified height. It specifies road widths and construction to ensure that fire fighting equipment is able to get to the scene. http://www.cfa.vic.gov.au/documents/CFA_Guidelines_For_Wind_Farms.pdf

The European fire suppression company, Minimax, states in a brochure that "Until recently, manufacturers, operators and firefighters were unable to reduce the risk of damage by fire." http://www.pefipresa.com/pdf/catalogos_comerciales/Folleto%20Aerogeneradores%20MINIMAX.pdf

From this it is inferred that industrial wind turbines do not as a rule contain fire suppression systems however Vestas offers it as an option on their 3MW turbine. (http://www.vestas.com/en/wind-power-solutions/wind-turbines/2.0-mw.aspx )
No other reference was made to fire protection in GE or other Vestas brochures that could be found.

## LIGHTNING PROTECTION

Industrial wind turbines are very susceptible to lightning strikes because of their height above the surrounding environment. In addition to this they are sometimes placed on higher terrain which adds to possibility of a lightning strike. A 1995 German study estimated that 80% of wind turbine insurance claims were caused by lightning strikes. (*Lightning Hazard Reduction at Wind Farms*, Richard Kithil, National Lightning Safety Institute http://www.lightningsafety.com/nlsi_lhm/wind1.html) (Manufacturers are aware of this and recognize the need to protect the turbines from lightning strike damage. Generally the rotor, stator, hub, nacelle, control cabinets, data lines, and other control circuitry such as that controlling the direction of the turbine are protected by various types of protection circuitry. (*Lightning and Overvoltage protection Wind Turbines*, ABB Lightning Protection Group, France) Blades of the turbine are generally designed to conduct lightning to some type of grounding circuit.

As indicated in the section above on the "Aquifer" a method used to conduct the lightning safely to earth (this is called "grounding") in certain situations involves a "grounding well" in which a conductor is inserted into the aquifer. Other methods, again depending on the soil include, but are not limited to grids of conductors or rebars buried in the ground at depths necessary to assure connection to moist earth; concentric rings of conductors again buried at the appropriate depth to assure good ground contact.

The National Renewable Energy Laboratory (NREL) paper strongly recommends that the purchaser of the industrial turbine demand that the manufacturer conform to Class 1 of IEC (International Electrotechnical Commission) 61024 (*Wind Turbine Lightning Protection Project*, 1999-2001, Brian McNiff, for the NREL http://www.nrel.gov/docs/fy02osti/31115.pdf). It is

thought that due to the nature of this topic updates to this document will be frequent, therefore the latest IEC standard on lighting protection for industrial wind turbines should be used as the standard for the Town of Rensselaerville. The complexity of dealing with managing the electromagnetic fields due to lightning strikes would demand that an expert in this area be hired by the Town and that the developer pay the fee.

## SOIL IMPACT

According to an article by the "Keepers of the Blue Ridge", anywhere from 2-5 acres of cleared and level space is needed for each industrial wind turbine. This site has before and after aerial photos of the Mountaineer Wind Power Site in Tucker County, West Virginia (http://www.keepersoftheblueridge.com/environmental-impact.html ) which dramatically shows the amount of land that had to be cleared for the project. Admittedly, if the developer follows good practice and restores as much land as practical to as close to the original conditions as possible, the effect on the land eventually will not be so obvious, however the ridge lines as viewed from the ground would be forever changed.

It is for this reason that the town must demand a detailed plan of construction including the plan for site restoration as mentioned in the above section on "Construction Techniques".

## EROSION

Due to the large areas of vegetation which are disturbed and removed in the construction of an industrial wind turbine installation and the time needed for nature to renew the area, the developer must present to the town a detailed plan for restoring vegetation and how erosion will be prevented or minimized during the time needed for various grasses and native vegetation to grow. This requirement would be similar to that found in the *Union County Oregon Wind Facility Permitting*, http://www.oregon.gov/ENERGY/RENEW/Wind/Permitting-UnionCountyOregon.shtml. Also, the impact of heavy equipment on potential breakdown of local road sub-surface (even if roads are remediated by developer) could have an impact on soil structures adjacent those roadways and be an additional cause of erosion.

## BLASTING

Leveling out the industrial wind turbine site may involve considerable blasting depending on the nature of the terrain, especially if the bedrock is a few feet below the soil level. The terrain in the Town of Rensselaerville varies and there would be a need for a geotechnical review of the proposed sites by a professional chosen by the town and paid for by the developer. (Hounsfield Wind Farm Blasting Plan, American Consulting Professionals of New York, prepared for Upstate NY Power Corp., http://www.dec.ny.gov/docs/permits_ej_operations_pdf/hnsfldappendixa.pdf ) The effects of any necessary blasting within the town's boundaries would also have to consider the effects on any caves, etc. as mentioned in the above sections on the "Aquifer" and "Wildlife Impact – Bats". Any blasting would also need to account for potential damage to housing and other foundations that could be potentially affected by blasting, and a plan for the developer to pay for the remediation costs of any damage to such structures must be in place.

## MEDEVAC HELICOPTERS & EMERGENCY RESCUE SAFETY ISSUES

Helicopters along with other aircraft, do not belong near, within, or just above a commercial wind installation. The critical issue: The high winds and turbulence produced by Industrial Wind

Turbines create a high level of risk to rescue helicopters. The additional danger of entanglement due to lack of judgment, darkness, mechanical problems, or pilot error present additional risk with close proximity flights of any kind.

The need however, for an emergency or EMS aircraft to extract injured people from the scene of an accident, especially in remote or rural areas, in order to transport them to prompt emergency care is very persuasive. Even short amounts of time lost/saved in the rescue process and subsequent transport is critical in order for lives be given the best chance of being saved. What can be considered in the quest to save lives and maintain safety standards for EMS workers and clients?

One possible solution is to apply brakes to bring turbine blades to a stand-still and to shut-down any electric current on the ground or above, so the aircraft could enter the area, however, with wind currents and turbulence from the turbines eliminated, the other risks still are present.(Would trained personnel be available at the time to do this?) Another possible solution might be to make the site easily accessible to slower EMS ground vehicles to quickly move victims to a safe landing and airlift zone.

**Notes:**

(1) Some local area (Wisconsin) EMS regulations, governing fire department and other rescue operations, require that a recue site determined to be at a wind farm, must have the fire department determine a safe Landing Zone (LZ) before a helicopter may land. This may require the victim(s) being transported by other means to the LZ prior to boarding and lift-out to the hospital. This costs precious time, just the reason EMS agencies exist in the first place. But danger to aircraft and people involved is too severe to not observe this safety precaution. [report by representative of Eagle III, an EMS company that uses a variety of equipment including helicopters, especially in rural locations.] http://www.eagle3.org/

(2) FAA requires nighttime location lights on wind towers, generally on the perimeter of the installation, not in the interior area. So, nighttime pilots and EMS workers, approaching a wind installation, often fly above a dark void only to land at the side, perhaps far from the emergency site. Then they must wait for some while before other vehicles, traveling roads and at much slower ground speed, can rescue and deliver clients to the aircraft.

Additionally, turbulence can cause either or both rotors of a helicopter to malfunction in controlling flight stability, altitude or flight path of the aircraft, and, if severe enough can cause failure of the craft to maintain balance and crash. This would be doubly unfortunate following an actual recue.

There is also the reality that aircraft, even helicopters, require maneuvering room to take off properly (direction influenced by wind direction) and to turn to gain the proper heading tor the desired course. This “room” is measured in terms of ¼- ½ mile minimum, depending on take-off angle and wind speed. Other factors have to do with weather conditions, visibility, ceiling for flight and proscribed safe distances from objects on the ground. An example of safety factors versus reality is given as requiring flight 500’ above a ground object as fair clearance. If the wind tower is already 400’ high and the turbine blades are 200’ or more in diameter, the flight elevation should be 500’ + 500’ or 1000’ minimum for that example. If clouds are low and visibility is less than ½ mile, the margin of forgiveness for error is difficult to deal with safely. [See “H is for HELP!”, a transcript of an interview with a retired EMS helicopter pilot. 12/27/08]

http://betterplan.squarespace.com/todays-special/2008/12/24/122708-h-is-for-help-what-did-the-ems-helicopter-pilot-say-a.html

Aerial crop spray applicators (crop dusters) have enormous difficulty coping with wind installations. A typical installation places 2.5 turbines per square mile. A usual area consumed by an active plane spraying fields is about 3 square miles of maneuvering room to account for change of direction and distance between swaths to be sprayed. This amounts to about 7 turbines in the work area. The turbines generate enormous amounts of wake turbulence, affecting any aircraft crossing the wake, and because of their great size, the towers and blades are a huge distraction to the pilot engaged in so many factors for his attention while flying and spraying.
[see "No Fly Zone" of 3/14/09 by an experienced aerial crop sprayer.]
http://betterplan.squarespace.com/todays-special/2009/3/14/31409-no-fly-zone-why-small-airplanes-emergency-medical-heli.html

Some EMS providers have given notice of refusing to enter an installation area and propose strategic safe LZ areas to affect receival of emergency clients for transport.
http://www.betterplan.squarespace.com

(3) In some areas of the country, some communities have experienced problems with an EMS helicopter not being able to land at an emergency site, compromising the time factor critical to effective rescue/treatment. Some communities (especially agricultural) are concerned about problems associated with crop-dusting aircraft which use a lot of space to fly their circuits accurately and safely. Many are concerned about problems getting airborne EMS providers to such wind sites, especially at night. [see survey and report conducted by the Informed Farmers Coalition, published by the Illinois Wind Energy Association in article "Bureau-Lee Co. Anti-wind . . . 17 May'10] www.windforillinois.org

## HEALTH, ENVIRONMENTAL, AND SAFETY CONSIDERATIONS
## AREAS NOT COVERED – For Future Consideration

Due to time constraints our committee did not address the following areas. We recommend that any future discussion of Industrial Wind Turbines consider these issues in addition to those we have already presented:

- FAA Requirements
- Turbine Failure and Impacts
- Effect upon Doppler Radar, Weather Forecasting, Radio, TV, Telephone, Microwave and Satellite Transmission.
- Access/Security
- Transmission Lines – Above ground and below ground
- Sub-Stations
- Gas Lines – "Dig Safely New York"
- Electrical Safety, Induced Ground Voltages, and Extraneous Electrical Effects

## Financial Impacts: Property Values & Pilot Payments

# Property Values

Overview:
The question of whether property values are affected by the presence of Commercial Wind Turbine installations is another area of contention. Various studies and anecdotal reports reach diametrically different conclusions. We believe that property values would be negatively affected based upon our research and the studies below.

**Some of the forces that might play into this equation:**

| Forces that could indicate an increase in property values | Forces that could indicate A decrease in property values |
|---|---|
| • Developer payments could increase net inflow to town income & lower taxes. | • Town, or parts of town, become perceived as an industrial zone. |
| • Lower taxes could reduce the overall annual cost of owning a home with a possible increase in property values. | • Loss of view shed. |
| • Individual property owners could increase their own property values because their property now comes with an annuity in terms of wind developer lease payments. | • Loss of rural character |
| | • Increased road traffic for heavy equipment maintenance. |
| | • Increased expenses yielding higher taxes as a result of possible deferred, hidden, or indirect costs to town. Examples: Developer and/or town initiate a lawsuit against each other. |

What does common sense indicate?
People normally don't want to live in an industrial zone and wind turbines are essentially industrial installations usually placed on farmland.

It could be argued, that Industrial Wind Turbines, turn a farming zone into an industrial one. The issue is not only the presence of the turbines but their ongoing noise levels, increased heavy vehicle traffic - likely constant during the construction phase – and thereafter at various times during the ongoing maintenance of these machines.

Does it make any sense that houses in the area of a large scale wind site would be more desirable than those in an area which maintained its rural atmosphere. There are enough anecdotal stories from many sources that talk to the radical change due to these installations.

| Study | Comments |
|---|---|
| Forward Wind Project Dodge County, WI 5/31/05<br>Client: Horicon Marsh System Advocates.<br>Report writer: Metropolitan Appraisal's Kevin Zarem MAI, WCGA (Wisconsin Certified General Appraiser)<br>Intended users: Client and PSC | <u>Strengths of study:</u><br>• Intended to comply with Uniform Standards of Professional Appraisal Practice, Standards 4 and 5.<br>• Included large data set information of Transmission Line (not Industrial Wind Turbine) impacts on residential property values.<br>• Appraiser reaches conclusion that "generalizations must rely on the weight of evidence from numerous studies, samples, and locations".<br><br><u>Weaknesses of study:</u><br>• Only view loss analyzed. No consideration of wind turbine noise, shadow flicker/strobing, road traffic, and community impact included in analysis.<br>• This is a forward looking study for a proposed project, not one that yields statistically significant data based upon actual arms-length sales. (Note: a situation in which a wind developer is buying a property affected by turbines can not reasonably be considered an arms length sale.)<br>• No property owner interviews or field studies.<br>• Paired analysis compares transmission lines to wind turbines for view loss impacts. Different heights, different impacts. Also, key negative impacts could arguably be said to include noise, shadow flicker, etc. not, viewshed alone. The negative health effects of wind turbines could arguably have a much greater impact upon property values than viewshed. One can choose not to look at a turbine (if this is an annoyance factor) but tuning out the variety of sounds is a very different matter.<br>• Size of study too small to draw statistically significant conclusions.<br><br>Note: Lit review in Appraisal Institutes<br><br>WSC Conclusions:<br>• To analyze property value impact based solely upon the single variable of viewshed calls this study into serious question. Especially given the direct and reported feedback on residents due to noise, shadow flicker, etc.<br>• The fact that the appraiser had to interpolate from other datasets indicates that, for this study at least, he could not find relevant information as of the 2005 study date.<br>• Conclusion reached by study that "*generally* suggest little or no impact on residential property values due to proximity to transmission lines" is not even based upon view impact but proximity of transmission lines to residential structures. A transmission line 1,000' from a residential structure would likely have far less impact than an Industrial Wind Turbine at the same distance. |
| REPP (Renewable Energy Policy Project) Report<br>May 2003<br><br><u>www.repp.org</u><br><br>Report:<br>http://www.repp.org/articles/static/1/binaries/wind_online_final.pdf | <u>Strengths of Study:</u><br>• Likely a science based organization, not a proxy organization for industry interests.<br>•<br><br><u>Weaknesses of Study:</u><br>• Criticized in Dodge County WI report as flawed because it includes 70% of related party transactions:<br>o "As highlighted in the PSC Report, the REPP Report fails to properly screen data leading to critical flaws…… According to PSC Report, 70% of the data used in the REPP Report was found to be related party transactions and is therefore, in my opinion, not representative of market value; and 72% of data used in the REPP /Report does not have acutual views of wind turbines, the effect being tested for."<br>• Place holderhao[guohrtg[hufhioghiojgg |

| | |
|---|---|
| | Possible Concerns:<br>• REPP's Board of Directors includes Executive Director of American Wind Energy Association (AWEA). Does this indicate a bias towards wind development no matter what the concerns? However, based upon range of Board members, could well be a science-based organization. |
| Wind Turbine Impact Study<br>Dodge & Fond Du Lac Counties, Wisconsin<br>9/9/2009 Preliminary Draft<br>by Kurt Kielisch,<br>Appraisal Group One | Sponsored by Calumet Count y Citiizens for Responsible Energy (CCCRE) Calumet County Wisconsin.<br><br>Three parts to study:<br>1. Literature Study<br>2. Opinion Survey<br>3. Sales Studies<br><br>Possible Concerns:<br>• What impact does being part of a sub-division have on property value vs. being "rural" property? If one strips out the sub-division sales and takes into account that larger lot sizes will sell for less per acre in general, the disparity between being within the "wind turbine influence" area and outside of it might not be that large. Looking at price per acre . |

**Notes on REPP Property Value Study:**

http://rma.repp.org/articles/static/1/binaries/wind_online_final.pdf
81 page report.

**Potential Flaws:**

- Five-mile radius. Major difference between a much smaller radius (within 0.5 mile, within 1 mile, within 2 miles, etc) and a global five miles.
- Is the potential error introduced in the analysis of property values on a case by case basis greater than the property values. What overall percentage of sale price does this represent? Is it statistically significant? If a house is selling for in the $200,000 range a price change of sixty-dollars per month becomes virtually insignificant.
- Are these all "arms-length" transactions. We would like to suggest that the purchase of a property by a wind developer is not an arms-length transaction.
- Are there houses within 1,200' to a mile or more that could not sell because of their proximity to large-scale wind turbines, and therefore never made it into the study?

# Pilot Payments

**New York State's Real Property Tax Law - NY CLS RPTL ß 487 (2010):**
**Pilot Payments vs. the right of a Town to assess based upon value of the Wind Energy System:**

**Real Property Tax Law (NY RPTL 487 Section 2) States that a Wind Energy System, *by default*, will be exempt from taxation for fifteen years provided that:**

- It meets the definitions and guidelines for eligibility for exemption provided by the president of NYSERDA (New York State Energy Research Development Authority. (Sections 3 & 4)
- Property owner completes necessary application and files with local tax assessor as well as files a copy with the Authority. (Section 6)

**Town Authority when RPTL 487 is in effect:**

- Town has the authority to require that property owner enter a PILOT (Payment in Lieu of Taxes) contract. (Section 9)

**Notes:**

- This law sunsets on December 31st 2010. (Section 5)
- The Town can elect to override the NYSERDA's authority provided in this law and replace it with their own local law. (Section 8)
- If RPTL 487 is in effect, Town has authority to require property owner to enter a contract to make PILOT payments (Payments in Lieu of Taxes). *Note that the liability for PILOT payments rests with the property owner, not the developer.*
- Exemption under RPTL 487 can only operate for 15 years (Section 9b). What happens at the end of 15 years?
- We strongly recommend that any payment agreements with an outside Industrial Wind Developer be keyed to the full term of their contracts with landowners. Also, that this full agreement be negotiated as a condition of Town's approval of industrial wind development. For example, Shell Oil/Shell Energy Services/Cinco agreement gave it the rights to extend original option for up to 67 years from time of signing.
- Agreement between Town and developer should be constructed to survive:
  - Transfers of corporate ownership
  - Shedding of corporate assets (usually set up as an LLC) so that Town has ability to go after assets of parent corporation if Wind Developer LLC defaults on its obligations.
- Ensuring that an Industrial Wind Developer is held accountable for payments to the town could be a problematic issue. The Industrial Wind Developer receives the profits, the Double Declining Depreciation, Production Tax Credits, and other state and local incentives. The landowner receives income – usually either a fixed annual payment (approximately $6,000 or $7,000 per turbine) or some combination of an annual fixed payment and a small percentage of gross energy production.
- NYSERDA funding and tax incentives and benefits from Industrial Wind Production The actual party liable under normal taxing jurisdiction is the property owner, not the developer, as the improvements reside on the property owner's land.
- contracts are for longer periods. Shell Oil's contract through their Cinco subsidiary gave them a 67-year period of control from date of signing.
- Opinion: Unless a town can levy taxes on the actual value of the turbines they are at a disadvantage. Section 9a states that PILOT payments are not to exceed the amount that would be due under taxes and the amount would effectively be negotiated with the wind developer, not the property owner.
- Once the fifteen year period is over, if the town decides to tax the wind turbines at their full value there are several potential significant problems:
  - The developer will likely walk away as the tax benefits would have been largely extracted in the first five years (at least the double declining depreciation portion).
  - Large scale wind turbines supposedly have a 20 year lifespan, so why would developer maintain their ownership with the scenario of a huge increase in operating costs (through taxation at full value), likely heavily increased maintenance costs, and a significant decrease in tax credits?
  - If developer does walk away, the town would be left in the position of negotiating a contract with the ISO (Independent Systems Operator) who controls the grid. There is no precedent in NY State, no guarantee that would happen, and likely no requirement on the ISO to do so. That would

leave the town with turbines and no agreement to generate income from them.
    - Given that US Tax code provides Double Declining Depreciation over a five-year period, the developer can validly claim that the turbines are worth a fraction of their replacement cost, thus making the town's case for full initial value taxation invalid.

**Recommendations:**

- Pass a town law to provide that no exemption under RPTL 487 be provided for Industrial Wind Turbines and that these energy systems be taxed at their full capital value.
- However, pass a separate town law that allows a 15-year tax exemption on the improvement value of Non-Commercial wind turbines and other renewable energy devices.

**Issue:**

- If needed in future, check on Wind Developer's litigation in this matter. Also, outcomes of cases involving Cell Towers in NY State. While a different technology and a different kind of equipment, might be cited as part of a legal challenge to town's authority to tax.

# Additional Notes

Our committee has not researched the issue of local employment in any depth. However if the town is considering the installation of an Industrial Wind Power facility on the basis of local job creation the following information might be useful.

The Town Supervisor of the Town of Fenner has stated in an interview that maintenance is always going on. There are three full time employees and sometimes 6 - 8 crew working. Because Russell is proactive they hire locally. That would place the full time employee to turbine ratio at one full time worker for every seven turbines. At peak maintenance times with eight employees that ratio would drop to one crew member for every 2.5 turbines. Anecdotally

One of the two initial developers of theTug Hill facility has stated that he was informed that "all 45 full time operations people were from Tug Hill!" This number would need to be independently verified to ensure that people on the payroll are actually working full time and not landowners receiving payments for the turbines on their properties, nor adjacent neighbors receiving payments for lease easements.

While employment after the intense startup construction phase would likely provide some local jobs, the benefit of those jobs would be strongly outweighed by the other negatives in regard to the town's Comprehensive Plan. In addition, Flat Rock Wind Power, the operator of the Tug Hill facility lost its certification for Empire Zone Funding status and the related tax benefits. While this Empire Zone status was later reinstated, in the interim, the developer withheld $6.7 million dollars (placing those funds into an escrow account). Significant to this discussion is the original reason for decertification under the Empire Zone Status: *"Flat Rock was decertified because of its designation as a "shirt-changer," defined as a company reincorporated as a different entity that claimed it created jobs when it actually just transferred employees from one entity to the other."*
(See http://www.watertowndailytimes.com/article/20100103/NEWS04/301039975)

The key point is that Industrial Wind Developer's claims of job creation needs to be closely scrutinized to ensure that a community will obtain the local job creation benefits claimed.

# Law & Policy Matters, Developer Agreements, & Related Considerations

## Recommended Contract Elements with Developers

While some of the recommendations in this section are related to contracts between Industrial Wind Developers and landowners, we believe it is important to present some of the possible pitfalls that we have seen in these contracts.

Disallow confidentiality agreements in Developer Contracts with both the town and landowners as a general principle. Only permit limited confidentiality in contracts if it applies to specific trade secrets or methods of operation or patent processes unique to that developer.
While the town has no authority to dictate contract terms between a developer and an individual property owner, they can require non-confidentiality between developer and property owner as a condition of the Town's entering an agreement with a developer. One reason is that developer/landowner contract elements might be at odds with zoning law or the town's Comprehensive Plan. Also, if there are future problems, landowners need to retain their rights of free speech related to the issues that arise.

## Bonding Issues on Decommissioning

- Key Recommendation: The developer, not the town, should bear all the liability and financial risk of decommissioning. The following recommendations are presented to achieve that end.

**Elements to be included in bonding agreement:**

- There are several key issues in dismantling a project:
    1. Cost of dismantling, separating components, transportation of scrap components, and scrap prices available at time to dismantling.
    2. Cost of land reclamation. Committee recommendation is to set a standard of four feet below ground surface and to specify what remediation is to be done.
    3. Wear and tear on roads from moving all this heavy equipment. Should be handled in a separate road agreement.
- Have separate expert selected by town and paid for by developer determine bonding value.
- Bond fund should not be part of developer's assets.
- Bond or surety should be held by an independent third party representing the Town or a County Commission.
- To protect Town, scrap value determining bonding should be at a fully discounted scrap value rate. The bond amount should be structured to shift the scrap value and decommissioning cost risk *away* from the community and directly onto the bonding company and developer. The bonding company will set its rates based upon its own internal risk analysis of scrap markets and costs. If the company agrees with developer cost of removal and scrap estimates, the developer should be able to obtain a very low bond rate.

Following are many elements that will affect the scrap value of a decommissioned turbine. In each case the developer, not the Town should bear the burden:

- Scrap market is volatile. Therefore scrap value very variable. Also scrap value varies based upon location (a function of transportation costs), purity, size and condition.
- Net value of scrap value needs to take into account:
    - Dismantling, separation of parts and elements into smaller parts. Size of scrap is one element in determining market value.
    - Purity or quality of final products for scrap sale.
    - Transportation costs to scrap yards.
- Bond amount for project dismantling costs should be adjusted annually based on a suitable index such as the "RS Means Heavy Construction Cost Data".
- Decommissioning to include removal of underground electrical transmission wire.
- Bonds for decommissioning to be purchased only from a highly rated insured/certified bonding firm. This issue is more important now during the volatility in the financial markets. Consider only a AA or AAA firm. The developer can make its case to the bonding company, not the town. If bonding company agrees, the cost of bonding to the developer will be less.

**Question:**

Would NY State take on the role of either guarantor or enforcer of the Bond?

Separate the decision about how much it will cost to decommission a wind development from the developer's liability for doing so. These decommissioning costs should be determined by a separate bonding company and not the developer, or through one of their auxiliary insurance companies (if they exist). The developer can then negotiate with the bonding company. If there is a problem the issue will be between the bonding company and the developer, not the community and the developer.

As we noted in the introduction to this document, it is the developer who "harvests" large financial rewards. It should be the developer who bears the costs and downsides of all uncertainties, not the Town.

**Resources:**

- *Beech Ridge Decommissioning Cost Review*, October 7, 2008 by Energy Venture Analysis, Inc.
- Multiple additional resources available in Excel Document

## Compliance with New York State Attorney General's Code of Conduct

### The NY State Attorney General's Wind Industry Ethics Code

The background and rationale for establishing a Wind Industry Ethics Code (also called a "Code of Conduct") is best explained in this news release from the NY State Attorney General's Media Center:
http://www.ag.ny.gov/media_center/2009/july/july29a_09.html

> "The Wind Industry Ethics Code is a direct result of the Attorney General's ongoing investigation into, among other things, whether companies developing wind farms improperly sought land-use agreements with citizens and public officials, and whether

improper benefits were given to public officials to influence their official actions relating to wind farm development."

Simply stated, the NY State Attorney General's Office received enough substantial complaints that they responded by creating this code. The initial announcement was made October 30th, 2008. Noble Environmental Power and First Wind were the first companies to sign on to the agreement:
http://www.ag.ny.gov/media_center/2008/oct/oct30a_08.html

Copies of the document signed by both wind companies can be downloaded here:
http://www.ag.ny.gov/bureaus/public_integrity/legal_documents.html
The document signed by Noble is directly accessible here:
http://www.ag.ny.gov/media_center/2008/oct/Code%20Signed%20by%20Noble%20and%20AG.pdf

**Overview of Code of Conduct:**
A July 29, 2009 announcement gives an overview of the Code:
http://www.ag.ny.gov/media_center/2009/july/july29a_09.html

As of that date sixteen wind power companies had signed the agreement. Among the group signing, together with their subsidiaries, they are responsible for more than 90% of wind power development in New York State.

From that announcement:
The Attorney General's Wind Industry Ethics Code prohibits conflicts of interest between municipal officials and wind companies and establishes public disclosure requirements. The Code:

9. Bans wind companies from hiring municipal employees or their relatives, giving gifts of more than $10 during a one-year period, or providing any other form of compensation that is contingent on any action before a municipal agency
10. Prevents wind companies from soliciting, using, or knowingly receiving confidential information acquired by a municipal officer in the course of his or her official duties
11. Requires wind companies to establish and maintain a public Web site to disclose the names of all municipal officers or their relatives who have a financial stake in wind farm development
12. Requires wind companies to submit in writing to the municipal clerk for public inspection, and to publish in the local newspaper, the nature and scope of the municipal officer's financial interest
13. Mandates that all wind easements and leases be in writing and filed with the County Clerk
14. Dictates that within sixty days of signing the Wind Industry Ethics Code, companies must conduct a seminar for employees about identifying and preventing conflicts of interest when working with municipal employees

The Attorney General's Task Force monitors the wind companies to ensure they are in compliance with the Ethics Code and receives complaints regarding the industry.

**Wind Power Committee observations on the Code of Conduct:**
- This is code is a definite positive step forward towards preventing abuses by Wind Developers, their subsidiaries, and by local officials who might find themselves in a *conflict of interest* situation. Local officials must recuse themselves from official duties related to Wind Developer's business.
- Wind Developer is required to file an abstract or memorandum of all Leases and

Easements. While this is not the complete document, there is adequate detail required: Filing must specify essential terms including:

- Names & addresses of parties to transaction.
- Full property description.
- Rights conveyed.
- Wind Developer's estimate of financial monetary compensation to landowner.
- Also, importantly, if owner is Municipal Officer or a relative of one.

Other points:

- Wind developers must train their employees to follow the Code of Conduct.
- Office of NY State Attorney General establishes a "Task Force to provide oversight of Wind Farm Development and monitor compliance with this Code." For three years after signing Code of Conduct, Wind Company contributes a proportional share of the reasonable administrative costs of the task force.
- If a Municipal Officer or Employee of the town transfers or conveys an interest in real property to a wind developer, the wind developer is required under the code to provide notice telling that town official to discuss their obligations with the municipality's attorney, including the obligation to recuse themselves from certain related matters.

From Attorney General's website:

Any complaints about wind development companies should be sent to the newly created Task Force by e-mailing them to WindTaskForce@ag.ny.gov.

The matter is being handled by Special Deputy Attorney General Ellen Nachtigall Biben, who oversees the Attorney General's Public Integrity Bureau, Deputy Bureau.Others in that bureau include Monica Stamm, Bureau Chief, and Assistant Attorneys General Andrew Heffner and Robert Vawter, as well as Executive Deputy Attorney General for Criminal Justice, Robin L. Baker.

**Recommendations:**

- Make it a requirement that any wind developer sign the Attorney General's Wind Industry Ethics Code as a prior condition of making any contact with or presentation to the town or any of its officials.
- Once it becomes clear that the Town will be approached by a Wind Developer or a related party for the purpose of installing Industrial-Commercial Wind Turbines within the Town, Town Board should act to ensure that following boards and parties read and understand the Code of Conduct.
  - Town Board
  - Planning Board
  - Zoning Board of Appeals
  - Code Enforcement Officer
  - Landowners approached by the Wind Developer.
- And, any other town officials or employees who will have contact with Wind Developer.
- If it becomes known that a Wind Developer has been approaching landowners to explore the issue, the town should pro-act with the wind developer to both disclose their activity to the Town Board, and to sign the Code of Conduct.

## Web of Relationships and Their Impact Upon Town Authority/Autonomy

The purpose of the following chart is to give an indication of the complexity of the system a local town government could encounter in dealing with Industrial Wind Development.

It is important to note that there is no mechanism in New York State law at present that would allow a town to become its own Power Authority, own its own turbines, and sell electrical power back into the grid as Industrial Wind Developers do.

[Insert Powerpoint Chart: *"Web of Interconnections"*]

# Miscellaneous Matters

The purpose of this section is to note issues that might not clearly belong in any other category but we felt were worthy of note:

- **No Disclaimer of Summary Recommendation:**
  No statement in this report is intended to imply anything other than our committee's Summary Recommendation: That "Industrial Wind Power installations within the town of Rensselaerville should not be permitted."

- **Freedom to hunt on one's own property:**
  Anecdotal but implied in developer contracts: Property owners have stated that they can not hunt on their property during times that Wind Developer's crews were doing maintenance on Industrial Wind Turbines. While it is fully reasonable for the wind developer's maintenance team or emergency crews to work in a "no hunting zone" the ban on hunting at any time the developer's crews are active is an unintended consequence that most landowners had not anticipated when they signed their leases.

- **Wind Power and Renewable Energy Credits (RECs)**
  A phone conversation with John Maserjian, Corporate Communications/Media Relations, Central Hudson Gas & Electric.

  > Note: This conversation arose out an attempt to determine the overall costs of Industrial Wind Power. One element in the equation is the final price that consumers pay on the back end when they choose to support Renewable Energy by purchasing their electricity through Renewable Energy Sources such as Wind Power.

  The initial question asked of John: "If a consumer chose to have all their energy supplied through Wind Power what would be the additional per KWH cost on their electric bill.

  John's information: Central Hudson does not directly sell Wind Power Energy. What a consumer purchases is *not* wind power produced electricity. They purchase *Renewable Energy Credits (RECs).* These are actually financial credits that the Wind Power Developer receives when they produce wind power that is sold into the grid. The actual cost to the consumer for making this choice is approximately 1¢ to 2¢ per KWH of electricity consumed by that customer. The amount of the premium paid depends upon a mix of factors including which wind producer is selling the RECs, the marketer (middle man) selling them, and the mix of sources of energy. REC purchases are not specifically for wind power but for an unspecified mix or renewable energy products including wind power, bio-fuels and small hydro. The money paid by the consumer goes directly to the wind installation producing it but through an intermediary source.

  When Industrial Wind producers sell their power into the grid they are separately and concurrently selling to one of three entities:
  1. New York State

2. Marketing Firms, which purchase REC's and resell them for a profit. (Presumably these are financial institutions.) It is these firms which receive the 1¢ to 2¢ per KWH that companies like Central Hudson or National Grid receive from the consumer. They pass these funds directly through to the marketing firm who has purchased the RECs from the Wind Farm.
3. Organizations or individuals can purchase REC's directly. While there is usually no financial benefit to their doing so, they can then satisfy a value-based desire to support Renewable Energy.

The actual additional premium paid by the consumer can not be applied directly or solely to wind power because that's not the way that the mechanism works.

John said that "Central Hudson can not enter into direct contract with Wind Power producers because "their output is so variable we can't get into contract with them."

For a consumer who wants to support Renewable Energy, John's suggestion is that rather than purchasing from an energy supplier who sells Renewable Energy as part of their product mix, that they purchase RECs directly. That way they know the comparative base price of the electric they produce and, separately, how much is being paid for Renewable Energy.

# Glossary

*Also see definitions under the Health, Environmental and Safety Considerations attached to each sub-section.*

- Empire Zone Funding - Empire Zones are geographically defined areas within New York State. Qualifying businesses located within the zone are eligible for Empire Zone program tax benefits.
  http://www.tax.state.ny.us/sbc/empire_zone.htm

- IDA – An acronym for "Industrial Development Agency" which are entities set up in each county of New York State under the authority of the State Legislature. IDA's exist to further industrial activity throughout the state but within the county level structure. Most often when Wind Developers enter agreements with towns it is through an IDA which takes lead agency responsibility and authority. When this happens usually the county receives a significant portion of the wind developer's payments.

- Independent Systems Operator (ISO): Is an organization formed at the direction or recommendation of the Federal Energy Regulatory Commission (FERC). In the areas where an ISO is established, it coordinates, controls and monitors the operation of the electrical pwer system, usually within a single US State, but sometimes encompassing multiple states.
  From: http://en.wikipedia.org/wiki/Independent_System_Operator

- Industrial Wind Power – Any wind power installation of any size, capacity, number of turbines established solely for the sale of that power produced into the electric grid.

- Lead Agency – The agency that takes "title to" (bottom line responsibility and control) of a project. In industrial Wind Power, it's most often the County IDA, but in one unique case of the Town of Fenner, was the lead agency and negotiated its own agreement directly with an Industrial Wind Developer.

- NYSERDA – An acronym for *"New York State Energy Research and Development Authority*". NYSERDA receives its authority from the New York State Legislature and is funded through fees collected on every NY State electric user's energy bill under the line SBC/RPS which stands for *"Systems Benefit Charge/Renewable Portfolio Standard"*
  http://www.nyserda.org/

- PILOT - Is an acronym for "Payment in Lieu of Taxes". Often referred to as "PILOT Payments". These are payments that Wind Developers and Industrial Facility operators pay to the lead agency instead of (in lieu of) property taxes. The authority for PILOT payments is provided by New York State law, with that authority transferred to the President of NYSERDA.

- RPTL and RPTL Section 487 – RPTL Is an acronym for “Real Property Tax Law”. RPTL Section 487 first enacted in 1977 and reenacted in 1990, provides a 15 year exemption from increased property values for tax purposes under certain conditions. [See “Pilot Payments” section of this report for a fuller discussion.] http://www.orps.state.ny.us/assessor/manuals/vol4/part1/section4.01/sec487.htm

- SBC/RPS – An acronym for “Systems Benefit Charge/Renewable Power Supply”. This charge is added to every residential electric customer’s bill in New York State and is more than two percent of the overall electric bill each billing period. These funds are used in various ways by NYSERDA to forward energy programs including providing heating assistance for low income customers, rebates on energy efficient appliances, and funding Industrial Wind Developments.